EUMETSAT NWC SAF
SUPPORT TO NOWCASTING AND VERY SHORT RANGE FORECASTING

User Manual for the NWC/GEO: Software Part

NWC/CDOP3/MTG/AEMET/SW/UM, Issue 1, Rev. 3.2

31 March 2026

Applicable to SAFNWC/GEO version 2025.2

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REPORT SIGNATURE TABLE

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DOCUMENT CHANGE RECORD

Version	Date	Pages	Changes
1.0	13 November 2020	85	First version for MTG STRR1 review
1.1.0	03 Febraury 2020	89	Document updated for MTG-I day-1 ORR1 • Section 1 (Introduction) has been improved to include NWC/GEO Version Identification, System Overview and Software Products • Other minor changes and improvements
1.2.0	31 August 2023	89	Updated of dependencies for COTS installation with Ubuntu 22 support
1.3.0	31 March 2025	90	Document updated for MTG-I day-1 ORR-2: • Change name version from vMTG to v2025 • Updated versions for 3rd party software • Main implemented changes for v2025
1.3.1	30 June 2025	90	Documented updated for v2025.1. Main implemented changes: • Add support to GOES19 • CMA: Fix issue with path calculation when it is used BIAS RTTOV • EXIM: Include extrapolation of imagery in HR resolution
1.3.2	31 March 2026		Documented updated for v2025.2.: • Added support to ICON • Update of the eccodes library from 2.35.1 to 2.42.0 • Include a LAND-SEA map in HR in MTG data auxiliary package • Improve of the calculation of the DTIME value • Main implemented changes respect NWC/GEP v2025.1

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1 INTRODUCTION

The EUMETSAT's "Satellite Application Facilities" (SAFs) are dedicated centres of excellence for processing satellite data, and form an integral part of the distributed EUMETSAT Application Ground Segment (http://www.eumetsat.int). This documentation is provided by the SAF on Support to Nowcasting and Very Short Range Forecasting, NWC SAF. The main objective of NWC SAF is to provide, further develop and maintain software packages to be used for Nowcasting applications of operational meteorological satellite data by National Meteorological Services. More information can be found at the NWC SAF webpage, http://nwc-saf.eumetsat.int.

1.1 PURPOSE

This document is the Software User Manual for the NWC/GEO application. The main objective of the NWC/GEO is the generation of meteorological products in support of nowcasting and very short range forecasting based on geostationary satellite data products.

The NWC/GEO User Manual is composed by a set of documents that include all the information needed to use the NWC/GEO facility. Different aspects are described in separated documents to easy the maintainability and use by all NWC/GEO stakeholders. This includes:

- The Software Part: intended to install, configure and operate the NWC/GEO application.
- Scientific Parts: For each PGE or PGE family, containing all the scientific information needed to understand the scope of the generated product.

The present document contains the Software Part of the NWC/GEO User Manual

Current version of the NWC/GEO allows the generation of the following products using specific Product Generator Elements or PGEs. (See section 1.5 for a high-level description of each Product)

Group	Product Name	PGE_id
Cloud	GEO Cloud Mask	GEO-CMA
	GEO Cloud Type	GEO-CT
	GEO Cloud Top Temperature and Height	GEO-CTTH
	GEO Cloud Microphysics	GEO-CMIC
Precipitation	GEO Precipitating Clouds	GEO-PC
	GEO Convective Rainfall Rate	GEO-CRR
	GEO Precipitating Clouds from Cloud Physical Properties	GEO-PCPh
	GEO Convective Rainfall Rate from Cloud Physical Properties	GEO-CRRPh
iSHAI	GEO imaging Satellite Humidity And Instability	GEO-iSHAI
Wind	GEO High resolution winds	GEO-HRW
EXIM	GEO Extrapolated Imagery	GEO-EXIM
ASII	GEO ASII Tropopause Folding	GEO-ASII-TF
	GEO ASII Gravitational Waves	GEO-ASII-GW
	GEO ASII-NG Inflight Icing	GEO-ASII-ICE
Convection	GEO Probability of Convection Initiation	GEO-CI
	GEO Convection Warning	GEO-RDT-CW
Tools	GEO Parallax Correction Tool	GEO-PLAX
	GEO Level 1 Satellite Data	GEO-L1SD

Table 1: NWC/GEO Products / PGEs

1.2 SCOPE

This Software User Manual contains all the information needed to install, configure and execute the NWC/GEO application. Special attention is paid to the description of the different files containing the configurable parameters that defined the behaviour and operation of the system.

In addition to this document, the users of the NWC/GEO package can obtain additional information and services in the Helpdesk of the SAFNWC. The Helpdesk tool is the interface between the SAFNWC Team and the SAFNWC Users, providing services such as SW and documentation delivery, SW problem reporting tool, direct communication with the users and information on all related aspects. This Helpdesk of the SAFNWC can be accessed at http://nwc-saf.eumetsat.int, taking advantage of the main functions of it.

This document applies to version MTG of the NWC/GEO application

The document is divided into the following sections:

- This section 1 contains the current introduction along with the list of used acronyms and applicable and reference documents.
- Section 2 presents the Software Manual.
- Section 3 describes the procedure for installing and configuring the software.
- Section 4 contains a quick start guide to start the NWC/GEO software in a short time.
- Section 5 presents a detailed description of all possible operations that can be performed by the NWC/GEO application package.
- Section 6 describes the content of NWC/GEO configuration files.

- Section 7 summarises the user commands available for NWC/GEO application.
- Section 8 describes the actions that can be performed by the Task Manager.
- Section 9 lists the wildcards that can be used in the Monitor Task Definition Files and Program Task Definition Files to use run time values as current system time, number of the last processed PGE, etc.
- Section 10 includes main aspects and references to specific information on format and content of main input data (Satellite and NWP) to NWC/GEO
- Section 11 presents the list of main error and warning messages produced by all different PGEs, and a short description of the potential cause that generates each message.
- Section 12 contains the list of TBCs and TBDs of the document.

1.3 NWC/GEO VERSION IDENTIFICATION

This document refers to the NWC/GEO v2025.2 software package. It includes the following components:

Module	Id	Component	Version
Common Elements	GEO-TM	MWC/GEO Task Manager	3.2
	GEO-NWCLIB	NWC/GEO Common Library	3.2
Cloud Module	GEO-CMA	Cloud Mask PGE	6.0
	GEO-CT	Cloud Type PGE	5.0
	GEO-CTTH	Cloud Top Temperature and Height PGE	5.0
	GEO-CMIC	Cloud Microphysics	3.0
Precipitation Module	GEO-PC	Precipitating Clouds PGE	2.0
	GEO-CRR	Convective Rainfall Rate PGE	5.0
	GEO-PCPh	Precipitation Clouds from Physical Properties PGE	4.0
	GEO-CRRPh	Convective Rainfall Rate from Physical Properties PGE	4.0
Clear Air Module	GEO-iSHAI	imaging Satellite Humidity And Instability	5.0
Wind Module	GEO-HRW	High Resolution Winds PGE	7.0.1
EXIM Module	GEO-EXIM	Extrapolated Imagery PGE	3.1
ASII Module	GEO-ASII-TF	Tropopause Folding detection	3.0
	GEO-ASII-GW	Gravity Wave pattern detection	2.0
	GEO-ASII-ICE	Icing Product	1.0
Convection Module	GEO-RDT-CW	Rapid-Development Thunderstorm Convection Warning and CTRAJ Convection Trajectories	6.0
	GEO-CI	Convection Initiation	3.0
Tools	GEO-Plax	Parallax correction Processor	2.0
	GEO-L1SD	Level 1 Satellite Data processor	2.1

Table 2: Main components of the NWC/GEO v2025.2

In addition, it also includes the following 3rd party software:

Id	Component	Version
CharLS	JPEG-LS lossless and near-lossless image compression and decompression library	1.0
ecCodes	BUFR, GRIB and GTS decoding and encoding library	2.42.0
FCIdecomp	MTG FCI L1c decompression software	1.0.2
HDF5	Hierachical Data Format library	1.10.7
IPL98	Image Processing Library	2.20
NETCDF-C NETCDF-FORTRAN	Network Common Data Form library	4.7.3 4.5.2
RTTOV	Radiative Transfer Model	13.0
zlib	Z-compression library (for HDF5)	1.2.11

Table 3: 3rd party Software of the NWC/GEO v2025.2

1.4 NWC/GEO System Overview

NWC/GEO SW application implements the functionalities required to generate the products presented in Table 1, including task scheduling, reading and extraction of input, auxiliary and control parameters files, re-mapping (when required) of any input data and, of course, execution of the algorithms required for the generation, quality control and formatting of each of the NWC/GEO products.

The SW is very flexible in the way to handle input data and processing options. In that sense, a large number of configurable items are available for user tailoring (e.g. in parameter files) instead hard-coded.

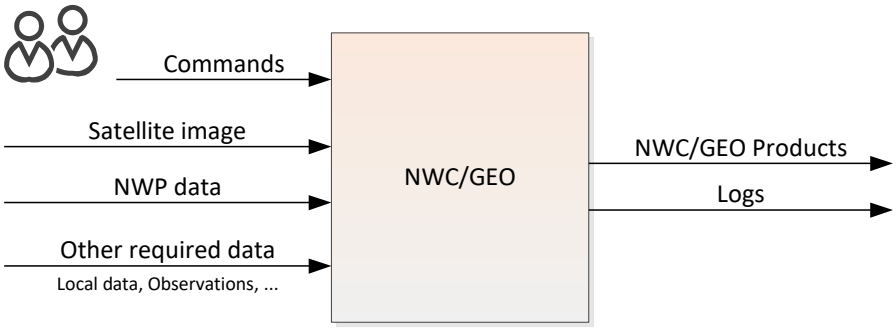

Figure 1: NWC/GEO Context Diagram

The NWC/GEO application is constituted mainly by a *Task Manager (TM)* and several product processors functions known as *Product Generation Elements* or PGEs, as depicted in **Error! Reference source not found.**.

- The *Task Manager (TM)* constitutes the application driver. It examines processing parameters and determines when and in which order other tasks must be executed. It decides (based on the used configuration) which products need to be generated and which inputs are required. It monitors process progress and available resources, and decides exception mechanisms (such as not processing a product due to time constraints or aborting due to lack of free disk space). It also handles user requests and any required archiving or other programmable task.

- Specific algorithms for the computation and generation of each product are implemented in the Product Processors or *Product Generator Elements (PGEs)*, also including procedures to check the products (using internal and/or external quality control procedures). The processors are commanded by the TM in the appropriate order during the operational execution.

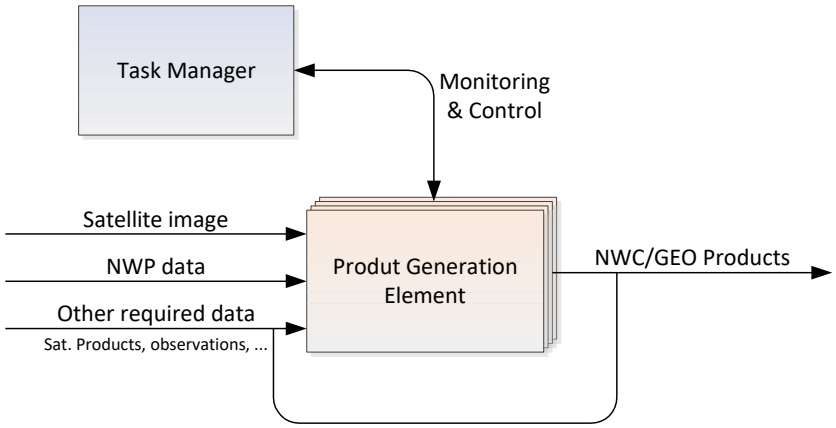

Figure 2. – NWC/GEO simplified view

In an operational environment, it is absolutely necessary to have an autonomous facility in charge of executing the sequence of tasks needed to process new incoming satellite products. Then, as a primary requirement, the NWC/GEO inserts all tasks needed to produce user-selected products for user-defined regions in the correct order. In addition, the application performs several supplementary tasks, transforming it into a powerful tool capable of managing a large variety of other additional actions, all of them essential for real-time operations.

The NWC/GEO package is provided fully configured for automatic NRT operation. Therefore, the operational execution of the application requires minimum additional information about the processing of the PGEs and secondary actions. Nevertheless, all this data are provided in different configuration files allowing the configuration of the system according to user and site preferences.

It is worth noting that each processor needs inputs from the geostationary platform, analysis, measurements, climatology or other auxiliary data and, for some of them, products from other processors or previous time-slot data (processor dependencies). How do external inputs (satellite data, NWP data and other observations) become available operationally is an issue to be solved by each user; the NWC/GEO just expects the appropriate input files to be ready at pre-defined (configurable) directories. See section 10 for additional details on required input data.

1.5 NWC/GEO SOFTWARE PRODUCTS

NWC/GEO/Cloud

The NWC/GEO/Cloud product group includes four cloud products applied to imagery on board geostationary meteorological satellites (see committed products table):

- *The Cloud Mask (CMa)* product provides on a pixel basis information on the presence of clouds, dust and volcanic plumes. The method is based on grouped dynamical threshold technique complemented by temporal coherency and image processing techniques. Thresholds are computed by RTM calculation using forecast NWP fields.

- *The Cloud Type (CT)* product provides on a pixel basis information on the major cloud types (fractional clouds, semitransparent clouds, high, medium and low clouds (including fog)), and on snow/sea ice occurrence. The method is based on grouped dynamical threshold technique complemented by image processing techniques. Thresholds are computed by RTM calculation using forecast NWP fields.

- *The Cloud Top Temperature and Height (CTTH)* product provides on pixel basis information on cloud vertical extension and on cloud top temperature. The method consists in fitting measured and simulated radiances from IR window and sounding channels. Simulated radiances are obtained from RTTOV RTM model using forecast NWP fields.

- *The Cloud Microphysics (CMIC)* provides on a pixel basis information on cloud microphysics (cloud thermodynamical phase, drop effective radius, cloud optical depth, liquid water/ice path). In daytime, the method basically consists in fitting measured and simulated reflectances from water (ice) absorbing and non-absorbing channels in the solar spectrum, the cloud phase retrieval needing additional thresholding of thermal IR channels. In night-time conditions, only the cloud phase is available, retrieved from the thresholding of thermal IR channels.

NWC/GEO/Precipitation

The NWC/GEO/Precipitation product group includes four precipitation products extracted from imagery on board geostationary meteorological satellites (see committed products table):

- *The Precipitating Clouds (PC)* product provides information on the probability of precipitation in pre-defined probability intervals on a pixel basis.

- *The Convective Rainfall Rate (CRR)* product estimates rainfall rates from convective and stratiform associated to convection systems on each pixel of the satellite image. It also computes the corresponding hourly accumulations for the same events.

- The Precipitating Clouds from Physical Properties (PCPh) product provides an estimation on the probability of precipitation (PoP) occurrence. It is based on a Principal component Analysis. It makes use of eight SEVIRI channels along with the cloud microphysics. There is only one algorithm that includes day and night conditions. Microphysical properties are simulated at night time and used in the algorithm. PCPh basic output can be modified by optionally applying a stability correction.

- The Convective Rainfall Rate (CRRPh) product provides information on convective, and stratiform associated to convection, instantaneous rain rates and hourly accumulations. It is based on a Principal component analysis. It uses eight SEVIRI channels along with the Cloud Microphysics. Microphysical properties are simulated at night time and used in the algorithm. There is one algorithm that includes day and night conditions. CRRPh basic output can be modified by optionally applying three main correction factors: the content of water vertically integrated through the cloud layer, the lighting activity and a stability correction based on the computation of convective indexes (Lifted, Showalter and K) extracted from the Numerical Model

NWC/GEO/iSHAI

Constituted by a single product:

- *The imaging Satellite Humidity And Instability (iSHAI)* product. The main outputs are Precipitable Water parameters (Total Precipitable Water and the precipitable water in several layers denoted hereafter as LPW), Instability Indexes and other parameters (Skin Temperature, Total Ozone, etc.) in near real time. The algorithm will be based on physical retrieval to obtain retrieved T/q profiles on clear pixels in the first phase. In the second phase the ozone profiles could be retrieved. The parameters will be calculated from the retrieved T/q profiles.

NWC/GEO/Wind

Constituted by a single product:

- *High Resolution Winds (HRW)* product: A level-2 product, comprising detailed sets of Atmospheric Motion Vectors (AMVs) throughout all hours of the day from geostationary imagers, considering Visible, Infrared and Water Vapour channel data. The output data include pressure level information and a quality control flagging, indicating the error in probabilistic terms.

NWC/GEO/EXIM

Constituted by a single product:

- *Extrapolated Imagery (EXIM)* product: calculation of forecast satellite or NWC SAF output images in the working region, through the extrapolation of the satellite or NWC SAF output images into the future, considering the displacements indicated by the AMVs of the HRW product.

NWC/GEO/ASII

This group features a "next-generation" of the former GEO-ASII product:

- The new *Automatic Satellite Image Interpretation - Next generation (ASII-TF, ASII-GW and ASII-ICE)* utilizes algorithmic components established during the development of the ASII product in previous versiosn of the NWC/GEO. It differs, however, in its focus on only a few selected phenomena of particularly high user interest and in its output of probability-of-occurrence on a pixel-by-pixel basis. The initial programme for this product is to provide automatic analyses of phenomena relevant to diagnosis and forecasting of CAT (clear air turbulence)-related aviation hazards. Over the long term, the product shall tackle tasks arising in other areas as well.

NWC/GEO/Convection

The group "NWC/GEO/Convection products" includes two products:

- *Convection Initiation (CI)* product: Initiation of convection, after the formation of clouds up to low clouds. CI will provide the probability for a cloudy pixel to become a thunderstorm. Three steps are required:
    - selection of pixel of interest (e.g. using instability mask or cloud mask)
    - predictors associated to this pixel, including historic of the pixel
    - diagnosis of convection through probability assessment.

- *Rapidly Developing Thunderstorms-Convection Warning, (RDT-CW)* product (named "Rapidly Developing Thunderstorms –RDT"- during CDOP and until the CDOP2 2013 release). RDT-CW provides information about significant convective systems from the triggering to mature phase. The convective systems are described in object mode, with different attributes e.g. overshooting top, updraft, top temperature and height, size, etc. A nowcast of RDT-CW typically up to one hour is made available at configurable time steps.

