Utilization of satellite data to enhance services for users – World Weather Research Programme perspective

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WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

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World Meteorological Organization
Organisation météorologique mondiale

WMO in the 21st Century

Research focus areas:

- Earth System Science Approach
- Seamless appproach
  - Across time and spatial scales
  - Across topics and communities
- Strengthening innovation (regional and national)
- Bridging the gap between research and operations

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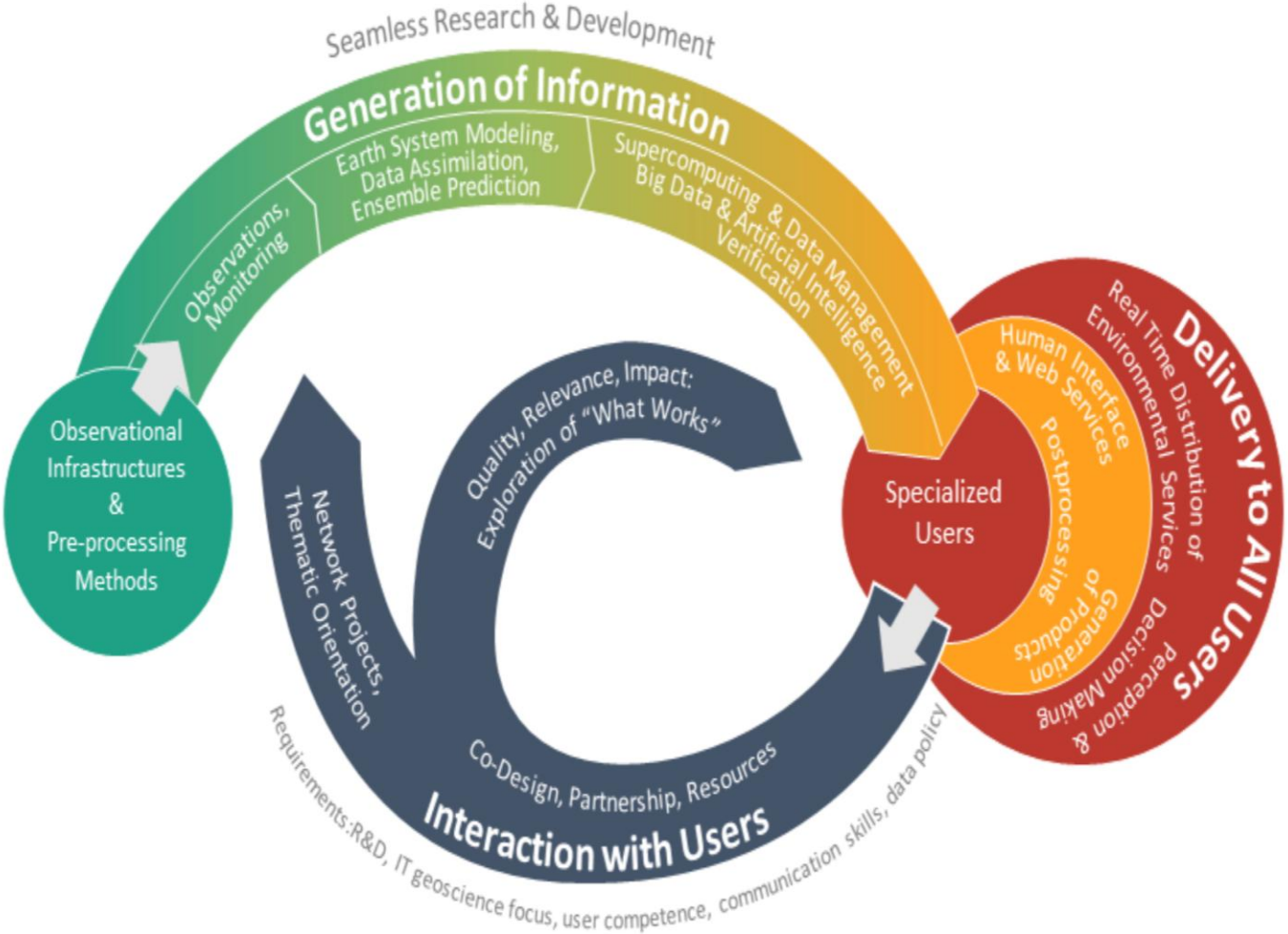
Earth System Science