  An associated intermediate product, Convection Trajectory (CTRAJ) may optionally be available. The analysis and tracking of all cloud systems allow to identify ongoing and achieved cloud trajectories. RDT-CW product is a subset of ongoing trajectories (current convective cloud systems), where CTRAJ provides information about all achieved trajectories. Thus, CTRAJ is RDT-CW dependent, and based on an object approach.

NWC/GEO/Tools

The NWC/GEO/Tools group includes 2 additional processors:

- The *Parallax Correction Tool (PLAX)* corrects the parallax effect in Cloud, Precipitation and Satellite data due to the Geostationary oblique view of high features far to the sub-satellite point (ssp).
- The *Level 1 Satellite Data (L1SD)* allows the generation of Satellite Level 1 data products in NWC/GEO and binary formats

1.6 DEFINITIONS AND ACRONYMS

See [RD.1] for a complete list of acronyms for the SAFNWC project.

1.7 REFERENCES

1.7.1 Applicable documents

The following documents, of the exact issue shown, form part of this document to the extent specified herein. Applicable documents are those referenced in the Contract or approved by the Approval Authority. They are referenced in this document in the form [AD.X]

For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the current edition of the document referred applies.

Current documentation can be found at the NWC SAF Helpdesk web: http://nwc-saf.eumetsat.int

Ref	Title	Code	Vers	Date
[AD.1]	Proposal for the Fourth Continuous Development and Operations Phase (CDOP-4)	NWC/SAF/AEMET/MGT/CDOP4 Proposal	1.0	12/03/21
[AD.2]	NWCSAF Project Plan	NWC/CDOP4/SAF/AEMET/MGT/PP	1.0.0	31/10/22
[AD.3]	NWCSAF Product Requirements Document	NWC/CDOP4/SAF/AEMET/MGT/PRD	1.0.0	31/10/22
[AD.4]	System and Components Requirements Document for the SAFNWC/GEO	NWC/CDOP2/MTG/AEMET/SW/SCRD	1.3	13/11/20
[AD.5]	Interface Control Document for Internal and External Interfaces of the NWC/GEO	NWC/CDOP2/MTG/AEMET/SW/ICD/1	1.4.0	31/03/25
[AD.6]	Output Data Format of the SAFNWC/GEO	NWC/CDOP2/MTG/AEMET/SW/DOF	1.4.0	31/03/25

Table 4: List of Applicable Documents

1.7.2 Reference documents

The reference documents contain useful information related to the subject of the project. These reference documents complement the applicable ones, and can be looked up to enhance the information included in this document if it is desired. They are referenced in this document in the form [RD.X]

For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the current edition of the document referred applies

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Ref	Title	Code	Vers	Date
[RD.1]	The Nowcasting SAF Glossary	NWC/CDOP2/SAF/AEMET/MGT/GLO		
[RD.2]	User Manual for the Cloud Product Processors of the NWC/GEO MTG-I Day-1	NWC/CDOP3/MTG/MFL/SCI/UM/Cloud	1.2.0	31/03/25
[RD.3]	User Manual for the Precipitation Product Processors of the NWC/GEO MTG-I Day-1	NWC/CDOP3/MTG/AEMET/SCI/UM/Precipitation	1.2.0	31/03/25
[RD.4]	User Manual for iSHAI Product Processors of the NWC/GEO MTG-I Day-1	NWC/CDOP3/MTG/AEMET/SCI/UM/iSHAI	1.2.0	31/03/25
[RD.5]	User Manual for the Wind Product Processors of the NWC/GEO MTG-I Day-1	NWC/CDOP3/MTG/AEMET/SCI/UM/Wind	1.2.0	31/03/25
[RD.6]	User Manual for the Extrapolated Imagery Processor of the NWC/GEO MTG-I Day-1	NWC/CDOP3/MTG/ZAMG/SCI/UM/EXIM	1.2.1	30/06/25
[RD.7]	User Manual for the Automatic Satellite Image Interpretation – Next Generation Processors of the NWC/GEO MTG-I Day-1	NWC/CDOP3/MTG/ZAMG/SCI/UM/ASII-NG	1.2.0	31/03/25
[RD.8]	User Manual for the Convention Product Processors of the NWC/GEO MTG-I Day-1	NWC/CDOP3/MTG/MF-PI/SCI/UM/Convection	1.2.0	31/03/25
[RD.9]	User Manual for the Tools of the NWC/GEO	NWC/CDOP3/MTG/AEMET/SCI/UM/Tools	1.2.0	31/03/25

Table 5: List of Referenced Documents

1.8 DOCUMENT OVERVIEW

This document contains all information needed to install, execute and operate the NWC/GEO software package. The document is divided into the following sections:

- This section 1 contains the current introduction along with the list of used acronyms and applicable and reference documents.

- Section 2 presents the Software Manual.
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- Section 8 describes the actions that can be performed by the Task Manager.
- Section 9 lists the wildcards that can be used in the Monitor Task Definition Files and Program Task Definition Files to use run time values as current system time, number of the last processed PGE, etc.
- Section 10 includes main aspects and references to specific information on format and content of main input data (Satellite and NWP) to NWC/GEO
- Section 11 presents the list of main error and warning messages produced by all different PGEs, and a short description of the potential cause that generates each message.
- Section 12 contains the list of TBCs and TBDs of the document.

2 DESCRIPTION OF THE SOFTWARE USER MANUAL

2.1 HOW TO USE THIS MANUAL

This Software User Manual describes the tasks to be performed in order to make full use of the NWC/GEO software package. It describes the installation procedure and all tasks needed to execute and operate the software.

This User Manual also contains some appendices describing the format of different configuration files, permitted actions, valid wildcards used to resolve system-dependent and time-dependent variables, available user commands, … These appendices can be used as reference pages during the system configuration phase, and at any time during routine operations.

2.2 INTENDED READERSHIP

This Software User Manual is intended to support the *System Administrators* responsible for the development of the following tasks:

- Install the NWC/GEO application
- Provide real-time data (Satellite, NWP and Auxiliary data) to the system
- Define operative policy as
    - data storage,
    - notification mechanisms
    - backups
    - managerial activities, ...
- Configure the system from a SW point of view according to the previous operative policy.
- Initiate, monitor and terminate the NWC/GEO application.

In this document, the System Administrator will find detailed information about the installation, configuration and operational procedures for the proper execution of the NWC/GEO applications package. The document includes detailed specification to successfully generate all required NWC/GEO products using its own infrastructure and configuration.

It is noted that this Software User Manual is complemented by detailed product-specific User Manuals (See references in 1.7.2). These documents support the *Scientific Administrator* of the NWC/GEO, in charge of:

- Receive and analyse the requirements and needs of the final users.
- Establish the scientific configuration of the NWC/GEO, that is
    - Define the region or regions where the NWC/GEO products will be generated
    - Identify the PGEs to be executed in each region
    - Establish the priority schema for the product generation (PGE and region priorities, and the criteria to order the PGE execution).
    - Adjust the configurable parameters for each PGE according to the specific needs and constrains (set-up the model configuration files for each PGE and region)

- Notify the changes to the System Administrator and Final Users.
- Analyse the scientific contents of the products and receive analysis, comments and suggestions from the final users in order to improve the quality and usefulness of the products.

3 INSTALLATION OF THE PRODUCT

3.1 PREVIOUS CONDITIONS AND LICENCES

The Right to use, copy or modify this software is in accordance with EUMETSAT Policy for the NWC/GEO software package.

The NWC/GEO applications package has been developed and tested in the following Linux/Rocky environment.

	RockyLinux 9	Ubuntu24	Ubuntu22
O.S	Rocky Linux 9.5 (Blue Onyx)	Ubuntu 24.04.2 LTS (Noble Numbat)	Ubuntu 22.04 LTS (Jammy Jellyfish)
CPU	8x Intel(R) Core(TM) i7-9700 CPU @ 3.00GHz	4x Intel(R) Core(TM) i5-4590 CPU @ 3.30GHz	4x Intel(R) Core(TM) i5-4590 CPU @ 3.30GHz
Arch	x86_64	x86_64	x86_64
Memory	32 GB	32 GB	32 GB
Disk	512 GB	512 GB	512 GB
Shell	bash; ksh	bash; ksh	bash; ksh
Compilers	GNU 11.5.0	GNU 13.3.0	GNU 11.3.0
gzip	gzip 1.12	gzip 1.12	gzip 1.10
make	GNU Make 4.3	GNU Make 4.3	GNU Make 4.3
m4	m4 (GNU M4) 1.4.19	m4 (GNU M4) 1.4.19	m4 (GNU M4) 1.4.18
CMake	CMake 3.26.5	CMake 3.28.3	CMake 3.12
Libaec	Libaec v1.0.6	Libaec v1.0.4	Libaec v1.0.4

Table 6: NWC/GEO primary supported environments

These resources are enough for the operational and NRT generation of the full set of NWC/GEO products for MTG in a continental region (~2 Mpixels). The generation of products in a larger area could require additional resources including memory, disk and/or CPU.

The operational execution of the NWC/GEO also requires setting up adequate interfaces to acquire needed input data (Satellite, NWP and Observation data).

Note that the NWC/GEO application has been designed to be installed once in a single platform/account. Installation/Operation of two or more NWC/GEO applications in the same machine is allowed given that different installations use different user accounts. Nevertheless, it is highly recommended that a single installation of the NWC/GEO applications package is executed in a dedicated WorkStation.

The current version of the NWC/GEO has been successfully tested in RHEL and Ubuntu 64 bits. Proper installation, operations and support in other Linux flavours cannot be assured.

User can contribute to the SAFNWC community giving feedback on the operation of the SW in other Linux distributions, through the Helpdesk web site (http://nwc-saf.eumetsat.int) via the Ticket functionality.

3.1.1 Memory usage

Memory requirements will depend upon the machine configuration (swap, pages,…) and processors (PGEs) configuration. Values presented in next table have been computed using a default region (EUR-MLAND) sized 1044x1896 MTG 2-km pixels. Therefore, they must be used for reference and may not be considered as standard.

Each value described in Table 7 is the data + stack size of the process as shown in the *DATA* column obtained by the `top` UNIX command. This memory size is the maximum memory allocated reached by the component.

Module	RAM use (GB) Processing region: EUM-MLAND Satellite: MTG
GEO-CMA	0,5
GEO-CT	0,5
GEO-CTTH	0,5
GEO-CMIC	0,5
GEO-PC	0,5
GEO-CRR	0,5
GEO-PCPh	0,5
GEO-CRRPh	0,5
GEO-iSHAI	1.0
GEO-HRW	2.0
GEO-EXIM	2.0
GEO-ASII-TF	0,5
GEO-ASII-GW	0,5
GEO-ASII-ICE	0,5
GEO-CI	1,0
GEO-RDT-CW	1,0

Table 7: PGE memory usage[1]

3.1.2 Maximum number of opened files

The execution of the NWC/GEO with a large number of pressure levels requires increasing the maximum number of opened files, typically set to 1024 in standard Linux installations.

If the maximum number of opened files, obtained executing

```
$ ulimit -n
```

is below 2048, increase it following the next procedure:

- Edit, as root, the file `/etc/security/limits.conf`
- Add the following lines at the end of the file

[1] All these values have been estimated using the `top` UNIX command. Values have been calculated running each PGE as a stand-alone application.

```
*                hard    nofile          8192
*                soft    nofile          2048
```

- Reboot the system
- Check that the maximum number of opened files has been set to 2048:

```
$ ulimit -n
2048
```

3.2 INSTALLATION PROCEDURE

The NWC/GEO is distributed in a set of separated packages. Some of them (SW packages) are mandatory and must be installed in order to execute the application. Other (Data packages) are only required to process a specific satellite.

Currently, the NWC/GEO provides the following packages

Type	Package ID	Description	Size
SW	CODE-COTS	Third party software (libraries) required by the NWC/GEO	1.4 GB
SW	CODE-SYSTEM	NWC/GEO application, including default configuration files	2.7 MB
DATA	DATA- MTI1_+000.0	Auxiliary data to generate MTG-based NWC/GEO products using MTGI1 0 deg products	12,0 GB
DATA	DATA-MSGx_+000.0	Auxiliary data to generate MSG-based NWC/GEO products using MSG 0 deg (primary) service	7.8 GB
DATA	DATA-MSGx_+009.5	Auxiliary data to generate MSG-based NWC/GEO products using MSG 9.5 deg (Rapid Scan) service	7.9 GB
DATA	DATA-MSGx_IODC	Auxiliary data to generate MSG-based NWC/GEO products using MSG IODC service	12 GB
DATA	DATA-GOES16_-075.0	Auxiliary data to generate GOES16-based NWC/GEO products	9.9 GB
DATA	DATA-GOES17_-137.0	Auxiliary data to generate GOES17-based NWC/GEO products	9.9 GB
DATA	DATA-GOES18_-137.0	Auxiliary data to generate GOES18-based NWC/GEO products	9.9 GB
DATA	DATA-GOES19_-075.0	Auxiliary data to generate GOES19-based NWC/GEO products	9.9 GB
DATA	DATA-HIMA08_+140.7	Auxiliary data to generate HIMA08-based NWC/GEO products	9.8 GB
DATA	DATA-HIMA09_+140.7	Auxiliary data to generate HIMA09-based NWC/GEO products	9.8 GB

The installation and compilation of the NWC/GEO applications package needs around 75[2] Gbytes of free disk space, but additional space[3] is required to run the package in an operational mode (A

[2] This is the disk space required to install the NWC/GEO with auxiliary data to process MTGI1 data.

[3] The required free disk space to run the application in an operational mode will depend on the size of the region to be processed, the number of satellite products held on disk, remapped NWP data and policy for backup of useful data (e.g. generated products, NWP data, auxiliary data, ...).

minimum of 500 GB is strongly suggested). It is assumed that the machine complies with the supported environments and minimum resources presented in Table 6 (see section 3.1).

Before the execution of the installation procedure, download from the NWC SAF Help Desk (http://nwc-saf.eumetsat.int) the COTS, CODE and required AUXDATA packages according your needs.

The installation is performed using the user-interactive script **`nwcgeo_v<version>`**. Before the execution of this script, it is highly recommended to create a *safnwc* user in charge of installing and administrating the NWC/GEO code (not absolutely necessary). Then, change to the directory containing the downloaded scripts and packages (COTS, CODE and AUXDATA) and execute it:

```
% cd <path_to script>
% chmod +x nwcgeo_v<version>
% ./nwcgeo_v<version> install
```

The next message is shown:

```
Welcome to the NWC/GEO <version> Installation Procedure
=======================================================

This script will guide you to successfully install and
configure the NWC/GEO <versions> software package


Press any key to continue ...
```

Follow the steps displayed on the screen, which basically consist of:

1. Installation Setup
    a. Check for required shell
    b. Check for available code and data packages.
       Please check that the following packages are available
        i. COTS: `NWC-CDOP3-GEO-AEMET-SW-CODE-COTS_vYYYY_ddMMMyy.tgz`
        ii. CODE: `NWC-CDOP3-GEO-AEMET-SW-CODE-SYSTEM_vYYYY_ddMMMyy.tgz`
        iii. The SW_DATA package required to process the satellite the user is interested to process:
        `NWC-CDOP3-GEO-AEMET-SW-DATA-<StaID>_<SSP>_vYYYY_ddMMMyy.tgz`
    c. Creation of the target directory where NWC/GEO will be installed
    d. Enable/disable the use of parallelization[4]

[4] Preliminary use of parallelization in the NWC/GEO has been included, but no significant improvement in the processing time has been observed. In addition, the software has not been extensively tested in parallel mode. Therefore it is strongly recommended to install the application without parallelization (default option).

e. Definition of the environment variables required for the installation. These variables are added to `.<shell>rc` file

2. Installation of COTS

   a. Decompression of the tgz package downloaded from the NWC SAF Help Desk (http://nwc-saf.eumetsat.int):

      NWC-CDOP3-GEO-AEMET-SW-CODE-COTS_v<cots_version>.tgz

   b. Compilation of all provided libraries

      If no problems are detected during the compilation, a message will appear describing the correct installation of the package:

```
------------------------------------------------------------------------
Successful installation of the COTS for NWC/GEO v<version>
Day Month dd hh:mm:ss UTC YYYY
------------------------------------------------------------------------
```

3. Installation of NWC/GEO CODE

   a. Decompression of the tgz package downloaded from the NWC SAF Help Desk (http://nwc-saf.eumetsat.int):

      NWC-CDOP3-GEO-AEMET-SW-CODE-SYSTEM_v<sys_version>.tgz

   b. Compilation of the NWC/GEO

      The operator shall receive the following message if the installation and verification procedure finalises successfully

```
-------------------------------------------
Successful installation of the NWC/GEO v<version>
Day Month dd hh:mm:ss UTC YYYY
-------------------------------------------
```

      In case of errors during compilation, contact with the NWC SAF Helpdesk http://nwc-saf.eumetsat.int for analysis.

4. Installation of satellite-specific configuration

   a. User shall select the satellite to configure the NWC/GEO. Following configurations are currently available

```
 1) MTG I1.Primary Service...L1c....Near Real Time.......(+000.0 deg)
 2) MTG I1.Primary Service...L1c....Reprocessing  .......(+000.0 deg)

 3) MSG Primary Service......HRIT...Near Real Time.......(+000.0 deg)
 4) MSG Primary Service......HRIT...Reprocessing.........(+000.0 deg)
 5) MSG Rapid Scan Service...HRIT...Near Real Time.......(+009.5 deg)
 6) MSG IODC Service.........HRIT...Near Real Time.......(IODC)
 7) MSG IODC Service.........HRIT...Reprocessing  .......(IODC)

 8) GOES16....M6............GOESR..Near Real Time.......(-075.0 deg)
 9) GOES16....M6............GOESR..Reprocessing.........(-075.0 deg)
10) GOES17....M6............GOESR..Near Real Time.......(-137.0 deg)
11) GOES17....M6............GOESR..Reprocessing.........(-137.0 deg)
12) GOES18....M6............GOESR..Near Real Time.......(-137.0 deg)
13) GOES18....M6............GOESR..Reprocessing.........(-137.0 deg)
14) GOES19....M6............GOESR..Near Real Time.......(-075.0 deg)
15) GOES19....M6............GOESR..Reprocessing.........(-075.0 deg)


16) Himawari-08.............HSD....Near Real Time.......(+140.7 deg)
17) Himawari-08.............HSD....Reprocessing.........(+140.7 deg)
18) Himawari-08.............EHH....Near Real Time.......(+140.7 deg)
19) Himawari-08.............EHH....Reprocessing.........(+140.7 deg)
20) Himawari-08.............FSD....Near Real Time.......(+140.7 deg)
21) Himawari-08.............FSD....Reprocessing.........(+140.7 deg)
22) Himawari-09.............HSD....Near Real Time.......(+140.7 deg)
23) Himawari-09.............HSD....Reprocessing.........(+140.7 deg)
24) Himawari-09.............EHH....Near Real Time.......(+140.7 deg)
25) Himawari-09.............EHH....Reprocessing.........(+140.7 deg)
26) Himawari-09.............FSD....Near Real Time.......(+140.7 deg)
27) Himawari-09.............FSD....Near Real Time ......(+140.7 deg)
```

5. Installation of satellite-specific auxiliary data

    a. User is requested to install Auxiliary Data for the selected satellite. Data is extracted from the corresponding tgz package downloaded from the NWC SAF Helpdesk (http://nwc-saf.eumetsat.int)

        NWC-CDOP3-GEO-AEMET-SW-DATA-<sat>_<subsat_lon>_v<data_version>.tgz

6. Final configuration of the NWC/GEO

    a. User is requested for some information to be further included as attributed in the generated products. This includes name, URL and e-mail of his/her institution

    b. User is requested to enable/disable optional outputs. This includes

        i. LAT/LON containers to be included in the output products

        ii. Production of GEO-AUX auxiliary data products (LATLON, SAT, SUN, LSDATA and TOPO; See [AD.6] for additional details on GEO-AUX products)

7. If the package is properly installed, next messages are shown

```
The NWC/GEO v<version> has been properly installed and
configured in your system

For additional details in the configuration and execution of the application
please refer to the NWC/GEO User's Manual NWC/CDOP3/GEO/AEMET/SW/UM

Please access to http://nwc-saf.eumetsat.int for additional information and
support

IMPORTANT NOTE:
You must logout and login your account in order to set the required environment
to execute the NWC/GEO application
After re-login, just execute "SAFNWCTM" to initiate the NWC/GEO with the
default configuration
```

IMPORTANT NOTE: You must logout and login your account in order to set the required environment to execute the NWC/GEO application. After re-login, just execute "SAFNWCTM" to initiate the NWC/GEO with the default configuration

3.3 SATELLITE RECONFIGURATION

Once installed, the satellite configuration of the NWC/GEO can be modified using the user-interactive script **nwcgeo_v<version>**. Change to the directory containing the downloaded scripts and the satellite AUXDATA packages, and execute:

```
% cd <path_to script>
% ./nwcgeo_v<version> satellite
```

Follow the steps displayed on the screen, which basically consist of:

1. Check for required shell and available data packages
2. Installation of satellite-specific configuration
3. Installation of satellite-specific auxiliary data

3.4 UNINSTALLATION OF THE PRODUCT

To uninstall the NWC/GEO application it is no needed any specific process.

Just remove the NWC/GEO directory:

```
%rm -rf $SAFNWC
```

After that, the NWC/GEO is no longer installed in the system.

3.5 ERROR MESSAGES AND RECOVERY PROCEDURES

All the tools used during the installation and building procedure are standard UNIX tools, such as, *tar*, *make, cmake*, *C* and *FORTRAN* compilers, …. Any error message produced during the installation and building procedure is generated by these UNIX tools. The user should refer to UNIX help pages to analyse any error messages received.

3.6 SUMMARY OF PROBLEMS AND HOW TO FIX THEM

The installation procedure does not require special resources and is restricted to building the NWC/GEO libraries and executables, and copy required data in appropriate location. Error messages may possibly appear in the following situations:

- There is not enough disk space to copy the distributed software, decompress it and/or build the application.
- Compilers are not accessible or are not correctly installed.
- Korn Shell (ksh) is not accessible or is not correctly installed
- User has not properly set all the environment as described in the installation procedure

3.7 DIRECTORY STRUCTURE

The directory structure of the NWC/GEO application is presented in Figure 3. The root directory of NWC/GEO is defined by the environment variable `SAFNWC` (defined during the installation procedure, and added to your `<shell>.rc` to automatically setup the environment variable at login). All other directories are child of this root directory.

$SAFNWC	
bin	Executable files
config	Configuration files
COTS	Software from 3rd party vendors
export	Outputs products generated for each PGE
<PGE>	One directory per PGE
LOG	Contain the Product Log Files. A file per region/slot execution containing PGE-specific log messages.
help	Help files
import	Directory with input data
Aux_data	Auxiliary files for PGEs (static files)
Common	Common or widely used auxiliary data
<PGE|Family>	PGE or Processor Family specific auxiliary files.
NWP_data	Directory for input NWP GRIB files
Obs_data	Directory for other input data (dynamic data) as for example, observations and product from other sources (in-situ data, soundings, satellite products, …) An appropriate subdirectory structure will be defined to store and manage different kind of data
Sat_data	Directory for input satellite data
Sdi_data	Internal directory used by the NWC/GEO
include	Application header files
lib	Directory for NWC/GEO libraries
logs	Directory storing the logs of the NWC/GEO application
src	Application source code
tmp	Temporary files (also referred as DATABUF)

Figure 3: NWC/GEO directory structure

The NWC/GEO application assumes that dynamic input data (i.e. Satellite, NWP and Observation data) are available in specific directories within the NWC/GEO directory tree (e.g. $SAFNWC/import/Sat_data for Satellite data). Note that the user is allowed to link these directories if input data are received and stored in other systems and/or directories.

The contents and cleaning strategy for directories presented in Figure 3 are explained in the following sections.

3.7.1 Directory “bin”

This directory contains the executable code of NWC/GEO application:

- The Task Manager
- The Product Generator Elements
- Tools required for the operations of the system
  - Cleaning tools
  - Ingestors
  - Pre-processors
  - …

3.7.2 Directory "config"

All the files used by the NWC/GEO to configure the operation are stored in the $SAFNWC/config directory, or linked to it. This will enable any component of the system to access to the configuration parameters needed for its execution.

The files located in the *config* directory control the execution of the Task Manager and the Product Generator Elements. Therefore a *scientific manager* will be in charge of maintaining these files according to specific needs: regions where the products will be generated, products to be produced, priorities, specific configurations (thresholds) for each PGE, etc.

Different directories store the default configuration for specific satellites and operational modes, and are properly installed during the installation process.

3.7.3 Directory "COTS"

This directory contains software and libraries developed by 3rd party vendors (outside the SAFNWC project) to perform specific activities. A specific subdirectory structure is created to store different packages.

The NWC/GEO installation procedure includes the instructions to install COTS (from source code and from binary packages). Compiled libraries and tools are stored in $SAFNWC/COTS/lib and $SAFNWC/COTS/bin respectively in order to make them available to other NWC/GEO components.

3.7.4 Directory "export"

All products generated by the NWC/GEO application are stored in the *export* directory tree, within a directory named according to the PGE identifier. Output products will be named and formatted according to the specification described in [AD.6].

A cleaning strategy is implemented by default in the TM in order to maintain the size of this container under control.

The operator must implement a specific procedure (using *cron* or TM capabilities) to store and archive the generated products (if required) before their automatic removal.

3.7.5 Directory "help"

Includes NWC/GEO help files. This information is further accessed using the user command `tm help` (See section 5.3.3)

3.7.6 Directory "import"

All input files to the NWC/GEO application, including common and specific auxiliary data files, are stored in or linked to this directory. This enables the NWC/GEO components to find the files they need. The sub-directories are customised according to the needs of each PGE, e.g. the Aux_data directory is sub-divided into as much directories as necessary to hold all the data needed by the different PGEs or Processor Families.

The user of the NWC/GEO application is in charge of filling the following directories with up to date files (dynamic data).

- $SAFNWC/import/Sat_data: Input satellite data.
- $SAFNWC/import/NWP_data: Input Numerical Weather Prediction Model data in GRIB format.
- $SAFNWC/import/Obs_data: Optional input local data. Currently, Lightning and OSTIA data.

The ICD/1 ([AD.5]) describes the full list of dynamic data required by the NWC/GEO application, the format and the naming criteria to allow the NWC/GEO to make use of them. The user is requested to provide required data in time and appropriate name and format.

A cleaning strategy is implemented by default in the TM in order to maintain the size of these containers under control.

Important Note: Users are requested to implement specific actions according to any other data they ingest.

3.7.7 Directory "include"

This directory holds all source headers. Appropriate subdirectory structure is created to store header files from different components of the application.

3.7.8 Directory "lib"

This directory stores the libraries of the NWC/GEO

3.7.9 Directory "logs"

Logs and notifications produced during the execution of the NWC/GEO application are stored in log files within this directory. The information stored in these files allows the operators and scientific users to check for details on operations and product generation.

The Task Manager generates, by default, daily log files. Note that the TM does not remove log files. User is requested to maintain, backup and remove obsolete log files.

3.7.10 Directory "src"

The *src* directory contains the source code of the NWC/GEO application. Code for different modules is stored in a subdirectory structure within *src* directory. Code for 3rd party software is stored in a separate *COTS* directory.

3.7.11 Directory "tmp"

All temporary files generated during the processing of the NWC/GEO, either by the PGEs or by the NWCLIB routines, are stored in this directory, also referred as DATABUF (Data Buffer). A directory structure is defined in *tmp* directory in order to better store and manage the information within the directory.

The Task Manager implements, by default, the cleaning policy for this directory in order to maintain the size of this area under control. This policy will depend on the type of the file to take into account that different files need different periods of storage.

3.8 SOFTWARE BASELINE DESCRIPTION

This v2025.2 includes the support to MTG I1 L1c native Products in netCDF format.

3.8.1 Main implemented changes (with respect to NWC/GEO v2025.1)

General Changes

- Added support to ICON. Some notes are included at the end of the section.
- Improve of the calculation of the DTIME value in the NWCLIB to allow more precision in some products calculation. These updates were implemented in the Visiting Scientist Activity "Stereo Height Assignment in NWC/GEO-HRW product":
    - For MTG-I, it is included a DTIME matrix read directly from the native L1c data, that are supported by the FSD format used to read the satellite data. A DTIME matrix are obtained per band, instead of calculated only one.
    - For GOES-R, a LUTs provided by James L. Carr et al. at the Visiting Scientist Activity are included in the auxiliary data package were defining better values than the ones defined previously through a scanning speed rate method"
- Include in the MTG auxiliary data a LAND-SEA map in High Resolution
- Update of FSD format to manage string type as unit
- Fix issue with logging writing when hostname size is too big
- Fix issue with cleaning temporal files
- Fix bug with GOES real time configuration
- Fix bug with time covered metadata when region contains parts outside of the satellite covered

GEO-CRR:

- Fix bug with mandatory nature of the VIS06

GEO-CMA:

- In case of solar intrusion, the tests using the channel IR3.8 are not used to avoid false clouds detections
- The channel IR3.8 is now "Optional" for MTG/FCI, to fix the issue of negative radiances for this channel

- Tuning of the "temporal" thresholds for MTG

GEO-CT:

- In case of solar intrusion, the tests using the channel IR3.8 are not used to avoid false clouds classification
- The channel IR3.8 is now "Optional" for MTG/FCI, to fix the issue of negative radiances for this channel

GEO-RDT:

- Optimization changes when computing attributes over the cloud cells

GEO-HRW:

- NWC/GEO-HRW v7.0.1 in NWC/GEO patch v2025.2 has improvements in the “pixel time” definition for both MTG-I and GOES-R satellites suggested by James L. Carr et al. at the Visiting Scientist Activity “Stereo Height Assignment in NWC/GEO-HRW product”:
    - For MTG-I, different “pixel time” matrices (obtained from the original MTG-I satellite input data) have been defined for the different satellite channels, in contrast to the rest of satellites, in which the same “pixel time” matrix is used for all channels
    - For GOES-R, “pixel times” are now obtained using LUTs provided by James L. Carr (which are similar for all satellite channels), defining better values than the ones defined previously through a scanning speed rate method"

Note to using regional NWP models, such as ICON:

1. If you only have levels up to 200 hPa you will have two important consequences on the GEO cloud products:
    - The cloud top pressure retrieved by the software cannot be less than 200 hPa, and therefore the estimated altitude of the top of the clouds cannot be greater than approximately 11 800 meters.
    - To perform reliable clear-sky and overcast simulations, RTTOV needs data up to 10 hPa at least (ideally up to 1 hPa). Using data only up to 200 hPa introduces strong biases, especially in the simulations of the sounding channels which are crucial for the altitude estimation of semi-transparent clouds. If you still want to use a regional NWP model (such as ICON), to tackle this problem I strongly encourage you to provide to the software NWP data for levels higher than 200 hPa, from the NWP model used for coupling for instance.
2. Using a high-resolution NWP model such as ICON, which is able to simulate explicitely the convection, can introduce significant error in the vertical profile used as input due to the mispositioning of convective cells.

3.8.2 Changes in Output Product Format

Please refer to the ‘Data Output Format’ document [AD.6] for a detailed specification of the new format.

3.8.3 Changes in Configuration Files

None. Only specific configuration for ICON has been included

3.8.4 Software Documentation

Applicable documentation is presented in Table 4, and accessible in the NWC/GEO Helpdesk (http://nwc-saf.eumetsat.int)

3.8.5 Software Baseline Changes

None. First version of MTG

4 QUICK START

This section describes the basic steps for those users who want to start the NWC/GEO package in a short time. The standard configuration of the software will be used as default.

4.1 PREVIOUS REQUIREMENTS

It is assumed that the user has installed the NWC/GEO application following the procedure described in section 3.

For the default operational usage of the package, the user shall provide the following inputs in the $SAFNWC/import/Sat_data directory. See the Interface control Document [AD.5] for a detailed description of the format, content and naming convention of the required files.

Satellite Data:

Satellite	Satellite data products
MTG	MTG FCI L1c BODY files in native netCDF format
MSG	MSG SEVIRI Level 1.5 files (PRO, SEGMENT and EPI) in native HRIT format, uncompressed and unencrypted
GOES-R	GOES16/17/18/19 ABI Level 1b M6 Radiance Product in native netCDF format
Himawari/HSD	Himawari-8/9 AHI data products in native Himawari Standard Data (HSD) format
Himawari/EHH	Himawari-8/9 data products delivered through EUMETCast in HRIT format
Himawari/FSD	Himawari-8/9 data products in the common NWC/GEO Format for Satellite Data (FSD)

NWP data:

ECMWF Numerical Weather Prediction grib files to be located in $SAFNWC/import/NWP_data directory.

4.2 STARTING THE APPLICATION

To start the NWC/GEO package, use the next command (see section 5.3 for a detailed description on all possible operations):

```
% SAFNWCTM
```

After that,

- If the NWC/GEO has been configured to operate in Real Time mode, the application is ready to process new incoming satellite data received in the $SAFNWC/import/Sat_data directory and generate the full set of NWC/GEO products in the default area (depending on the satellite and satellite mode)
- If the NWC/GEO has been configured to operate in Reprocessing mode (offline mode), the application automatically schedule the processing of all satellite products already available in the $SAFNWC/import/Sat_data directory

A default set of monitoring and programmed actions runs in background mode (see sections 5.3.1.3.4 and 5.3.1.3.5 for further details).

To see monitoring tasks, execute next command:

```
% tm monitor
```

Default Monitoring Actions include (can vary depending of the satellite configuration):

- Monitoring the reception of a new, appropriate satellite files and commands the execution of the processing of the new slot
- Monitoring the reception of new NWP files and executes the Remapping pre-process.
- Monitoring if a PGE has finished.
- Monitoring if all PGEs have finished for a certain region.
- Monitoring if the processing of a satellite slot (all PGEs generated for all configured regions) has finished.
- Monitor free disk space.

To see programmed tasks, execute next command:

```
% tm program
```

Default Programmed Actions include (can vary depending of the satellite configuration):

- Removal of obsolete files in `$SAFNWC/import/Sat_data` directory
- Removal of obsolete files in `$SAFNWC/import/NWP_data` directory
- Removal of obsolete files in `$SAFNWC/export` directory
- Removal of obsolete files in `$SAFNWC/tmp` directory
- Daily change of the log file

4.3 MONITOR THE PROCESSING

The processing of a Satellite slot to generate the set of configured NWC/GEO products will start automatically

- when a new satellite data product is available, if the application has been configured to process in Near Real Time, or
- for all available satellite slots already stored in $SAFNWC/sat_data|sat_raw (depending on the satellite), if the application has been configured in Reprocessing mode

Appropriate tasks are added to the Task Manager schedule in order to generate the configured NWC/GEO products. The whole process can be tracked looking at the log files or using the Schedule Monitor window opened using the following command:

```
% tm schedule monitor
```

When generated, products are available in the `$SAFNWC/export` directory.

4.4 QUIT THE APPLICATION

Use the following command to abort all PGEs and exit the application:

```
% tm quit
```

5 DESCRIPTION OF THE PRODUCT

5.1 INTRODUCTION

A key objective of the NWC SAF is the development and distribution of an integrated software package to enable the operational extraction of a set of Meteorological Products to support nowcasting and very short range forecasting. The NWC/GEO is the NWC SAF Software package for the generation of NWC SAF products based on satellite data products from geostationary platforms.

The Product Generator Elements (PGEs) are the components that implement the algorithms to derive NWC/GEO products from satellite and other input data. It should be noted that the manual operation of these PGEs is not feasible taking into account that:

- PGEs require a large amount of supporting information and auxiliary files.
- PGEs must be executed depending on the frequency of two consecutive satellite image slots. For example, for MTG, every 10 minutes.
- PGEs must be executed as soon as a new Satellite product is available.
- The execution of a PGE must take into account the dependencies with other PGEs. Some products need as input other NWC/GEO products and, therefore, PGEs must operate in an appropriate order.
- In a real-time operational mode, it is necessary to carry out some other secondary tasks, essential to assure the optimal execution of the NWC/GEO software over long periods of time.

In order to solve these problems, the NWC/GEO package contains a *Task Manager* tool, responsible for managing all tasks necessary for the timely generation of the SAF Products used to support nowcasting and very short range forecasting. This Task Manager, together with a set of configuration files, runs the NWC/GEO application with minimum user intervention.

High-level configuration of the system is defined in a set of specific configuration files. Note that the NWC/GEO includes specific configuration files for all supported satellites. Appropriate files are installed in the $SAFNWC/config directory during the installation and configuration of the applications, as described in section 3. The configuration of the satellite to be processed by the application can be modified as described in section 3.3.