Technical developments on seamless Earth system science need to go hand in hand with informed advancement of observations, monitoring capabilities and advanced assimilation and Earth system modelling and other prediction methods, which are the backbone of existing meteorological services.

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Ruti et al., BAMS 2019. DOI 10.1175/BAMS-D-17-0302.1

Goals of NWC SAF workshop

- To assess the applicability and usefulness of the NWC SAF products in the current phase (CDOP-3)
- To revise the proposals for further developments in order to collect the user requirements for the next phase (CDOP-4).
- Focused on MTG and EPS-SG new generation satellites.



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EUMETSAT NWC SAF
SUPPORT TO NOWCASTING AND VERY SHORT RANGE FORECASTING

World Weather Research Programme

1. Evolving Technologies: their impact on science and their use. New technologies in weather and related environmental monitoring, observations, computing and social media. Exascale computing and machine learning, where new knowledge is needed

2. Urbanization: research and services for megacities and large urban complexes. The overall objective is to help ensure sustainable urbanization in the developing world, through weather and climate resilience.

3. Water: modeling and predicting the water cycle for improved disaster risk reduction and resource management.

4. High-Impact Weather: toward impact based forecast in a variable and changing climate. Social and geophysical sciences shaping future early warnings

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WWRP WORLD WEATHER RESEARCH PROGRAMME

The Earth System Science you need to make your life safer and better

Key Structure & Core Projects

Data Assimilation & Observational Systems

Predictability, Dynamics & Ensemble Forecasting

Nowcasting & Mesoscale Prediction

Weather Modification

Tropical Meteorology

Verification

Social and Economic Applications

High-Impact Weather Value Chain: Multi-scale forecasts, warnings and impacts; Predictability & Uncertainty; Vulnerability & Risk; User communication. Timescale:Minutes to two weeks - Urban jointly with Global Atmosphere Watch

Sub-Seasonal to Seasonal: Improve forecast skill; Tropical cyclones, droughts, floods, heat waves, monsoons, etc.; Data exchange and accessibility; S2S Database. Timescale: Two weeks to seasons. Jointly with WCRP

Polar Prediction: Develop improved weather and environmental prediction services; Year of Polar Prediction: (mid 2017-mid 2019). Timescale: From hours to seasons. In coordination with WCRP

Use and Applications of Nowcasting

- For the nowcasting of precipitation and thunderstorms, satellite data are especially important ***in regions where lightning and weather radar data are missing or do not provide significant signals***.
- Real time monitoring and nowcasting of cloud cover is highly relevant for solar and wind power production (renewable energy).
- In areas without efficient precipitation gauges, surface observation stations and/or radar systems, coverage provided by satellite data is crucial for nowcasting of various weather phenomena, such as cloudiness, fog or volcanic ash. Fog and visibility monitoring and nowcasting is relevant for the security in all transportation sectors; while volcanic ash nowcasting is especially crucial for aviation.

EUMETSAT SAFs

The key objective of the NWC SAF is to provide to National Meteorological Services, Scientific Institutions and in general meteorological users from EUMETSAT member states and worldwide, with:

an **advanced, robust and**
activities in Nowca

The production and provisi
of a set of meteorological p
The provision of **support se**
benefit of the software app
consortium to its users.

The NWC-SAF provides a wide range of products based on measurements by the Meteosat (and other) satellites (EUMETSAT 2019):

- cloud products
- precipitation products
- convection products
- humidity and instability products
- wind products
- conceptual model products and
- extrapolated imagery products.

EUMETSAT CM SAF CLIMATE MONITORING

EUMETSAT ROM SAF RADIO OCCULTATION METEOROLOGY

CLIMATE MONITORING

The CM SAF generates and archives high-quality climate datasets on a continuous basis.

RADIO OCCULTATION METEOROLOGY

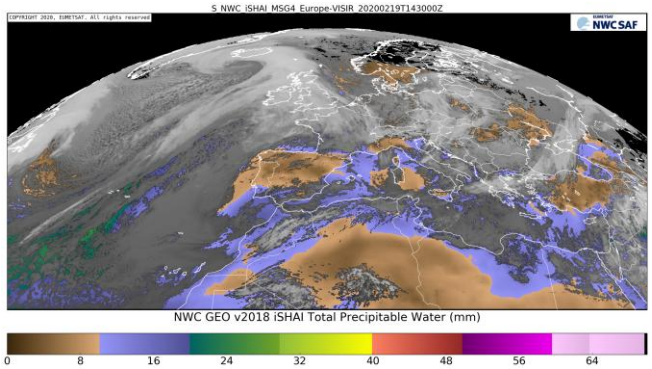
The ROM SAF generates and archives high-quality GPS Radio Occultation (RO) datasets for Numerical Weather Prediction (NWP) applications and specific climate application areas.

SUPPORT TO NOWCASTING AND VERY SHORT RANGE FORECASTING

Nowcasting is a weather forecast for the next few hours, based on current information.

LAND SURFACE ANALYSIS

The LSA SAF develops techniques to retrieve products related with land, land-atmosphere interactions, and biospheric applications.



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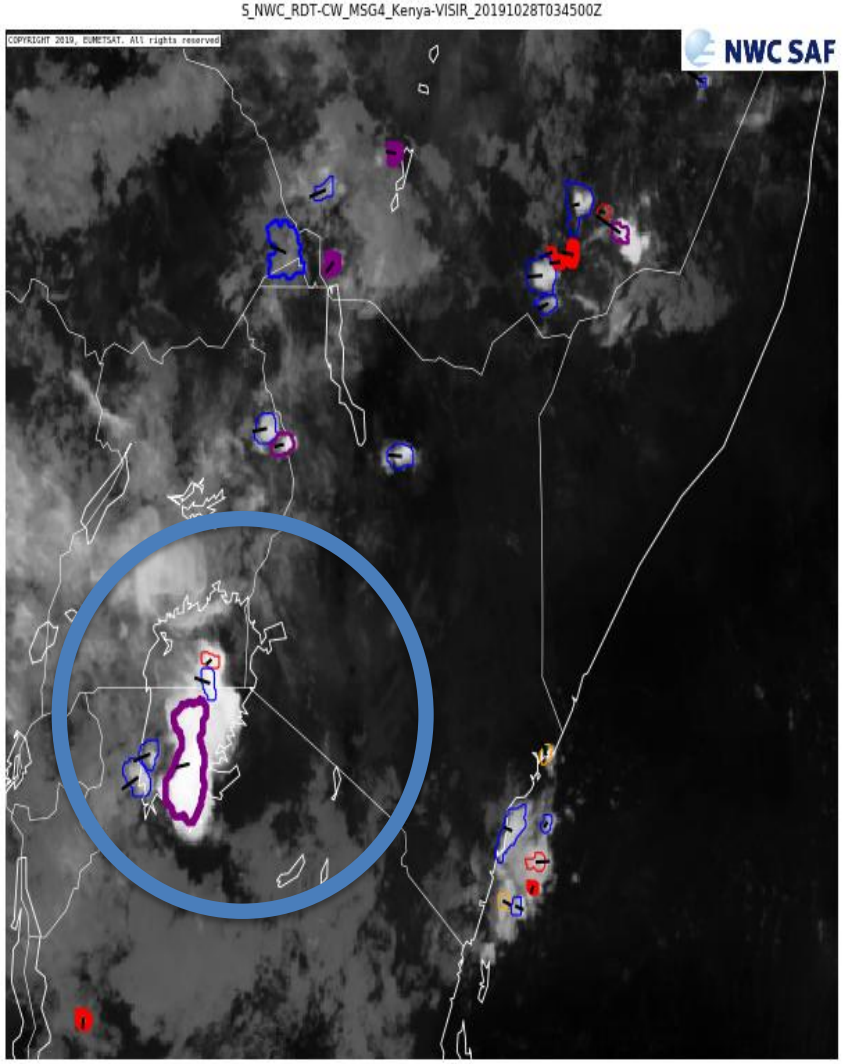
Improved weather info and hazard warnings from hours to a season,