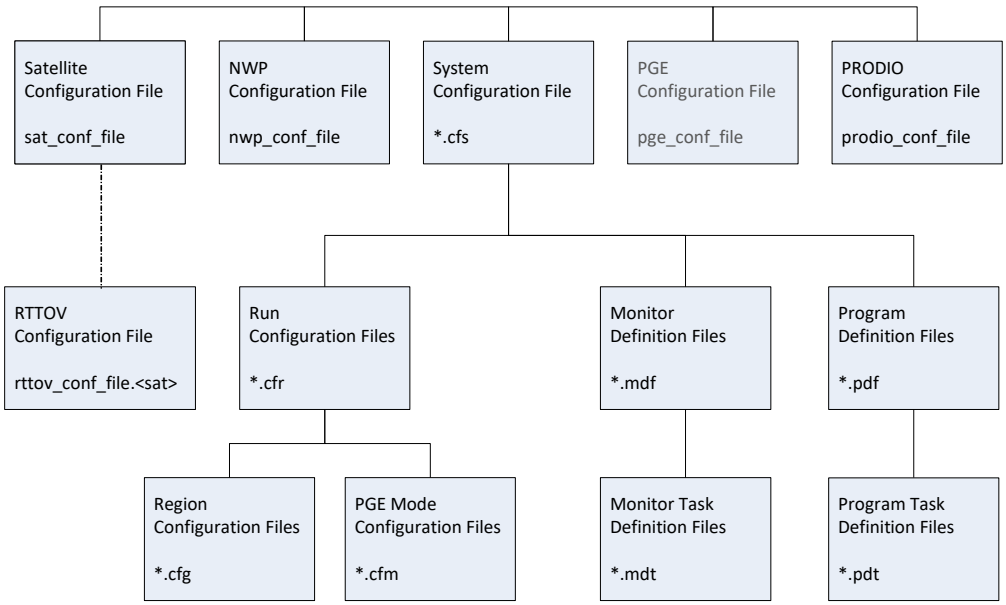

Figure 4: NWC/GEO Configuration files hierarchy

Next table contains a brief description of all configuration files presented in previous figure:

Table 8: High level NWC/GEO Configuration Files

Filename	Content
`sat_conf_file`	*Satellite Configuration File*: Includes satellite-specific information required by any NWC/GEO component. (see §6.9)
`nwp_conf_file`	*NWP Configuration File* Includes the characteristics of the NWP data to be used as input by the PGEs. (see §6.10) The application includes different NWP configuration files for different data providers. The operator must copy and setup the appropriate NWP configuration file to the nwp_conf_file file before executing the NWC/GEO application.
`pge_conf_file`	*PGE Configuration File* Provides information about the processors (PGEs) in order to allow the Task Manager to properly execute a processing chain taking into account dependencies and other constrains. (see §6.1.1) ***This file should not be modified by the users***
`prodio_conf_file`	*Product Configuration File* This file contains user-defined information to be included within the product, as netCDF attributes. This file is setup during the installation procedure.
`<filename>.cfs`	*System Configuration File*

	The whole configuration of the processing is defined in a single *System Configuration File*. However, to increase maintainability, configurable parameters have been grouped in different files and referred in other configurations files using a top-down structure (See **Error! Reference source not found.**) Different configurations for the NWC/GEO are provided by default for different satellite configurations

At start-up, the application reads the configuration files, creates the execution environment and defines the NWC/GEO operations based on

- monitoring events,
- programmed activities, and
- scheduled (PGE-related) tasks.

Basically, the NWC/GEO application manages a list of tasks required to generate the selected set of NWC/GEO products. The system allows the execution in two different modes:

- *Real-Time* or *Operational* mode, for the timely generation of NWC/GEO products using new incoming NRT satellite products, and
- *Off-Line* or *Reprocessing* mode, allowing the generation of NWC/GEO products using archived satellite products.

In both modes:

- NWC/GEO supports user commands (see section 7).
- NWC/GEO allows the execution of a set of configurable actions triggered by a monitoring event (See section 6.6).
- NWC/GEO allows the execution of a set of actions at a specific date and time (See section 6.7)
- NWC/GEO manages a list of scheduled tasks for the generation of the NWC/GEO products. It is ordered in such a way as to assure the correct sequence in the execution of the different PGEs, and it takes special care in resolving the dependencies between different NWC/GEO products.

The NWC/GEO application also needs some information about PGEs, such as dependencies and priorities, which is contained in the PGE Configuration File (`pge_conf_file`) (see section 6.1.1). Next table shows PGE dependencies, where:

- M: mandatory: The NWC/GEO products is required as mandatory input to the PGE
- O: Optional: The NWC/GEO products is an optional input to the PGE
- P: Previous. The NWC/GEO product for the previous slot is an optional input to the PGE (Previous dependencies are always optional)

Table 9: NWC/GEO Product Dependencies

Input NWC/GEO	CMA	CT	CTTH	CMIC	PC	CRR	PCPh	CRRPh	iSHAI	HRW	EXIM	ASII-TF	ASII-GW	ASII-ICE	CI	RDT-CW	PLAX	L1SD
CMA	P	M	M						M		O						O	
CT	P		M	M	M					MP	O				O	O	O	
CTTH				O						M	O			M		O	O	
CMIC							M	M		M	O			M	O	O	O	
PC											O						O	
CRR						P					O					O	O	
PCPh											O						O	
CRRPh								P			O					O	O	
iSHAI																		
HRW										P	M				O	O		
EXIM																		
ASII-TG																		
ASII-GW																		
ASII-ICE																		
CI																		
RDT-CW																		

M: Mandatory product (current slot)
O: Optional Product (current slot)
P: Optional product from Previous slot(s)

Next figures show the PGE dependencies in a graphical form. Mandatory dependence is represented by solid arrows, while dashed arrows show optional dependence. Dependency figure for EXIM is provided in a separate chart to improve the clarity of the main figure

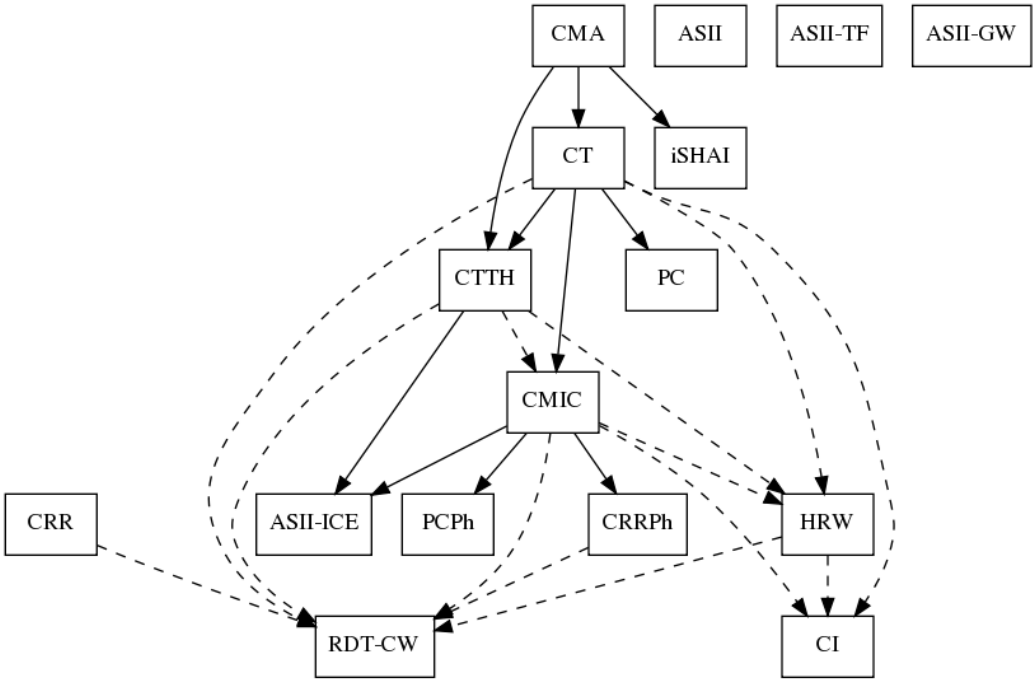

Figure 5: Dependency between NWC/GEO products (Main figure)[5]

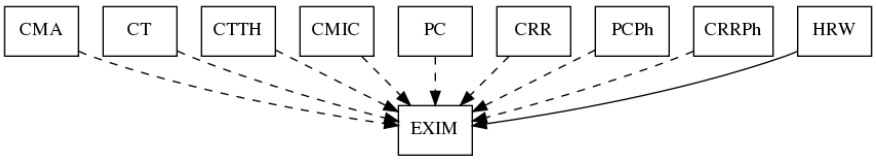

Figure 6: EXIM dependency

In addition, each PGE uses a *model configuration file* (`*.cfm`), describing its own configurable items, such as algorithm thresholds, satellite channels to be used, etc. A detailed description of the content of all these files is presented in the specific PGE Product User manual (See section 1.7.2)

5.2 PREVIOUS REQUIREMENTS

NWC/GEO is configured by default to use

- Satellite data. One of the following according the option selected during the installation (see [AD.5] for a detailed description of the data format, content and filename criteria)
    - MTG configuration: MTG L1c satellite products

[5] Mandatory dependence is represented by solid arrows. Dashed arrows show optional dependence

- MSG configuration: MSG L1.5 HRIT uncompressed satellite products
- GOESR configuration: GOES-R data products in native ABI M6 Level 1b Radiance Products (netCDF)
- HIMA/HSD configuration: Himawari-8 products in HSD native format
- HIMA/EHH configuration: Himawari-8 products in HRIT format as disseminated by the EUMETSAT's EUMETCast system
- HIMA/FSD configuration: Himawari-8 products in the common NWC/GEO Format for Satellite Data (FSD)

- ECMWF NWP grib data files in pressure levels (see [AD.5] for a detailed description of the data format, content and filename criteria)

Nevertheless, the NWC/GEO it is able to manage data produced by other sources as long as they comply with all requirements described in the Internal and External Interfaces of the NWC/GEO ([AD.5]) related to both Satellite and NWP data. The user is requested to copy/update both sat_conf_file and nwp_conf_file configuration files in case he/she uses other source of data.

5.3 HIGH-LEVEL NWC/GEO OPERATIONS

As already explained above, the system allows the execution in two different modes: *Real-Time* and *Off-Line*. Each one of these two modes is automatically configured during the installation procedure according the information provided by the operator (see section 3.2). The satellite configuration of the application can also be modified as described in section 3.3:

5.3.1 Start of NWC/GEO in REAL-TIME

5.3.1.1 Functional Description

The main function of the NWC/GEO application is the timely generation of NWC/GEO Products over long periods of time with minimum human intervention. Note that the NWC/GEO reads, at start-up, a set of high-level configuration files and a System Configuration File provided by the operator (see section 3.7.3). Then, it behaves according to the configuration and the results of user-defined monitoring actions, programmed actions and user commands (using the *tm* user-interface application).

This procedure shows how to start the Task Manager in the operational real-time mode, the mode to be used for the timely generation of NWC/GEO Products. The Task Manager can also be executed in an off-line mode, in order to generate SAF Products from historical data (See next section 5.3.2).

The user must implement the procedure to copy NRT NWP and Satellite data files in the $SAFNWC/import/NWP_data and $SAFNWC/import/Sat_data directories respectively. The default configuration implements some specific tasks to automatically remove old, obsolete NWP and Satellite data when they are no longer needed by the application. Note that NWP data available in the $SAFNWC/import/NWP_data are automatically extracted, pre-processed and remapped, as required by the configured PGEs, by the application at start-up.

The processing of the application is driven using 3 different lists:

- The *Monitor List* contains a set of actions to be executed by the system according to specific events. These monitoring actions obtain information about the status of the system and the application. Each monitoring task contains a list of actions to be executed according to the results of monitoring activity.
- The *Program List* contains a list of actions to be executed at a fixed date and time.
- The *Schedule List* contains the list of tasks in charge of generating the NWC/GEO products.

This section describes the definition of the configuration files used for the automatic generation of user-selected products covering user-defined geographical areas or regions in Real Time operation.

As noted above, the NWC/GEO application is expected to run continuously over long periods of time. It has been designed to run as a background process, thereby minimising the risk of improper actions by the user. In fact, users are restricted to interacting with the NWC/GEO using the *tm* user interface (see following sections and available commands in 7).

5.3.1.2 Cautions and Warning Messages

After starting the NWC/GEO (see section 4) the following header appears:

```
============================================================

         Satellite Application Facility
                   on support to
     Nowcasting and Very Short-Range Forecasting

                    NWC/MSG v<version>

                         <Date>

     Copyright yyyy, EUMETSAT, All Rights Reserved

------------------------------------------------------------
   Visit our web site for information and support at
              http://nwc-saf.eumetsat.int
============================================================
```

If the Task Manager has been successfully started next message will appear:

```
------------------------------------------------------------
Task Manager for the NWC/GEO has been started successfully
------------------------------------------------------------
```

Only one instance of the Task Manager is allowed to run in the system at a time. If the Task Manager is running and one attempts to run it again, the following message appears:

```
-------------------------------------------------------
Unable to start the Task Manager for the NWC/GEO
The NWC/GEO application is currently running
-------------------------------------------------------
```

Finally, any other error produces the following message:

```
-------------------------------------------------------
Unable to start the Task Manager for the NWC/GEO
See the file nohup.out for details
-------------------------------------------------------
```

In that case, see the file `nohup.out` for details. Normally this message appears if the TM detects an error in any of the Configuration Files at start-up. The following messages could appear:

```
"TM_INITIALISE - File Not Found"
```

Error reading configuration files. File does not exist.

```
"TM_INITIALISE - File Format Error"
```

Error finding parameters in a configuration file.

5.3.1.3 Default configuration

All configuration files are assumed to be in the `$SAFNWC/config` directory. Next figure shows a summary of all configuration files involved in Real Time Operations.

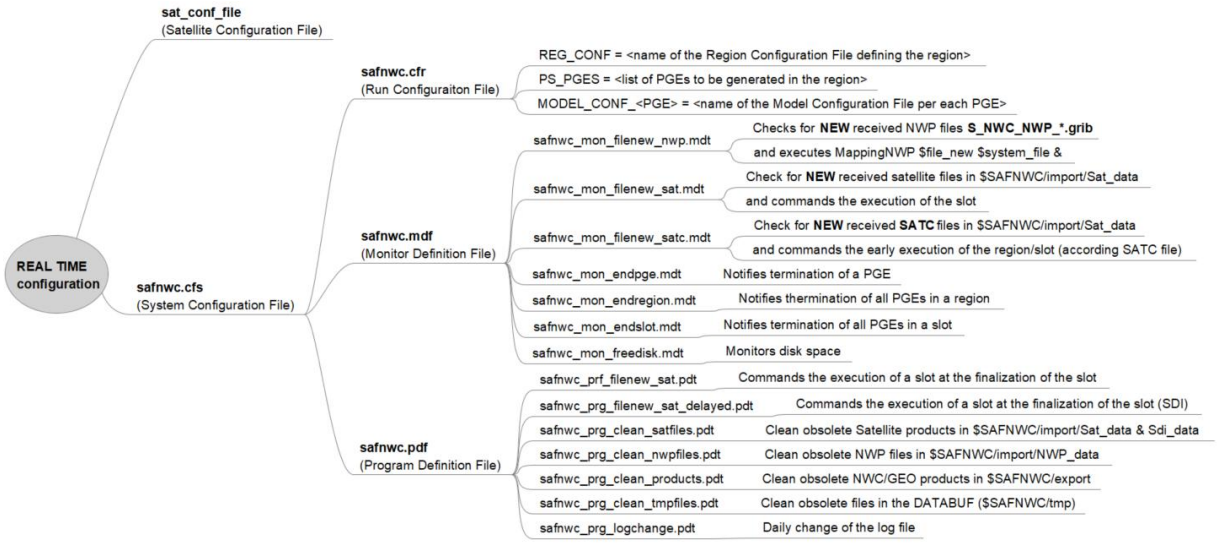

Figure 7: NWC/GEO REAL-TIME configuration

5.3.1.3.1 Satellite Configuration File

The Satellite Configuration File includes satellite-specific information required by any NWC/GEO component. (see §6.9). The NWC/GEO application provides different satellite configuration files for all supported satellites. Appropriate file is installed during the installation procedure (see §3.2).

***Important note**: NWC/GEO application provides a set of Satellite Configuration Files that contain satellite specific information in the moment the software has been released. But this information may change in time. The operator will be responsible for updating the sat_conf_file to the latest characteristics of the satellite being processed.*

5.3.1.3.2 System Configuration File

The System Configuration File contains general, configurable system parameters and refers to all other configuration files needed to execute the TM. Therefore, the TM only needs the name of the System Configuration File to completely configure the processing environment. See section 6.2 for details on format and content. NWC/GEO provides a default System Configuration File for REAL-TIME mode for all satellites, *safnwc.cfs*.

5.3.1.3.3 Definition of the Run Configuration Files for each Region

The Run Configuration File contains the names of the files containing information about run-time options for each of the regions to be processed. For example, this file includes the list of Products to be produced in each region and the configuration files to be used by each PGE when processing this region. See section 6.3 for details on format and content.

5.3.1.3.4 Monitoring tasks

A set of mandatory monitoring activities required to operate the NWC/GEO in Real-Time mode are provided by default for all supported satellites. This include the following activities

Table 10: Real Time and Reprocessing monitoring activities per configuration

`safnwc_mon_filenew_nwp.mdt`	
	Looks for new files `S_NWC_NWP*.grib` received in the `$SAFNWC/import/NWP_data` directory, and commands the pre-processing of these data to remap and prepare required NWP fields. The NWCLIB tool `MappingNWP` is used to read, extract and remap all NWP fields required by all configured PGEs in all configured regions. This task applies to all configurations
`safnwc_mon_filenew_sat.mdt`	
	Looks for new Satellite Files received in the `$SAFNWC/import/Sdi_data` directory, used to trigger the execution of the slot This task applies to following configurations • ***MSG Rapid Scan and MSG PS and IODC Reprocessing***: Looks for the reception of the EPIlogue file to initiate the processing of the slot • ***GOES-R Reprocessing***: Looks for the reception of file for band 16 to initiate the processing of the slot • ***FSD_RT and REP***: Looks for the reception of the FSD global file to initiate the processing of the slot

`safnwc_mon_filenew_satc.mdt`	
	Looks for new SATC file received in the `$SAFNWC/import/Sat_data` directory, used to trigger the execution of the slot. This SATC file is automatically created by the SDI component t (Satellite data Ingestor) in charge of ingesting and counting native satellite data received in `$SAFNWC/import/Sat_data` in order to allow the early execution of the region/slot when all required satellite data have been received This task applies to following configurations • ***Himawari EHH and Himawari HSD*** • ***MSG PR and IODC Real Time Processing*** • ***MTG***
`safnwc_mon_endpge.mdt`	
	Simply logs in the configured console (see "tm printtty" user command) the conclusion of the PGE. This task can be used as starting point if a specific post-processing is required on the just produced NWC/GEO product. This task applies to all configurations
`safnwc_mon_endregion.mdt`	
	Simply logs in the configured console (see "tm printtty" user command) and in the System Log File the conclusion of the processing of the region. This task can be used as starting point if a specific post-processing is required on the just concluded region (for example, archive and send products to other systems) This task applies to all configurations
`safnwc_mon_endslot.mdt`	
	Simply logs in the configured console (see "tm printtty" user command) and the System Log File the conclusion of the processing of the slot. This task can be used as starting point if a specific post-processing is required on the just concluded slot (for example, archive and send products to other systems) This task applies to all configurations
`safnwc_mon_freedisk.mdt`	
	Monitors disk space. A Warning message is provided if the disk space is below 1GB MB This task applies to all configurations

See section 6.6 for additional details in the definition of monitoring tasks

5.3.1.3.5 Programmed tasks

A set of mandatory programmed activities required to operate the NWC/GEO in Real-Time mode are provided by default for all supported satellites. This include the following activities

Table 11: Real Time and Reprocessing programmed activities per configuration

`safnwc_prg_filenew_sat.pdt`	
	Executes the processing of a slot based on time. This task is used when there are no other event (e.g. the reception of a defined file) to be used to trigger the execution of the slot This task applies to following configurations • ***GOES-16 M6 in Real Time processing:*** The slot is executed 14 minutes after the initiation of the nominal slot (RC=15min)

`safnwc_prg_filenew_sat_delayed.pdt`	Executes the processing of a slot not already executed after the reception of all required data at the finalization of the slot. Some configurations allow the early execution of the region/slot when all data have been received and ingested. If some required data are not received the slot is not executed in advance, and this task is used to execute it at the finalization of the slot This task applies to following configurations • ***Himawari-08 EHH and HSD in Real Time:*** The slot is executed (if not previously executed) 10 minutes after the initiation of the nominal slot (RC=10min) • ***MSG Primary Service and IODC in Real Time:*** The slot is executed (if not previously executed) 15 minutes after the initiation of the nominal slot (RC=15min) • ***MTG Primary Service in Real Time:*** The slot is executed (if not previously executed) 10 minutes after the initiation of the nominal slot (RC=10min)
`safnwc_prg_clean_satfiles.pdt`	Removes files in `$SAFNWC/import/Sat_data & Sdi_data` directories not accessed in the last 75 minutes This task applies all Real Time configurations
`safnwc_prg_clean_nwpfiles.pdt`	Removes files in `$SAFNWC/import/NWP_data` directory not accessed in the last 36 hours This task applies all Real Time configurations
`safnwc_prg_clean_products.pdt`	Removes files in `$SAFNWC/export` directory not accessed in the last 75 minutes. This task applies all Real Time configurations
`safnwc_prg_clean_tmpfiles.pdt`	Removes obsolete files in `$SAFNWC/tmp` directory. A specific tool `tm_cleandatabuf` is used to flag a file as obsolete according different criteria depending on the type of the product This task applies all Real Time configurations
`safnwc_prg_logchange.pdt`	Daily change of the NWC/GEO System Log File, named as `safnwctm_YYYYMMDDT000000Z.log` This task applies all Real Time configurations

See section 6.7 for additional details in the definition of programmed tasks

5.3.1.4 Procedure

- Define the configuration stating from the default configuration defined in the previous section. In particular,
    - Define the region(s) of interest in Region Configuration File(s) (§6.8)
    - Define the PGEs to be produced (per region) in Run Configuration File(s) (§6.3)
    - Include the list of the Run Configuration Files in the System Configuration File (§6.2)
- Start the NWC/GEO task Manager using the following command:

```
% SAFNWCTM [system_configuration_file] [-d] [-s] [-r]
```

where

- `system_configuration_file` is the name of the system configuration file (`xxx.cfs`) to be loaded at start-up; it must exist in the `$SAFNWC/config` directory. The TM automatically loads the `safnwc.cfs` as default if the user does not provides any file.
- `-d` option activates the debug mode. In this mode, the NWC/GEO logs some more messages in the Log File for debugging purposes.
- `-s` option initialises the NWC/GEO in suspended mode. The `tm resume` user command must be used to initiate the execution of the application
- -r option skip the initial remapping of NWP data located in $SAFNWC/import/NWP_data directory[6]

5.3.1.5 Examples

Start the NWC/GEO using default configuration files

```
%SAFNWCTM
```

Start the NWC/GEO using user-specific configuration in debug mode:

```
%SAFNWCTM my_system.cfs -d
```

5.3.1.6 Known errors, causes and solutions

None

5.3.2 Start of NWC/GEO in REPROCESSING mode

5.3.2.1 Functional Description

Although the main functionality of the NWC/GEO application is the generation of SAF products in real-time mode, it is also possible to run the package in off-line mode. This mode is intended to generate NWC/GEO products from archived data.

NWC/GEO is configured in off-line (reprocessing) mode setting the keyword `REAL_TIME` of the System configuration File to `FALSE`

```
REAL_TIME    FALSE
```

Processing is identical for both real-time and off-line modes, with the following exceptions:

- In off-line mode, PGE tasks are ordered by ascending slot.

[6] This option can be used if the TM is stopped for a while and re-started again with the same configuration. In that case, currently remapped NWP data will be available in the $SAFNWC/tmp directory and the iinitial remapping process can be skipped.

- Most of the tasks have no real sense in the off-line mode. The main purpose of the NWC/GEO application running in off-line mode is the generation of meteorological products using archived data. Therefore, all tasks referring to the reception of live satellite products, NWP data or the procedures used to clean import, export and tmp directories are not used in the off-line mode.

Both NWP and Satellite data files must be available in $SAFNWC/import/NWP_data and $SAFNWC/import/Sat_data directories respectively before the execution of the NWC/GEO. Note that NWP data are automatically extracted, preprocessed and remapped, as required by the configured PGEs, by the NWC/GEO application at statup.

5.3.2.2 Cautions and Warning Messages

See section 5.3.1.2

5.3.2.3 Default configuration

All configuration files are assumed to be in the `$SAFNWC/config` directory. Next figure shows a summary of all configuration files involved in Reprocessing Operations.

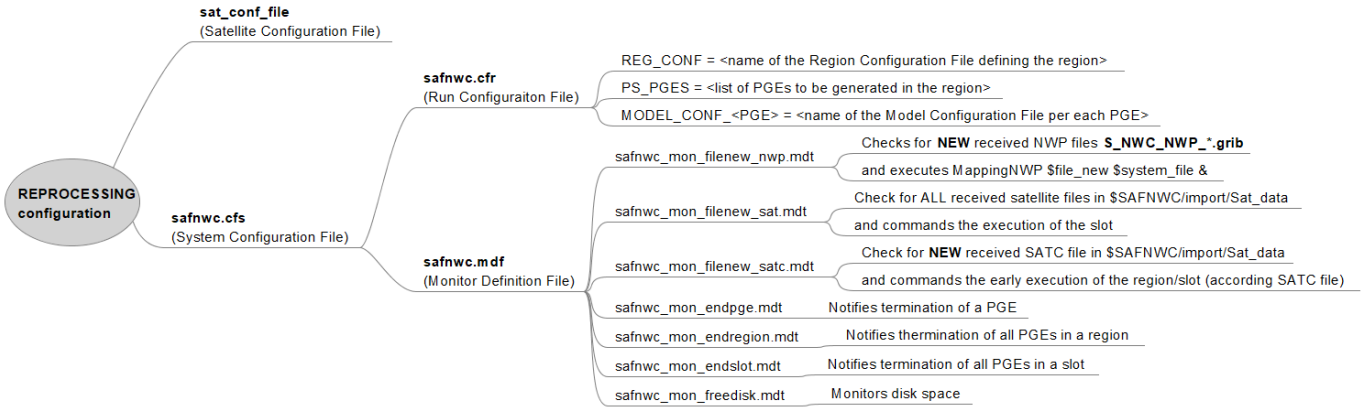

Figure 8: NWC/GEO Reprocessing configuration

5.3.2.3.1 Satellite Configuration File

Please refer to section 5.3.1.3.1

5.3.2.3.2 System Configuration File

Please refer to section 5.3.1.3.2. The keyword `REAL_TIME` keyword in the System configuration file for all Reprocessing modes is set to `FALSE`.

5.3.2.3.3 Definition of the Run Configuration Files for each Region

Please refer to section 5.3.1.3.3

5.3.2.3.4 Monitoring tasks

Please refer to section 5.3.1.3.4

5.3.2.3.5 Programmed tasks

There are no programmed task when the NWC/GEO is configured in Reprocessing mode

5.3.2.4 Procedure

Please refer to section 5.3.1.4

5.3.2.5 Examples

Start the NWC/GEO using default configuration files for off-line mode

```
%SAFNWCTM
```

Start the NWC/GEO using user-specific configuration in debug mode:

```
%SAFNWCTM my_system_offline.cfs -d
```

5.3.2.6 Known errors, causes and solutions

None

5.3.3 Help

5.3.3.1 Functional Description

Display help pages

5.3.3.2 Cautions and Warning Messages

Warning and error messages related to the management of programmed tasks include

Message	Description
`Command xxx not found`	Requested command is not known (it is not a NWC/GEO command)

5.3.3.3 Procedure

The User can submit any command during the execution of the Task Manager. Next table summarises the help commands

User Command	Parameter	Comment
`tm help`	-	Display the main help page, listing all available NWC/GEO commands
`tm help`	`command`	Display the help page for the requested command

Table 12: List of "tm help" commands

5.3.3.4 Examples

Display the list of available NWC/GEO commands

```
%tm help
```

Display the help page for command monitor

```
%tm help monitor
```

5.3.3.5 Known errors, causes and solutions

None

5.3.4 Version

5.3.4.1 Functional Description

Display NWC/GEO system and components version. The command `tm version` will show the following listing:

```
=========================================================

          Satellite Application Facility
                   on support to
     Nowcasting and Very Short-Range Forecasting

                    NWC/GEO v<vers>
                       <Date>

=========================================================

NWC/GEO Component's version
---------------------------
  GEO-TM       v<tm_vers>
  GEO-NWCLIB   v<nwclib_vers>
  GEO-CMA      v<cma_vers>
  GEO-CT       v<ct_vers>
  GEO-CTTH     v<ctth_vers>
  GEO-CMIC     v<cmic_vers>
  GEO-PC       v<pc_vers>
  GEO-CRR      v<crr_vers>
  GEO-PCPh     v<pcph_vers>
  GEO-CRRPh    v<crrph_vers>
  GEO-iSHAI    v<ishai_vers>
  GEO-HRW      v<hrw_vers>
  GEO-EXIM     v<exim_vers>
  GEO-ASII-TF  v<asii-tf_vers>
  GEO-ASII-GW  v<asii-gw_vers>
  GEO-ASII-ICE v<asii-ice_vers>
  GEO-RDT-CW   v<rdt-cw_vers>
  GEO-CI       v<ci_vers>

---------------------------------------------------------
     Copyright YYYY, EUMETSAT, All Rights Reserved
---------------------------------------------------------
   Visit our web site for information and support at
              http://nwc-saf.eumetsat.int
=========================================================
```

5.3.4.2 Cautions and Warning Messages

None

5.3.4.3 Procedure

The User can submit any command during the execution of the Task Manager. Next table summarises the version commands

User Command	Parameter	Comment
`tm version`	-	Displays the NWC/GEO version and NWC/GEO Component's version

Table 13: Version commands

5.3.4.4 Examples

Display the System and Components version

```
%tm version
```

5.3.4.5 Known errors, causes and solutions

None

5.3.5 System Status

5.3.5.1 Functional Description

Display the status of the application, with a general description of the system together with some statistics on processing.

The `tm status` command displays current status of the system. The command will show the following listing:

```
=====================================================
 DD MMM YYYY    NWC/GEO Task-Manager Status   hh:mm:ss
=====================================================

Beggining Time: DD MMM YYYY hh:mm:ss
Elapsed Time:          nnnd hh:mm:ss
Task Manager Status:
   REAL_TIME Mode:  ON/OFF
   Active Mode:     ON/OFF

Number of tasks in Schedule / in execution:    n/ m (Max: x)

Region Priority / PGE:  CMA CT CTTH CMIC PC CRR PCPh CRRPh iSHAI …
-------------------------------------------------------------------------------
MSG-N           01:     XXX XX XXXX XXXX XX XXX XXXX XXXXX XXXXX …
Spain           02:     XXX XX XXXX      XX XXX
-------------------------------------------------------------------------------

Number of PGE executed/successfully/Total RunTime/Mean RunTime
-----------------------------------
CMA:              a       b          c  d
CT:               a       b          c  d
CTTH:             a       b          c  d
…
-----------------------------------
Total:      A       B          C   D

Number of Slots completely processed : N

Mean time employed by Task Manager Cycle:   0.00s
Maximun cycle time:                         0.00s
```

This includes the following information:

- A header with current date and time
- The start date/time of the TM, and elapsed time
- The TM operational Mode:
    - Real-Time or Off-Line mode, and
    - Active or Suspended mode
- The number of tasks in the schedule list, in execution, and maximum number of allowed concurrent processes (according to `NB_PROCESS` value in the system configuration file. See §6.2).
- The number of configured regions, the region priority and the list of PGEs to be generated for each region

- For each PGE, i) the number of times the PGE has been executed, ii) the number of times the PGE has been executed successfully, iii) the total runtime used by the PGE and iv) the mean runtime used for each PGE. The list also presents the accumulative data for all PGEs.
- The total number of Slots completely processed.
- The maximum time used to execute a TM cycle. This value must remain below the TM_CYCLE_SECS defined in the tm_safnwc.h file header. If it exceeds this value it will be necessary to check the TM actions in order to discover a slow running process. In such case the execution of the command must be started as a background process, by adding the symbol '&' at the end of the action

  For example, `MON_ACTION_01 A_Execute compress -V *.* &`

Also note that previous sections have described the use of the *tm monitor*, *tm program*, and *tm schedule* commands, used to display the content of the different lists containing the monitoring tasks, the programmed actions and the list of scheduled tasks for the generation of the products. (Please refer to sections 5.4.1, 5.4.2 & 5.4.3 to obtain a complete description of the use and results of such commands).

1.1.1.1 Cautions and Warning Messages

None

1.1.1.2 Procedure

The User can submit any command during the execution of the Task Manager. Next table summarises the status commands

User Command	Parameter	Comment
`tm status`	-	Displays the current status of the Task Manager and some statistics about the processing of the PGEs

Table 14: Status commands

5.3.5.2 Examples

Display the System status

```
%tm status
```

5.3.5.3 Known errors, causes and solutions

None

5.3.6 Termination of the Task Manager

5.3.6.1 Functional Description

Terminate the operation of the Task Manager together with all PGE-related processes currently being executed.

1.1.1.3 Cautions and Warning Messages

Warning and error messages related to the termination of the Task Manager include:

Message	Description
`Exiting SAFNWC Task Manager`	Informs the conclusion of the SAFNWC TM

5.3.6.2 Procedure

The User can submit any user commands during the execution of the Task Manager. Next table summarises the commands for terminating the system.

User Command	Parameter	Comment
`tm quit`	-	Terminates the execution of the Task Manager

Table 15: Quit commands

5.3.6.3 Known errors, causes and solutions

None

5.4 LOW-LEVEL NWC/GEO OPERATIONS

5.4.1 Management of Monitoring Tasks

5.4.1.1 Functional Description

As described in section 5.3.1.1, the Task Manager is able to keep a list of events to be monitored and a list of actions to be executed if a monitored value exceeds a user-defined nominal range. This section provides the commands used to manage the *Monitor List*. All of them are presented in Table 16.

The `tm monitor` command displays the list of monitoring tasks currently loaded in the system. The command will show the following listing:

```
%tm monitor
```

```
=====================================================
 DD MMM YYYY      Monitored  Task            hh:mm:ss
=====================================================
Number of monitored task:   7

    1               M_File_New >$SAFNWC/import/Sat_data *EPI* NEW<
     (-1.5000E+00,-5.0000E-01)    7    10    60
       Action  0:             A_PrintScreen >$system_time: New SEVIRI file found: >$file_new<<
       Action  1:                 A_Execute >TM_FileNew_SEVIRI $file_new 30 &<

    2               M_File_New >$SAFNWC/import/NWP_data S_NWC_NWP* ALL<
     (-1.5000E+00,-5.0000E-01)   57    60     0
       Action  0:             A_PrintScreen >$system_time: New NWP file found: >$file_new<<
       Action  1:                 A_Execute >$SAFNWC/bin/MappingNWP $file_new $system_file<

    3                M_End_PGE ><
     (-1.5000E+00,-5.0000E-01)    1     1     0
       Action  0:             A_PrintScreen >PGE $pge, Slot $endpge_slot, Region $rname ($r):
                                             Has concluded with ...

...
```

The output includes:

- A header with current date and time
- The number of monitoring tasks loaded in the system
- For each monitored task:
    - The Monitor Id (used to remove the task), the monitor method (See §6.6.2) and the parameters of the monitored tasks (between the >< symbols)
    - The nominal range for the monitored value (between parentheses), the remaining time for execution, the STEP time and the TIMEOUT time. These values are defined in the Monitor Task Definition File (See §6.6.2).and provided in TM_CYCLE_SECS units (1 second).
    - The list of actions to be executed if a monitored value exceeds the nominal range.

5.4.1.2 Cautions and Warning Messages

Warning and error messages related to the management of monitoring tasks include

Message	Description
`Unauthorized user`	User is not allowed to execute the command. Only the *safnwc* user is allowed to modify the configuration of the NWC/GEO
`Error reading configuration files`	An error has been detected reading the configuration files. File is not found, file is not properly formatted or do not include all required information. See the System Log File for additional information.