GCRF African-SWIFT

Aims:

1. Significant improvements in weather forecasts in Africa, and the tropics, from hourly to seasonal timescales.
2. Build capability among UK and African partners to improve, maintain and evaluate operational tropical forecasts in future.
3. Develop African capacity for sustained training of forecasters

Builds upon existing partnerships between forecasting centres and universities combining strengths of academic and operational perspectives.

East Africa

HIGH impact Weather lAke sYstem (HIGHWAY) Project

- Enhance existing observations over lake Victoria
- Improve scientific understanding of the weather over Lake Victoria basin
- Added value in forecasting and early warning tools/processes
- Added data in NWP - verification

Funded by the UK Department For International Development

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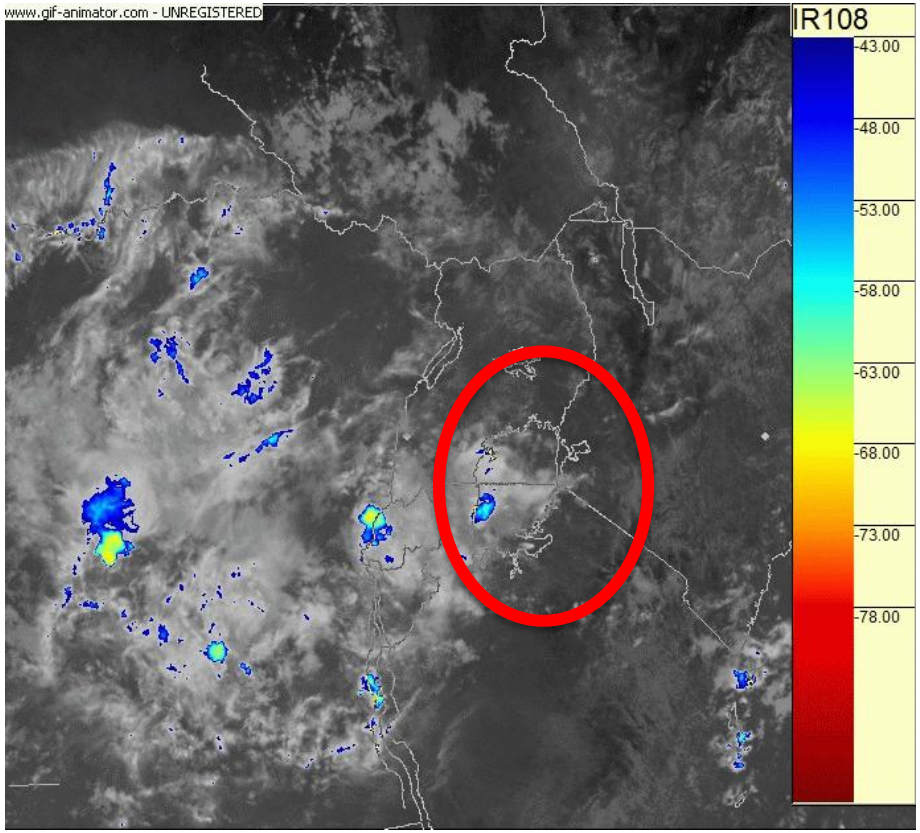
Early Warning Systems

Surface area of 23,146 square miles (~60k km2)
5.4m people live around the lake
220k rely on fishing for livelihood
Thousands of people/year die in incidents in/on the lake

IR108 colour enhanced

21 Apr 2015
1800-2200

EUMETSAT archived data

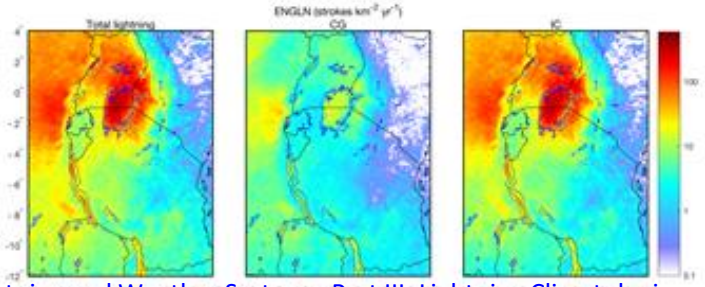


Prolific Lightning and Thunderstorm Initiation over the Lake Victoria Basin in East Africa

Katrina S. Virts[1] and Steven J. Goodman[2]

- Earth Systems Global Lightning Network data
- Terrain-related thunderstorm initiation hotspots northeast of the lake
- Initiation over the lake and northern lowlands.
- Initiation between 11-14 LT, about 1-2 hours earlier than the average cluster.
- Mesoscale clusters are most common during February-April and October-November.

1 NASA/Marshall Space Flight Center, Huntsville, Alabama, USA
2 Thunderbolt Global Analytics, Huntsville, Alabama, USA
AMS, https://doi.org/10.1175/MWR-D-19-0260.1



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Session: Session 8 Lightning and Weather Systems, Part III: Lightning Climatologies
Program: Ninth Conference on the Meteorological Application of Lightning Data 2019

Key features of the MTG mission

1. Continuity of observation in the visible spectrum from geostationary orbit.
2. Better spatial, temporal & radiometric resolution data for enhanced Nowcasting (NWC) applications.
3. New lightning image data to support Nowcasting applications.
4. Infrared & ultraviolet/visible soundings for 3D probing of the atmosphere
5. Enriched input to Numerical Weather Prediction (NWP) data assimilation & the future derivation of quantitative products.
6. New ways to follow weather systems 'from the cradle to grave'.

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Role of satellites and nowcasting for our future

- ✓ **High level coordination (NWC SAF, EUMETNET, EUMETSAT, CWG, NMR WG of WWRP etc.)**
- ✓ **Keep track of user requirements (also Africa)**
- ✓ **Satellite observation systems co-design**
- ✓ **Collaborative Nowcasting & Mesoscale research**

- ➢ ***What is the future of satellites and nowcasting – 2030 and beyond?***
- ➢ ***What is the future integration of satellite technologies (i.e. geostationary, polar low orbit) to fulfill the Earth System prediction requirements in 2040?***

Recent overviews of the state of Nowcasting

- *Conference Report: Third European Nowcasting Conference (2019) by Schmidt et. al. in Meteorological Zeitschrift*
  https://www.schweizerbart.de/papers/metz/detail/28/91801/Conference_Report_Third_European_Nowcasting_Conference

  DOI 10.1127/metz/2019/0983
- *A recent overview of Nowcasting was published in 2019 by Wapler et. al. A Reference Module in Earth Systems and Environmental Sciences:*

  http://www.elsevier.com/locate/permissionusematerial

  DOI 10.1016/B978-0-12-409548-9.11777-4.
- *WMO Guidelines for Nowcasting (2017)*

  WMO-No.1198. 82 PP. Guidelines for Nowcasting Techniques. ISBN: 978-92-63-11198-2.
  Available at: https://library.wmo.int/opac/doc_num.php?explnum_id=3795
- *White paper planned on «Nowcasting in 2030»*

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Thank you
Merci

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