5.4.1.3 Procedure

The User can submit any command during the execution of the Task Manager. Next table summarises the commands for the management of the *Monitor List*.

User Command	Parameter	Comment
`tm monitor`	-	Displays the current list of monitored actions loaded in the system
`tm monitor add`	`filename.mdt`	Adds a monitoring task to the current Monitor List. The command requires the name of a Monitor Task Definition File
`tm monitor load`	`filename.mdf`	Loads a set of monitoring tasks. All tasks in the Monitor List are removed before loading the new list. The command requires the name of a Monitor Definition File
`tm monitor remove`	`<monitor_id>`	Removes a monitoring task in the Monitor List. The monitor_id is obtained from the Monitor List displayed with tm monitor
`tm monitor remove all`	-	Removes all the monitoring tasks in the Monitor List

Table 16: List of "tm monitor" commands

All configuration files are assumed to be located in the `$SAFNWC/config` directory.

5.4.1.4 Examples

Display the list of monitored tasks loaded in the system:

```
%tm monitor
```

Remove task number 2 from the *Monitor List*

```
%tm monitor remove 2
```

Remove all Monitoring tasks

```
%tm monitor remove all
```

Load Monitoring tasks defined in a Monitor Definition File

```
%tm monitor load my_mon_list.mdf
```

Load a Monitoring task defined in a Monitor Task Definition File

```
%tm monitor add my_mon_task.mdt
```

5.4.1.5 Known errors, causes and solutions

None

5.4.2 Management of Programed Tasks

5.4.2.1 Functional Description

As described in section 5.3.1.1, the Task Manager is able to maintain a list of events to be executed at a fixed time. This section describes the commands used to manage the *Program List*. All of them are presented in Table 17.

The `tm program` command displays the list of programmed tasks currently loaded in the system. The command will produce the following listing:

```
%tm program
```

```
=====================================================
 DD MMM YYYY      Programmed Task            hh:mm:ss
=====================================================
Number of Programmed tasks:   5

    3: 02 NOV 2015 16:38:00    0d 00:15:00
       Action  0:      A_CleanObsoleteFiles >$SAFNWC/export 75<
    4: 02 NOV 2015 16:48:00    0d 00:15:00
       Action  0:                 A_Execute >$SAFNWC/bin/tm_cleandatabuf &<
    1: 02 NOV 2015 16:49:00    0d 00:15:00
       Action  0:      A_CleanObsoleteFiles >$SAFNWC/import/Sat_data 75<
    2: 02 NOV 2015 18:05:00    0d 03:00:00
       Action  0:      A_CleanObsoleteFiles >$SAFNWC/import/NWP_data 2160<
    5: 03 NOV 2015 00:00:00    1d 00:00:00
       Action  0:                 A_LogFile >safnwctm_$system_time.log<
```

The output includes:

- A header with current date and time
- The number of programmed tasks loaded in the system
- For each programmed task:
    - The Program Id (used to remove the task), the time of execution and the PRG_REPEAT value (See details in §6.7.2)
    - A list containing the actions to be executed by the TM at the programmed time.

5.4.2.2 Cautions and Warning Messages

Warning and error messages related to the management of programmed tasks include

Message	Description
`Unauthorized user`	User is not allowed to execute the command. Only the *safnwc* user is allowed to modify the configuration of the NWC/GEO
`Error reading configuration files`	An error has been detected reading the configuration files. File is not found, file is not properly formatted or do not include all required information. See the System Log File for additional information.

5.4.2.3 Procedure

The User can submit any command during the execution of the Task Manager. Next table summarises the commands for the management of the *Monitor List*.

User Command	Parameter	Comment
`tm program`	`-`	Displays the current list of programmed actions loaded in the system
`tm program add`	`filename.pdt`	Adds a programmed task to the current Program List. The command requires the name of a Program Task Definition File
`tm program load`	`filename.pdf`	Loads a set of programmed tasks. All tasks in the Program List are removed before loading the new list. The command requires the name of a Program Definition File
`tm program remove`	`program_id`	Removes a programmed task in the Program List. The program_id is obtained from the Program List displayed with tm program
`tm program remove all`	`-`	Removes all the programmed tasks in the Program List

Table 17: List of "tm program" commands

All configuration files are assumed to be in the `$SAFNWC/config` directory.

5.4.2.4 Examples

Display the list of programed tasks loaded in the system:

```
%tm program
```

Remove task number 2 from the *Program List*

```
%tm program remove 2
```

Remove all Programmed tasks

```
%tm program remove all
```

Load Programmed tasks defined in a Program Definition File

```
%tm program load my_prog_list.pdf
```

Load a Programmed task defined in a Program Task Definition File

```
%tm program add my_prog_task.pdt
```

5.4.2.5 Known errors, causes and solutions

None

5.4.3 Management of Scheduled Tasks

5.4.3.1 Functional Description

As described in section 5.3.1.1, the Task Manager maintains a list of tasks to generate user-selected NWC SAF products. This section describes the commands used to manage the *Schedule List*. They are presented in Table 18.

The `tm schedule` displays the list of scheduled tasks currently loaded in the system. This command generates the following output:

```
%tm schedule
```

```
=====================================================
DD MMM YYYY      Scheduled Tasks             hh:mm:ss
=====================================================
Number of Scheduled tasks:  nn

 ID    PID  PGE               Slot         Reg   Prority  Dep   RunTime
                                                 PGE  Reg
-------------------------------------------------------------------------
  1: 21060 CMA        YYYYMMDDThhmmssZ      01   01   01   0 0       1   0%
  2:    -1 CT         YYYYMMDDThhmmssZ      01   01   01   1 0
  3:    -1 CTTH       YYYYMMDDThhmmssZ      01   02   01   3 0
  4:    -1 CMIC       YYYYMMDDThhmmssZ      01   02   01   6 0
  5:    -1 PC         YYYYMMDDThhmmssZ      01   03   01   2 0
  6:    -1 CRR        YYYYMMDDThhmmssZ      01   03   01   0 0
  8:    -1 iSHAI      YYYYMMDDThhmmssZ      01   03   01   1 0
  9:    -1 HRW        YYYYMMDDThhmmssZ      01   03   01   14 0
…
```

The following can be seen:

1) A header with current date and time

2) The number of scheduled tasks loaded in the system

For each task there is a print-out of:

1) The Schedule Id (used to remove the task)

2) The Process Id. If the task is currently being executed, the output shows the process id. Tasks scheduled for execution are marked with a PID=-1

3) The PGE identifier

4) The slot

5) The region number according to the System Configuration File

6) The PGE and Region Priority

7) The dependency bit mask for current and previous slot. This column shows the current dependency with other SAF products, that is, it shows what Products must be generated before starting the generation of a PGE, for both current and previous slot. Note that the dependency with previous slot is only used in reprocessing (OFF-LINE) mode

8) The runtime for tasks currently being executed.

9) The progress for tasks currently being executed.

5.4.3.2 Cautions and Warning Messages

Warning and error messages related to the management of scheduled task include:

Message	Description
`Error reading configuration files`	An error has been detected reading the configuration files. File is not found, file is not properly formatted or do not include all required information. See the System Log File for additional information.
`Schedule list contains <n> tasks waiting for execution`	Message shown when a new slot is added to the schedule list in real-time mode, and some tasks from the previous slot are still in the schedule list, waiting for execution
`Loop in <nn.nn> overflows the TM cycle`	The Task Manager performs all its tasks in a cyclical mode. This message appears if a process blocks the TM cycle for long time. The configuration of the system must be reviewed. For example, be sure that all scripts or applications executed in monitoring and programmed actions are executed in background (adding a '&')

5.4.3.3 Procedure

The User can submit any user commands during the execution of the Task Manager. Next table summarises the commands responsible for managing the *Schedule List*.

User Command	Parameter	Comment
`tm schedule`	-	Displays the current list of scheduled PGE generation tasks.
`tm schedule monitor`	-	Opens a xterm and continuously displays the list of scheduled PGE generation tasks in a dynamic view.
`tm schedule remove`	`schedule_id`	Removes a schedule task in the Schedule List. The schedule id is obtained from the Schedule List displayed with tm schedule. If the task is currently in execution it is necessary to use the tm abort command.
`tm schedule remove all`	-	Removes all the scheduled tasks in the Schedule List. This command will not remove the task currently in execution.
`tm schedule abort`	`schedule_id`	Cancels a PGE task currently in execution.
`tm schedule monitor`	-	Opens a new xterm to continuously monitor the content and status of the scheduled tasks.

Table 18: List of "tm schedule" commands

All configuration files are assumed to be located in the `$SAFNWC/config` directory.

5.4.3.4 Examples

Display the list of scheduled tasks:

```
%tm schedule
```

Remove task number 2 from the *Schedule List*

```
%tm schedule remove 2
```

Remove all *Scheduled tasks*

```
%tm schedule remove all
```

Cancels task number 3 from the Schedule List (currently in execution)

```
%tm schedule abort 3
```

5.4.3.5 Known errors, causes and solutions

None

5.4.4 Suspend and Resume

5.4.4.1 Functional Description

The User can suspend the generation of products. The TM in suspended mode does not command the generation of new NWC/GEO products, but all other functionality (User command, Monitoring activities and Programmed activities) works as in the non-suspended mode.

The user is also able to resume the production of NWC/GEO products, if previously set in suspended mode, by executing the `tm resume` command.

Scheduled tasks remain in the *Schedule List* after suspension of the system, but it does not command the execution of any new PGE. After resuming, the system is allowed to start the execution of scheduled tasks (according to dependencies and priorities).

5.4.4.2 Cautions and Warning Messages

Warning and error messages related to the suspension and resumption of the system include:

Message	Description
`TM is currently in suspended mode`	The user intends to suspend the system, but it is already suspended.
`TM is currently in run mode`	The user intends to resume the system, but it is already resumed.

5.4.4.3 Procedure

The User can submit any user commands during the execution of the Task Manager. Next table summarises the commands responsible for suspending/resuming the system.

User Command	Parameter	Comment
`tm suspend`		Suspends the generation of NWC/GEO products. All other tasks (monitoring, programmed and user command) works as in non-suspended mode
`tm resume`		Resumes the generation of the NWC/GEO products

Table 19: Suspend/resume commands

5.4.4.4 Examples

Suspends the executin of the NWC/GEO TM

```
%tm suspend
```

Resume the execution of the NWC/GEO TM

```
%tm resume
```

5.4.4.5 Known errors, causes and solutions

None

5.4.5 Management of Log devices

5.4.5.1 Functional Description

Check and modify the current log devices.

- Log File: This file contains all log and notifications produced during the execution of the NWC/GEO.
- Print Terminal: The terminal used to send the A_PrintScreen and A_Bell notifications defined in Monitor and Programmed tasks (See sections 6.6.2 and 6.7.2).

Display the content of the Log file.

5.4.5.2 Cautions and Warning Messages

None.

5.4.5.3 Procedure

The User can submit any command during the execution of the Task Manager. Next table summarises the commands for the management of the log devices.

User Command	Parameter	Comment
`tm log`		Display the current log devices (log file and print terminal)
`tm log logfile`	`[filename]`	Change the TM Log File to provided filename, or left blank to cancel sending log messages to a log file
`tm log printtty`	`[tty_dev]`	Change the TM Print Terminal to provided terminal, or left blank to cancel sending output messages to a terminal, The Print Terminal receives the notifications from A_PrintScreen and A_Bell actions (see section 8).
`tm showlog`	`[n]`	Displays the latest n lines of the Task Manager Log File. If n is omitted the latest 10 lines are displayed by default

Table 20: List of "tm log/showlog" commands

5.4.5.4 Examples

Display the current Log file and Print Terminal

```
%tm log
```

Change the current log file

```
%tm log logfile new.log
```

Change the Print Terminal to current terminal

```
%tm log printtty `tty`
```

Display the lastest 10/15 lines of the Log File

```
%tm showlog           10 lines, by default
%tm showlog 15        15 lines requested
```

5.4.5.5 Known errors, causes and solutions

None

5.4.6 Reconfiguration of the System

5.4.6.1 Functional Description

Update full configuration of the system on command. This functionality can also be performed as a consequence of a monitoring or programmed task, using the `A_Reconfigure` Action (see section 8).

5.4.6.2 Cautions and Warning Messages

The TM will log any error detected in the configuration files. Check file format and content.

5.4.6.3 Procedure

The User can submit any user commands during the execution of the Task Manager. Next table summarises the commands responsible for reconfiguring the system.

User Command	Parameter	Comment
`tm rldconf`	`filename.cfs`	Reloads all configurable parameters from the submitted System Configuration File See important note in section 5.4.6.3

Table 21: Reconfiguration commands

IMPORTANT NOTE: If the modification of the configuration modifies the processing region and/or the products to be generated, NWP data must be reprocessed (remapping to new region and/or extraction of new required fields) before the execution of the PGEs. In that case, it is required to follow the next procedure:

```
Suspend the system          %tm suspend
Reconfigure the system      %tm rldconf my_newsys_conf_file.cfs
Commands the Remapping      %AllMappingNWP my_newsys_conf_file.cfs
Resume the system           %tm resume
```

In any case, if possible, it is strongly suggested to avoid the reconfiguration of the system using this functionality, and perform a clean start of the application following the next procedure

```
Terminate the NWC/GEO             %tm quit
Clean the DATABUF                 %rm -rf $SAFNWC/tmp/* # BE CAREFUL!
Start using new configuration     %SAFNWCTM my_newsys_conf_file.cfs
```

5.4.6.4 Examples

Reconfigure the System according to a new System Configuration File (my_new_sys_conf_file.cfs)

```
%tm rldconf my_newsys_conf_file.cfs
```

5.4.7 Adding a new slot for processing

5.4.7.1 Functional Description

Adds a specific slot to the *Schedule List* for processing.

It is noted that the Task Manager is designed to run automatically and unassisted. In both off-line (reprocessing) and on-line (NRT-operational) mode, the system processes according to the set of rules defined as monitoring and programmed activities.

Therefore, the operator of the NWC/GEO is not requested to manually add the execution of specific slots. Nevertheless, the command `tm newslot` provides a mechanism to insert, on command, all the necessary tasks for the processing of a specific slot. In addition, the `tm newregion` command allows inserting the necessary tasks for the processing of a specific slot in a specific region.

5.4.7.2 Cautions and Warning Messages

Warning and error messages related to the injection of a new slot for processing include:

Message	Description
`Error decoding slot date/time from <date/time>`	Unable to decode date/time. Check date/tome format.
`Error decoding region id from <n>`	Unable to decode the region id. Check format.
`Error region id n not known ([m,n])`	Region id (n) not available, Provide a region id in the range [m,n].

5.4.7.3 Procedure

The User can submit any command during the execution of the Task Manager. Next table summarises the commands used to manually add the processing of a new slot:

User Command	Parameter	Comment
`tm newslot`	`YYYYMMDDThhmmssZ`	Adds, to the Schedule List, all tasks needed to process a new slot
`tm newregion`	`YYYYMMDDThhmmssZ region_id`	Adds, to the Schedule List, all the tasks needed to process a specific slot and region Region is referred by its index [0, n] according the order given in the Run Configuration File

Table 22: Adding slot/region commands

5.4.7.4 Examples

Add the processing of a new slot for all configured regions

```
%tm newslot 2015-10-15T12:15:00Z
```

Add the processing of a new slot in a specific region (2nd region defined in the System Configuration File)

```
%tm newregion 2015-10-15T12:15:15Z 2
```

5.4.7.5 Known errors, causes and solutions

None

5.5 INTERACTIVE PGE OPERATIONS

Although it is neither necessary nor recommended, the Product Generator Elements (PGEs), developed as stand-alone applications, can be executed manually to generate a specific product, considering that all required input data are available in appropriate format, naming and location. This typically includes:

- Satellite Configuration File located in the `$SAFNWC/config` directory (See §6.9)
- NWP Configuration File located in the `$SAFNWC/config` directory (See §6.10)
- System Configuration File located in the `$SAFNWC/config` directory (See §6.2)
- Run Configuration File located in the `$SAFNWC/config` directory (See §6.3)
- Region Configuration File located in the `$SAFNWC/config` directory (See §6.8)
- PGE Model Configuration File located in the `$SAFNWC/config` directory (See PGE User Manuals in Table 6)
- Satellite data in supported format (See §10.1) available for current slot in the `$SAFNWC/import/Sat_data` directory
- NWP files remapped for required parameters (see §10.2) located in `$SAFNWC/tmp`
- Satellite-specific auxiliary data fields located in `$SAFNWC/import/Aux_data/<satellite>`
- PGE-specific auxiliary data

All PGEs use a common interface, and can be executed manually using the following syntax:

```
% GEO-<PGE_id>-v<vers> <time_of_slot>
                       <region_configuration_file>
                       <model_configuration_file>
```

where

- <PGE_id> is the PGE identifies (CMA, CT, CTHH, …)
- <vers> is the version of the PGE
- <time_of_slot> is the nominal time for the slot to be processed (format: YYYY-MM-DDThh:mm:ssZ)
- <region_configuration_file> is the name of the region configuration file defining the region where the product must be generated (See §6.8)
- <model_configuration_file> is the name of the Model Configuration File containing PGE-specific parameters for the generation of the product (See PGE User Manuals in Table 6)

Please refer to PGE User Manuals (see Table 6) for additional information on the interactive execution of the PGEs

5.6 ADDITIONAL TOOLS

The SAFNWC/MSG application includes some additional tools that can be executed as parameters to the action: 'A_Execute'. These applications are provided within the TM module and, after compilation, are stored in the $SAFNWC/bin directory. New external tools could be added in future versions as required by the users or provided by them.

5.6.1 TM_cp_Products

This application copies all products for a specific satellite, region and date in a destination path defined by the user.

Usage:

TM_cp_Products <satellite_id> <region_id> <slot> <destination>

Integration in a Monitoring or Programmed task:

A_Execute %safnwc_home/bin/TM_cp_Products $satellite $rname $endreg_slot <destination>

Important note. All products are copied in the defined destination path. The user must assure that the destination directory exists.

5.6.2 TM_tar_Products

This application creates a tar file containing all products for a specific satellite, region and date. The tar file is stored in the directory defined by the user.

Usage:

TM_tar_Products <satellite_id> <region_id> <slot> <destination>

Integration in a Monitoring or Programmed task:

A_Execute %safnwc_home/bin/TM_tar_Products $satellite $rname $endreg_slot <destination>

Generated .tgz file is named as

S_NWC_SAF_<satellite_id>_<region_id>_<slot>.tgz

Important note. The user must assure that the destination directory exists.

6 NWC/GEO CONFIGURATION FILES

6.1 CONFIGURATION FILES FOR PGES

6.1.1 PGE configuration file (pge_conf_file)

The PGE configuration file is used for defining the PGEs components to be managed by the NWC/GEO. For example, this file defines the name of the PGE executable or the dependencies between different PGEs.

This file is located in the `$SAFNWC/config` directory, and named as `pge_conf_file`.

User shall not modify this file.

6.1.2 PGE model configuration files (.cfm)

The PGEs use a Model Configuration File containing information about specific PGE configurable parameters. There exists a PGE-specific Model Configuration File per PGE. The exact content of these files depends on each PGE and is described in detail in the PGE User's Manual (see Table 5)

Model Configuration Files must be located in the `$SAFNWC/config` and are identified by the extension ".cfm".

6.2 SYSTEM CONFIGURATION FILE (.CFS)

Keyword	Description	Type	Possible Value(s)
Operational Parameters			
REAL_TIME	Specifies the operational mode as REAL_TIME or OFF_LINE	char[]	TRUE (REAL_TIME) FALSE (OFF_LINE)
SORT_KEY	Configures the criteria used for ordering the tasks to generate the PGEs. Tasks can be ordered by REGION priority or by PGE priority	char[]	REGION PGE
NB_PARALLEL_PGES	Number of concurrent processes. TM will execute, if possible, a maximum of *n* PGEs concurrently, taking into account the dependencies between the Products.	Integer	>0
NB_THREADS_PGE	Default number of threads used for the execution of parallelized PGEs	Integer	>0
NB_THREADS_MAPPING	Number of threads used for the execution of the NWP remapping process	Integer	>0
Processing Regions			
REGION	Starts a block containing the specification of a processing region. This block is repeated for each processing region. The block ends with 'REGION_END'.	-	(VOID)
RUN_CONF	Name of run configuration files (see section 6.3) Files are expected to be in the $SAFNWC/config directory.	char[]	filename
PRIORITY	Priority of the processing of each region.	integer	>0 (1: Higher priotity)
REGION_END	Ends a REGION block	-	(VOID)
Monitor and Program Definitions files			
[MONITOR_FILE]	File name for the Monitor Definition File used to initialise the list of monitoring tasks (see section 6.6.1)	char[]	filename
[PROGRAM_FILE]	File name for the Program Definition File used to initialise the list of programmed tasks (see section 6.7.1)	char[]	filename
Initialization and Finalization scripts			
INIT_SCRIPT	Name of the script to be executed at the initialization of the NWC/GEO The executable file is assumed to be located in $SAFNWC/bin directory	char[]	filename
END_SCRIPT	Name of the script to be executed at the finalization of the NWC/GEO The executable file is assumed to be located in $SAFNWC/bin directory	char[]	tty device
Output Devices			
[LOG_FILE]	Name for the TM Log File. File will be created in the *$SAFNWC/logs* directory	char[]	filename
[PRINT_TTY]	Terminal device to display A_PrintScreen and A_Bell actions	char[]	tty device

Table 23: System Configuration File

Examples

```
# System_conf_file.cfs

# Operational Parameters
# ----------------------
REAL_TIME       TRUE
SORT_KEY        REGION
NB_PARALLEL_PGES      1
NB_THREADS_PGE        1
NB_THREADS_MAPPING    1

# Definition of the Region Processing Chains (Run Configuration Files)
# --------------------------------------------------------------------
REGION
RUN_CONF      run_conf_file_1.cfr
PRIORITY      1
REGION_END

# Monitor and Program Definition Files
# ------------------------------------
MONITOR_FILE    monitor_file.mdf
PROGRAM_FILE    program_file.pdf

# Output Devices
# ------------------
LOG_FILE        safnwctm_%system_time.log
```

6.3 RUN CONFIGURATION FILE (.CFR)

Keyword	Description	Type	Possible Value(s)
REG_CONF	Name of the region configuration file	char[]	filename
PS_PGES	Identifier of PGEs to be run for this region	char[]	Any combination of PGE Identifiers as defined in the PGE Configuration File (See section 6.1.1)
MODEL_CONF_<PGEid>	Name of the model configuration file for PGE <PGEid>. There must be a MODEL_CONF_<PGEid> line for each PGE included in the PS_PGES and for other PGEs not included but required as input for the selected PGEs according the PGE dependencies.	char[]	filename

Table 24: Run Configuration File

Example:

```
REG_CONF       safnwc_EURMLAND.cfg
PS_PGES        CMA CT CTTH CMIC PC CRR PCPh CRRPh iSHAI HRW ASII-TF ASII-GW RDT-CW CI

MODEL_CONF_CMA        safnwc_CMA.cfm
MODEL_CONF_CT         safnwc_CT.cfm
MODEL_CONF_CTTH       safnwc_CTTH.cfm
MODEL_CONF_CMIC       safnwc_CMIC.cfm
MODEL_CONF_PC         safnwc_PC.cfm
…
```

6.4 RTTOV CONFIGURATION FILE

The RTTOV Configuration File of the NWC/GEO is used for defining some parameters needed for the RTTOV simulation. It contains the RTTOV identifiers for the satellite, instrument and channels, and the list of bands that are going to be considered for the simulation.

The file is assumed to be located in the `$SAFNWC/config` directory and named `rttov_conf_file.<sat>`, where `<sat>` is the identifier of the satellite as it is contained in the `SATELLITE` keyword of the `sat_conf_file`. RTTOV

Please refer to section 5.1.5 of the Interface Control Document for Internal and External Interfaces of the NWC/GEO ([AD.5]) for additional detail on content and format of the RTTOV Configuration File

6.5 USER-DEFINED PRODIO CONFIGURATION FILE

The user-defined PRODIO Configuration file contains user-defined data to be used in the generation of the NWC/GEO products. This information will be stored in specific attributes in the netCDF product structure (see [AD.6]).

The file is assumed to be located in the `$SAFNWC/config` directory and named `prodio_conf_file`. It will include the following information:

Keyword	Description	Type	Possible Value(s)
INSTITUTION	Name of the Institution that generates the products	char[]	String
URL	Institution Web address	char[]	String
EMAIL	Institution contact point email address	char[]	String
LATLON	Enable/disable the generation of lat/lon data in the NWC/GEO output ptoducts	char[]	YES|NO
AUX	Enable/disable the generation of auxiliary data as NWC/GEO output products (LSD, TOPO, LATLON, SAT angles)	char[]	YES|NO
AUX_SUN	Enable/disable the generation of auxiliary data as NWC/GEO output products (SUN angles)	char[]	YES|NO

Table 25: User-defined PRODIO Configuration File content

6.6 MONITOR FILES

6.6.1 Monitor Definition File (.mdf)

The Monitor Definition Files describe a list of monitoring tasks. This list can be loaded to the TM:

1) At start-up, using the `MONITOR_FILE` keyword in the System configuration File

2) On-line, with the `tm monitor load` command

Keyword	Description	Type	Possible Value(s)
MONITOR_FILE	Name of the file describing each monitoring task. Repeated as necessary	char[]	filename

Table 26: Monitor Definition File

6.6.2 Monitor Task Definition File (.mdt)

The Monitor Task Definition Files define each monitoring task. These tasks can be loaded in the TM

1) Including it in a Monitor Definition File (see previous section)

2) Using the `tm monitor add` command

Keyword	Description	Type	Possible Value(s)
MON_METHOD	The monitor method to be used.	char[]	See Table 28
MON_PARAMETER	If needed, parameter(s) to be used by the monitor method (See Table 28)	char[]	
MON_THRESHOLD	If needed, range (min, max) defining the nominal behaviour (See Table 28)	Float[2]	min < max
MON_STEP	If needed, monitor rate time (in seconds) (See Table 28)	Integer	≥ 0
MON_TIMEOUT	If needed, sleeping time after trigger the event (in seconds). If TIMEOUT = -1 the monitoring task is automatically removed after the first trigger. (See Table 28)	Integer	≥ 0
MON_ACTION	Definition of the action to be executed according to the result of the monitoring activity. Repeated as necessary	char[]	See section 8

Table 27: Monitor Task Definition File

Available monitor methods are presented in next table

MON_METHOD	MON_PARAMETER	MON_THRESHOLD	MON_STEP MON_TIMEOUT	Comment
M_Free_Disk	file_system	✓	✓	Monitors the free disk space
M_File_Exists	filename		✓	Monitors if a file exists
M_File_New	path pattern ALL|NEW(1)		✓	Monitors if a new file satisfying the filename pattern has been received in the defined path.
M_End_PGE	-			Monitors if a PGE has terminated
M_End_Region	-			Monitors if all PGEs for a region and slot have finished
M_End_Slot	-			Monitors if a full Slot has finished (all PGEs for all regions)

Required keywords in the Monitor Task Definition File are marked with symbol ✓
(1) ALL: All files in *path* satisfying *pattern* are considered new files
NEW: Only files created after the initiation of the activity are considered new files

Table 28: Available Monitor Actions for the SAFNWC Task Manager

6.7 PROGRAM FILES

6.7.1 Program Definition File (.pdf)

The Program Definition Files describe a list of programmed tasks. This list can be loaded to the TM:

1) At start-up, using the `PROGRAM_FILE` keyword in the System Configuration File

2) On-line, with the `tm program load` command

Keyword	Description	Type	Possible Value(s)
PROGRAM_FILE	Name of the file describing each programmed task. Repeated as necessary	char[]	filename

Table 29: Program Definition File

6.7.2 Program Task Definition File (.pdt)

The Program Task Definition Files define each programmed task. These tasks can be loaded in the TM

1) Including it in a Program Definition File (see previous section)

2) Using the `tm program add` command

Keyword	Description	Type	Possible Value(s)
PRG_TIME	Programmed date and time for the beginning of the execution. The value field must contain the following format: hh:mm:ss [dd-mm-yyyy] Current date is assumed if dd-mm-yyyy field is not present.	chain of character *hh:mm:ss [dd-mm-yyyy]*	
PRG_REPEAT	Repeating time cycle. Use the format dd hh:mm:ss If this value is set to 0 (0d 00:00:00) the task is automatically removed after the first execution	chain of character *d*d *hh:mm:ss*	
PRG_ACTION	Definition of the action to be executed at the programmed time. Repeated as necessary	chain of characters	See section 8

Table 30: Program Task Definition File

6.8 REGION CONFIGURATION FILE (.CFG)

There is one region configuration file for each processed region. The name of the file is the one indicated in the Run Configuration File for the corresponding region.

Naming convention: each product configuration file will end with the “cfg” extension, and will be placed in the `$SAFNWC/config` directory of the current application.

This file specifies parameters used as run-time options for the PGEs, replacing the need to pass such options as command line arguments. *Table 31* describes its contents.

Keyword	Description	Type	Possible Value(s)
REGION_ID	Short ID of the region used to name the product files	char[]	User-defined string
REGION	A longer description of the region. It will be included in the output product header	char[]	User-defined string
REGION_CENTRE(1)	Coordinates of the centre of region to be processed in degrees. Order is latitude, longitude	float[2]	latitude: from –90.0 to +90.0 longitude: from –180.0 to +180.0
REGION_CENTRE_P(1)	Coordinates of the centre of region to be processed in pixel coordinates referred to the satellite frame in Nominal Resolution. Order is Line, Column	int[2]	[1,NB_LINES] [1,NB_COLS]
REGION_SIZE(1)	Size of region to be processed, in kilometres. Order is size in line, column directions Use special case “0 0” to define “full disk”	float[2]	two floats greater than zero, or 0 0 to define full disk
REGION_SIZE_P(1)	Size of region to be processed, in pixel referred to the satellite frame in Nominal Resolution. Order is size in line, column directions Use special case “0 0” to define “full disk”	int[2]	two integers greater than zero, or 0 0 to define full disk
REGION_UL(1)	Coordinates of the Upper-Left corner of region to be processed in degrees. Order is latitude, longitude	float[2]	latitude: from –90.0 to +90.0 longitude: from –180.0 to +180.0
REGION_BR(1)	Coordinates of the Bottom-Right corner of region to be processed in degrees. Order is latitude, longitude	float[2]	latitude: from –90.0 to +90.0 longitude: from –180.0 to +180.0
REGION_UL_P(1)	Coordinates of the Upper-Left corner of region to be processed in pixel referred to the satellite frame in Nominal Resolution. Order is line, column	int[2]	[1,NB_LINES] [1,NB_COLS]
REGION_BR_P(1)	Coordinates of the Bottom-Right corner of region to be processed in pixel referred to the satellite frame in Nominal Resolution. Order is line, column	int[2]	[1,NB_LINES] [1,NB_COLS]

(1) Region is defined using one of the following combinations:

(REGION_CENTRE, REGION_SIZE)
(REGION_CENTRE, REGION_SIZE_P)
(REGION_CENTRE_P, REGION_SIZE_P)
(REGION_UL, REGION_BR)
(REGION_UL_P, REGION_BR_P)

Table 31: Region Configuration File

Example

```
# Region Configuration File describing a region
# of 3000x8000km, centred at 50ºN, 0ºW
#
REGION_ID          MSG-N
REGION             MSG-N; CENTRE=50 0; SIZE=3000x8000km
REGION_CENTRE      50.0  0.0
REGION_SIZE        3000. 8000.
```

6.9 SATELLITE CONFIGURATION FILE (SAT_CONF_FILE)

Satellite-specific information required by any NWC/GEO component is provided in a Satellite Configuration File. The Satellite Configuration File contains known information about the satellite before the arrival of the data. Note that pre-processing tasks will be performed using the information provided in this file.

Detailed content and format of the Satellite configuration file is provided in section 5.1.3 of the Interface Control Document for Internal and External Interfaces of the NWC/GEO ([AD.5])

It is worth noting that the NWC/GEO includes several satellite configuration files according to the number of supported platforms. Appropriate satellite configuration file is installed during the installation procedure (See section 3.2)

6.10 NWP CONFIGURATION FILE (NWP_CONF_FILE)

The NWP Configuration File of the NWC/GEO is used to define the characteristics of the NWP data files to be used as input data for PGEs.

This file associates specific NWP keywords to the appropriate GRIB codes according to the model to be used. These keywords are further used in the PGE Model Configuration files in order to produce model-independent code. The NWP Configuration File also contains the list of pressure levels available in the model files.

Detailed content and format of the NWP configuration file is provided in section 5.1.4 of the Interface Control Document for Internal and External Interfaces of the NWC/GEO ([AD.5])

The NWC/GEO includes NWP configuration files for different models by default. Nevertheless, the user is allowed to generate additional configuration files according to the specific characteristics of the NWP model he/she is going to use. The specification of the NWP data model to be used for the generation of the NWC/GEO products will be configured by the operator at system level.

The NWC/GEO provides NWP configuration files for the following models

NWP Model	Description	filename
ECMFW	European Centre for Medium Weather Forecaster	nwp_conf_file.ECMWF
ARPEGE	Action de Recherche Petite Echelle Grande Echelle	nwp_conf_file.ARPEGE
GFS	Global Forecast System	nwp_conf_file.GFS

The operator must copy (and update if necessary) the appropriate NWP configuration file as the default file, named as `nwp_conf_file`, according the NWP data he/she intends to use. The user shall

review not only the NWP_PPP grib codes and shortNames, but also the list of AV_PRESSURE_LEVELS to match those retrieved from the NWP data provider.

7 USER COMMANDS

The interface between the user (operator) and the NWC/GEO application is performed via the `tm` application. Interface of the *tm* application is

```
tm command [-o<device>] [list_of_parameters]
```

where available commands and related parameters are presented in the table included hereafter.

Important Note: `tm` command is designed to be executed interactively. By default, it uses current terminal (tty) to display the output of the NWC/GEO. If the user requires executing a user command from a script or cron, the user must define the output device with the option `-o<device>`, where `device` can be, for example, a file.

NWC/GEO available user commands include:

User Command	Parameter	Comment
`tm help`	`-`	Display the main help page, listing all available NWC/GEO commands
`tm help`	`command`	Display the help page for the requested command

User Command	Parameter	Comment
`tm version`	`-`	Displays the NWC/GEO version and NWC/GEO Component's version

User Command	Parameter	Comment
`tm monitor`	`-`	Displays the current list of monitored actions loaded in the system
`tm monitor add`	`filename.mdt`	Adds a monitoring task to the current Monitor List. The command requires the name of a Monitor Task Definition File
`tm monitor load`	`filename.mdf`	Loads a set of monitoring tasks. All tasks in the Monitor List are removed before loading the new list. The command requires the name of a Monitor Definition File
`tm monitor remove`	`<monitor_id>`	Removes a monitoring task in the Monitor List. The monitor_id is obtained from the Monitor List displayed with tm monitor
`tm monitor remove all`	`-`	Removes all the monitoring tasks in the Monitor List

User Command	Parameter	Comment
`tm program`	`-`	Displays the current list of programmed actions loaded in the system
`tm program add`	`filename.pdt`	Adds a programmed task to the current Program List. The command requires the name of a Program Task Definition File
`tm program load`	`filename.pdf`	Loads a set of programmed tasks. All tasks in the Program List are removed before loading the new list. The command requires the name of a Program Definition File
`tm program remove`	`program_id`	Removes a programmed task in the Program List. The program_id is obtained from the Program List displayed with tm program
`tm program remove all`	`-`	Removes all the programmed tasks in the Program List

User Command	Parameter	Comment
`tm schedule`	`-`	Displays the current list of scheduled PGE generation tasks.
`tm schedule monitor`	`-`	Opens a xterm and continuously displays the list of scheduled PGE generation tasks in a dynamic view.
`tm schedule remove`	`schedule_id`	Removes a schedule task in the Schedule List. The schedule id is obtained from the Schedule List displayed with tm schedule. If the task is currently in execution it is necessary to use the tm abort command.
`tm schedule remove all`	`-`	Removes all the scheduled tasks in the Schedule List. This command will not remove the task currently in execution.
`tm schedule abort`	`schedule_id`	Cancels a PGE task currently in execution.
`tm schedule monitor`	`-`	Opens a new xterm to continuously monitor the content and status of the scheduled tasks.

User Command	Parameter	Comment
`tm newslot`	`YYYYMMDDThhmmssZ`	Adds, to the Schedule List, all tasks needed to process a new slot
`tm newregion`	`YYYYMMDDThhmmssZ region_id`	Adds, to the Schedule List, all the tasks needed to process a specific slot and region Region is referred by its index [0, n] according the order given in the Run Configuration File

User Command	Parameter	Comment
`tm suspend`		Suspends the generation of NWC/GEO products. All other tasks (monitoring, programmed and user command) works as in non-suspended mode
`tm resume`		Resumes the generation of the NWC/GEO products

User Command	Parameter	Comment
`tm log`		Display the current log devices (log file and print terminal)
`tm log logfile`	`[filename]`	Change the TM Log File to provided filename, or left blank to cancel sending log messages to a log file
`tm log printtty`	`[tty_dev]`	Change the TM Print Terminal to provided terminal, or left blank to cancel sending output messages to a terminal, The Print Terminal receives the notifications from A_PrintScreen and A_Bell actions (see section 8).
`tm showlog`	`[n]`	Displays the latest n lines of the Task Manager Log File. If n is omitted the latest 10 lines are displayed by default

User Command	Parameter	Comment
`tm rldconf`	`filename.cfs`	Reloads all configurable parameters from the submitted System Configuration File See important note in section 5.4.6.3

User Command	Parameter	Comment
`tm status`	`-`	Displays the current status of the Task Manager and some statistics about the processing of the PGEs

User Command	Parameter	Comment
`tm quit`	`-`	Terminates the execution of the Task Manager

Table 32: User commands

8 ACTIONS

The Task Manager is able to execute different actions as result of monitoring or programmed events. The actions to be executed by the Task Manager are defined in the Monitor Task Definition File (keyword MON_ACTION_*xx*, §6.6.2) and in the Program Task Definition File (keyword PRG_ACTION_*xx*, §6.7.2). This section presents the set of available actions which can be executed by the TM, and the parameters for each of them. All this information is summarised in the following table.

Action Name	Parameters	Coments
A_PrintScreen	message	Display a *message* in the PRINT_TTY terminal
A_Log	message	Writes a *message* in the TM Log File
A_Bell	-	Emits an audible signal in the PRINT_TTY terminal
A_Mail	address subject message	Send a mail message to *address*.
A_Execute	command	Executes the system command *command*. (system command, program or executable script) It is recommended to execute time-consuming commands with the & option to avoid the pause of the Task Manager.
A_Reconfigure	system_conf_file	Reload all the configurable parameters from the *system_conf_file* file
A_CleanObsoleteFiles	path time	Removes obsolete files from *path* directory. A file is considered obsolete if its last access time differs more than *time* minutes with respect the current system time
A_CleanObsoleteMonitor	time	Removes obsolete monitoring task from the *Monitor List*.
A_LogFile	log_file	Change the TM Log File to *log_file*
A_MonitorAdd	file.mdt	Adds a monitoring task to the current *Monitor List*.
A_MonitorDel	monitor_id	Removes a monitoring task in the *Monitor List*
A_MonitorCancel		Removes all the monitoring tasks in the *Monitor List*
A_MonitorLoad	file.mdf	Loads a set of monitoring tasks. All tasks in the *Monitor List* are removed before loading the new list.
A_ProgramAdd	file.pdt	Adds a programmed task to the current *Program List*
A_ProgramDel	program_id	Removes a programmed task in the *Program List*
A_ProgramCancel	-	Removes all the programmed task in the *Program List*
A_ProgramLoad	-	
A_ScheduleDel	schedule_id	Removes a schedule task in the *Schedule List*.
A_ScheduleCancel	-	Removes all scheduled tasks in the S*chedule List*
A_ScheduleAbort	schedule_id	Cancels a task currently in execution
A_TMAbort	-	Terminates the execution of TM
A_ProcessSlot	YYYYMMDDThhmmssZ	Inserts in the *Schedule List* all the tasks required to generate all PGEs for a new slot
A_ProcessRegion	YYYYMMDDThhmmssZ reg_id	Inserts in the *Schedule List* all the tasks

Action Name	Parameters	Coments
		required to generate all PGEs for a specific slot/region

Table 33: Available Actions for the NWC/GEO

The parameter field in the definition of the actions allows the use of wildcards (see section 9)

9 WILDCARDS

The user is able to use some wildcards in the Monitor Task Definition Files and Program Task Definition Files to represent the current system time, the number of the last processed PGE, etc. Available wildcards are presented in next table.

Wildcard	Comment	Format
% wildcards		
%system_time	To be replaced by current system time	YYYYMMDDThhmmssZ
%safnwc_home	To be replaced by the root directory for the SAFNWC	String
%satellite	To be replaced by the value of the key '*SATELLITE*' in the satellite configuration file (See [AD.5])	String
$ wildcards		
$system_time	To be replaced by current system time	YYYYMMDDThhmmssZ
$system_file	To be replaced by current System Configuration File	String
$satellite	To be replaced by the value of the key '*SATELLITE*' in the satellite configuration file (See [AD.5])	String
$pge	To be replaced by the Identifier of the last termitated PGE	String
$st	To be replaced by the completion status of the last terminated PGE. Completion status can be: - exit*xxxx* (when process have been normally completed) - sign*xxxx* (when process have been interrupted by a signal) - stop*xxxx* (when process have been stopped by a signal) Where *xxxx* is a signed value	String
$ptime	To be replaced by the processing time of the last terminated PGE, in seconds	integer
$r	To be replaced by the number of the region related to the last terminated PGE	integer
$rname	To be replaced by the name of the region related to the last terminated PGE	String
$g	To be replaced by the number of the last terminated region (all PGEs have terminated)	integer
$gname	To be replaced by the name of the last terminated region (all PGEs have terminated)	String
$endpge_slot	To be replaced by the nominal slot related to the last terminated PGE	YYYYMMDDThhmmssZ
$endreg_slot	To be replaced by the nominal slot related to the last terminated region	YYYYMMDDThhmmssZ
$endall_slot	To be replaced by the last finalised slot	YYYYMMDDThhmmssZ
$file_new	To be replaced by the just identified new file (captured by a M_File_New monitoring activity)	string

Table 34: Available Wildcards for the NWC/GEO

There exist two different types of wildcards (%-type and $-type) in order to define the moment in which TM must resolve the wildcard:

- %-type wildcards are resolved at the moment of reading the Task Definition File
- $-type wildcards are resolved every time the task is executed

10 MAIN INPUT DATA TO NWC/GEO

10.1 INPUT SATELLITE DATA

Key input to NWC/GEO processors is Geostationary Satellite image products. Current version allows reading satellite data in the following formats:

- MTG L1c in native netCDF format
- MSG L1.5 SEVIRI in native HRIT unencrypted and uncompressed files
- GOES-R Mode 6 in native ABI L1b Radiance products in netCDF format
- Himawari in native HSD unencrypted and uncompressed files
- Himawari in HRIT format as disseminated through the EUMETSAT's EUMETCast system
- FSD netCDF format defined for NWC/GEO

These formats are described in detail in the section 4.2 of the Interface Control Document for Internal and External Interfaces of the NWC/GEO ([AD.5])

It is noted that compressed SEVIRI HRLIT files (i.e. filename ending with "–_C") cannot be managed by the NWC/GEO package. These images must be pre-processed using the wavelet de-compressor available via EUMETSAT web site (http://www.eumetsat.int).

Input satellite files to the NWC/GEO application shall be placed within the `$SAFNWC/import/Sat_data` directory.

The detailed description of the satellite bands required for each PGE is provided in the PGE User's Manual (See section 1.7.2)

Following tables show the mandatory (M) and optional (O) satellite data required by all different PGEs for all supported satellites (MTG, GOES-N, GOES-R and Himawari)

Table 35: Required input satellite data per PGE for MSG series satellites

LABEL	Band	CMA	CT	CTTH	CMIC	PC	CRR	PCPh	CRRPh	iSHAI	HRW	EXIM	ASII-TF	ASII-GW	ASII-ICE	CI	RDT-CW
VIS06	0,635 µm; 3km	M	M		M	M	O	M	M		O	O					O
VIS08	0,810 µm; 3km	O									O	O					
HRV	0,750 µm; 1km	O									O						O
NIR16	1,640 µm; 3km	O			M	M						O					O
IR38	3,920 µm; 3km	O	O			M						O					O
WV62	6,250 µm; 3km			O		M	M	M	M	M	O	O	M			M	M
WV73	7,350 µm; 3km	O	O	O		M		M	M	M	O	O		O		M	O
IR87	8,700 µm; 3km	O	O		M			M	M			O				M	O
IR97	9,660 µm; 3km							M	M	M		O	M				O
IR108	10,80 µm; 3km	M	M	M	M	M	M	M	M	M	O	O	M	O		M	M
IR120	12,0 µm; 3km	M	M	O		M		M	M	M	O	O				M	O
IR134	13,4 µm; 3km	O		O				M	M	M		O				M	O

Table 36: Required input satellite data per PGE for GOES-R series satellites

LABEL	Band	CMA	CT	CTTH	CMIC	PC	CRR	PCPh	CRRPh	iSHAI	HRW	EXIM	ASII-TF	ASII-GW	ASII-ICE	CI	RDT-CW
VIS04	0,470 µm; 1km																
VIS06	0,64 µm; 0,5km	M	M		M	M	O	M	M		O						O
VIS08	0,865 µm; 1km	O									O						
NIR13	1,378 µm; 2km	O	O														
NIR16	1,610 µm; 1km	O			M	M						O					O
NIR22	2,250 µm; 2km	O			O												O
IR38	3,90 µm; 2km	O	O			M						O					O
WV62	6,190 µm; 2km			O		M	M	M	M	M	O	O	M			M	M
WV70	6,950 µm; 2km			O						M	O						
WV73	7,340 µm; 2km	O	O	O		M		M	M	M	O	O		O		M	O
IR87	8,70 µm; 2km	O	O		M			M	M			O				M	O
IR97	9,610 µm; 2km							M	M	M		O	M				O
IR103	10,35 µm; 2km	O	O							M						M	M
IR108	11,20 µm; 2km	M	M	M	M	M	M	M	M	M	O	O	M	O			O
IR120	12,3 µm; 2km	M	M	O		M		M	M	M		O				M	O
IR134	13,3 µm; 2km	O		O				M	M	M		O				M	O

Table 37: Required input satellite data per PGE for Himawari series satellites

LABEL	Band	CMA	CT	CTTH	CMIC	PC	CRR	PCPh	CRRPh	iSHAI	HRW	EXIM	ASII-TF	ASII-GW	ASII-ICE	CI	RDT-CW
VIS04	0,47 µm; 1 km																
VIS05	0,51 µm; 1 km																
VIS06	0,64 µm; 0,5 km	M	M		M	M	O	M	M		O						O
VIS08	0,86 µm; 1 km	O									O						
NIR16	1,6 µm; 2 km	O			M	M						O					O
NIR22	2,3 µm; 2 km	O			O												O
IR38	3,9 µm; 2 km	O	O			M						O					O
WV62	6,2 µm; 2 km			O		M	M	M	M	M	O	O	M			M	M
WV70	6,9 µm; 2 km			O						M	O						
WV73	7,3 µm; 2 km	O	O	O		M		M	M	M	O	O		O		M	O
IR87	8,6 µm; 2 km	O	O		M			M	M			O				M	O
IR97	9,6 µm; 2 km							M	M	M		O	M				O
IR103	10,4 µm; 2 km	O	O							M							M
IR108	11,2 µm; 2 km	M	M	M	M	M	M	M	M	M	O	O	M	O		M	
IR120	12,4 µm; 2 km	M	M	O		M		M	M	M		O				M	O
IR134	13,3 µm; 2 km	O		O				M	M	M		O				M	O

Table 38: Required input satellite data per PGE for MTG series satellites

LABEL	Band	CMA	CT	CTTH	CMIC	PC	CRR	PCPh	CRRPh	iSHAI	HRW	EXIM	ASII-TF	ASII-GW	ASII-ICE	CI	RDT-CW
VIS04	0,444 µm; 1km																
VIS05	0,510 µm; 1km																
VIS06	0,640 µm; 1km	M	M		M	M	O	M	M		O						O
VIS08	0,865 µm; 1km	O									O						
VIS09	0,914 µm; 1km																
NIR13	1,380 µm; 1km	O	O														
NIR16	1,610 µm; 1km	O			M	M											O
NIR22	2,250 µm; 1km	O			O												O
IR38	3,800 µm; 2km	O	O			M						O					O
WV62	6,300 µm; 2km			O		M	M	M	M	M	O	O	M			M	M
WV73	7,350 µm; 2km	O	O	O		M		M	M	M	O	O		O		M	O
IR87	8,700 µm; 2km	O	O		M			M	M	M		O				M	O
IR97	9,660 µm; 2km							M	M	M		O	M				O
IR108	10,50 µm; 2km	M	M	M	M	M	M	M	M	M	O	O	M	O		M	M
IR120	12,30 µm; 2km	M	M	O		M		M	M	M	O	O				M	O
IR134	13,30 µm; 2km	O		O				M	M	M		O				M	

10.2 INPUT NWP DATA FILES

Numerical Weather Prediction data are used by most of the PGEs as input data, being mandatory for some of them.

In order to allow the NWG/GEO managing NWP data and making them available to the PGEs, NWP data files must follow the specifications presented in section 4.3 of the Interface Control Document for Internal and External Interfaces of the NWC/GEO ([AD.5])

All NWP files must be stored within the `$SAFNWC/import/NWP_data` directory with the following name convention:

`S_NWC_NWP_YYYYMMDDThhmmssZ_fff.grib`

where

- `YYYYMMDDThhmmssZ` defines the model run time
- `fff` represents the forecast term, in hours

The detailed description of the NWP fields required for each PGE is provided in the PGE User's Manual (See section 1.7.2)

The user is responsible for ensuring the timely provision of NWP data fulfilling the needs of all PGEs he/she intends generate.

The following tables summarises the mandatory (M) and optional (O) NWP data required by all different PGEs

Table 39: Required input NWP data per PGE

NWP keyword	Field<<	Units	CMA	CT	CTTH	CMIC	PC	CRR	PCPh	CRRPh	iSHAI	HRW	EXIM	ASII-TF	ASII-ICE	ASII-GW	CI	RDT-CW
Single-Level fields																		
Surface Level																		
NWP_ST	Surface temperature. (skin temperature.)	K	O	O	O		M				M							
NWP_SP	Surface pressure	Pa			O			O			M	O						
NWP_SGEOP	Geopotential (at the surface: orography)	m2s-2	O	O	O						M							
2m Level																		
NWP_2T	2m air temp.	K			O			O			M							
NWP_2RH	2m relative humidity	%			O						M							
NWP_2D	2m dewpoint temperature	K			O			O			M							
NWP_2Q	2m Specific Humidity	kg/kg									M							
Tropopause Level																		
NWP_TT	Tropopause temperature	K		O	O													O
NWP_TP	Tropopause pressure	hPa			O													O
NWP_TH	Tropopause height	m2s-2			O													
Other																		
NWP_TCWV	Total Column Water Vapour	kg m-2	O	O														
NWP_TOZ	Total Ozone Content	Dobson				O												
NWP_ALTM	NWP altitude model	m	O	O	O													
NWP_LSM	NWP Land Sea Mask	(0-1)																
NWP_LI	Lifted Index								O	O							O	O
NWP_KI	K index	K							O	O							O	O
NWP_SHW	Showalter Index								O	O							O	O

NWP keyword	Field<<	Units	CMA	CT	CTTH	CMIC	PC	CRR	PCPh	CRRPh	iSHAI	HRW	EXIM	ASII-TF	ASII-ICE	ASII-GW	CI	RDT-CW
Pressure-Level fields																		
NWP_GEOP	Geopotential	m2s-2			O			O	O	O		O						
NWP_T	Temperature at various levels	K	O	O	O			O	O	O	M	M		M				
NWP_D	Dewpoint at various levels	K																
NWP_UW	Wind velocity (u-component)	ms-1						O				M		M			O	O
NWP_VW	Wind velocity (v-component)	ms-1						O				M		M			O	O
NWP_RH	Relative humidity	%			O			O						M				
NWP_Q	Specific Humidity	kg/kg									M							
NWP_OZ	Ozone mass mixing ratio	kg/kg									M							
NWP_AWV	Integrated Water Vapour above the pressure level	kg m-2				O												
NWP_BWV	Integrated Water Vapour below the pressure level	kg m-2				O												

10.3 INPUT LOCAL DATA AND OBSERVATIONS

Auxiliary observations and local data can also be used by some PGEs as optional input data

In order to allow the NWG/GEO managing Local data and Observations and making them available to the PGEs, data files must follow the specifications presented in section 4.4 of the Interface Control Document for Internal and External Interfaces of the NWC/GEO ([AD.5])

Following tables show the mandatory (M) and optional (O) local data and observations required by all different PGEs

Table 40: Required input Observations and Local data per PGE

	CMA	CT	CTTH	CMIC	PC	CRR	PCPh	CRRPh	iSHAI	HRW	EXIM	ASII-TF	ASII-GW	ASII-ICE	CI	RDT-CW
Lightning data						O		O								O
Ground station lightning data							O	O								O
OSTIA SST and local estimated error	O		O													
Daily safnwc snow occurrence file	O															
RTTOV bias files	O		O						O							

11 WARNING AND ERROR MESSAGES

The PGEs use generic exit codes to inform about the success or failure of the product generation process. These generic codes are

Table 41: Generic PGE exit codes

Code (#)	Code (ID)	Description
0	OK	The product has been generated successfully
128	ERROR_COMMAND	The command line arguments, content or format is not correct
129	ERROR_FILE_ACCESS	Error opening a file to read and/or write
130	ERROR_FILE_IO	Error reading and/or writing data
131	ERROR_MEMORY	Error allocating memory
132	ERROR_MATH	Mathematical error (e.g. division by zero)
255	ERROR	Generic Error which disables processing

In addition, the PGEs also generates detailed messages to inform the operator about the conditions of the processing. This information is particularly useful when the generation of a product fails, to identify the cause of the malfunction and to implement the corrective actions, if possible, to guarantee the generation of the product in next slots.

Please refer to PGE-specific Product User Manual (see Table 5) for the list of warning and error messages per PGE.

12 LIST OF TBD/TBC, OPEN POINTS, ASSUMPTIONS, AND COMMENTS

TBD TBC	Sec	Resp.	Due date.	Comment