Report on Physical Retrieval of Clear Air Parameters from SEVIRI Workshop

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Function	Name	Signature	Date
Prepared by	INM		*21 January 20*
Reviewed by			
Authorised by	L. F. López Cotín SAFNWC Project Manager		*21 January 20*

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1. SUMMARY OF THE WORKSHOP

The Workshop on Physical Retrieval of Clear Air Parameters from SEVIRI was held during November 28 – 29, 2007 at the Tryp Gran Vía hotel in Madrid, Spain. The workshop was organized by the INM and sponsored by EUMETSAT.

The primary goals of the Workshop were to:

1. Clarification of most important goals for physical retrieval.

2. Overview of SEVIRI existing methods with honest appraisal of strengths and weaknesses.

3. Identify tasks to include the most adequate physical retrieval in the SAFNWC package

The focus of the workshop was to exchange ideas and opinions concerning those goals with physical retrieval experts. The location and date of the workshop was chosen to facility the participation of Dr. Jun Li in the workshop. Dr Jun Li from Cooperative Institute for Meteorological Satellite Studies (CIMSS) of University of Wisconsin-Madison was at INM (Madrid, Spain) during the last two weeks of November adapting the prototype algorithm, in the framework of the SAF Nowcasting Visiting Scientist Activities.

About twenty five participants attended the workshop, representing developer of SEVIRI physical retrieval algorithms (MPEF, CMA SAF and GOES SOUNDER), developer of statistical retrieval algorithm (NWC SAF), NWC SAF users (Portugal, Italy, Poland, INM and CM SAF) and developers of relevant algorithms using other Instruments (EUMETSAT, FU BERLIN). The participants and their affiliations are shown in Appendix II. The focus of the presentations varied somewhat between the description of the retrieval algorithms, the validation results of the algorithms and case studies to show the utility of the retrieved parameters. Links to the Portable Document Format (PDF) files containing the presentations are included in Section 4. Deliberations by the working groups on algorithm proposal and validation methods led to the key recommendations described in Section 3.

2. WORKSHOP BACKGROUND

The objective of this work is to contribute to the future implementation of a physical retrieval approach in the SAFNWC software package.

The clear air parameters are retrieval with the current SAFNWC/MSG code by using statistical retrievals. This statistic approach was selected at the beginning of the project in order to fulfil two important requirements stated in the URD concerning the timeliness and the independence of forecasted fields. The purpose of the SAFNWC algorithms is to derive each clear air parameter at pixel by pixel scale every 15 minutes over MSG'N'. The core of the statistical retrieval for SAFNWC clear air products is one neural network for each parameter (in particular, multilayer preceptron is used). The neural networks have been trained with the simulated radiances of seven infrared SEVIRI channel: R6.2, R7.3, R8.7, R9.7, R10.8, R12.0 and R13.4.

During the 11th Meeting, the Steering Group proposed the INM Project Team to focus the work during the SAF CDOP on implementing a physical retrieval approach. The physical retrieval approach was not taken into account in previous phases of the project due to constraints on computation time.

Dr. Jun Li from Cooperative Institute for Meteorological Satellite Studies (CIMSS) of University of Wisconsin-Madison evaluated the advantages/disadvantages of two SEVIRI retrieval algorithms: Meteorological Products Extraction Facility (MPEF) and Climate Monitoring (CM) SAF approaches, and analysed the possibility of adapting to SEVIRI the new GOES (Geostationary Operational Environmental Satellite)-12 Sounder physical retrieval algorithm (physical iterative approach with forecast or regression as first guess) including all the improvements. In the INM SAFNWC Visiting Scientist Activity (VSA) report called "Recommendation on Physical Retrieval Algorithm for SEVIRI Nowcasting Product", Dr Jun Li introduces the existing physical retrieval algorithms, analyses the strength and weakness of each physical algorithm and summarizes the recommendation on the physical retrieval algorithm for SEVIRI nowcasting product.

The recommended physical retrieval algorithm is based on the combination of components from the three existing physical retrieval algorithms, which includes:

1. Maximum likelihood approach (CM-SAF, MPEF)

2. Regularization with discrepancy principal (GOES Sounder)

3. SEVIRI observation error covariance matrix (CM-SAF, MPEF, GOES Sounder)

4. Using RTTOV8 radiative transfer model and its linear tangent model for Jacobian (MPEF)

5. Use forecast as background (MPEF, GOES Sounder)

6. Background error covariance matrix (CM-SAF, MPEF, GOES Sounder)

7. EOF representation for profile (GOES Sounder)

8. Use regression as first guess (GOES Sounder)

9. Use predetermined surface IR emissivities

10. Use radiance bias adjustment

3. WORKSHOP RECOMMENDATIONS

The workshop findings and recommendations are given below. They are split in two topics: algorithm and validation.

3.1 ALGORITHM PROPOSAL:

Recommendation 1: New Product Generator Element (PGE-14) will be added to NWCSAF/MSG Package. Dealing with Physical Retrieval based on: Dr Jun Li recommendations, VSA Report and the work already done in the « prototype » during the VSA.

1. Starting point: Prototype

2. Items for further consideration and for development - I Algorithm:

     • Number of EOF

     • Emissivity input

     • Error covariance of observations

     • Separate Land / Sea

     • Error covariance of Background

     • Option for using Forecast / Climatology as Background

3. Items for further consideration and for development - II Output Parameters:

     • Stability Indexes

     • Humidity: TPW, Layers to be selected

     • To compute also the selected parameters from the original NWP used as background

     • To extract the areas of discrepancies between the "original" and the PGE-14 outputs

Recommendation 2: Availability on 2010 as requested CMSAF.

Recommendation 3: ATBD cooperation with CMSAF and EUMETSAT.

Recommendation 4: Algorithm testing and validation.

3.2 PRODUCTS VALIDATION

The workshop also formulated requirements for a validation strategy for satellite clear air parameters. The following categories were identified:

1. Product validation.

2. Validation of the products application or "skill tests".

3. Subjective application validation.

The recommendations for each category:

Recommendation 1 (product validation): to carry on with the current validation activities (comparisons with IWV GPS, Radio Soundings and NWP data), considering the possibility of adding other source data (possible cooperation with CM-SAF).

Recommendation 2 (skill tests): to implement software to allow a systematic process.

This idea is twofold:

- to check if the stability parameters are able to detect the potentially developed convention hours later (e.g. 6 hours later) and

- to check the consistency among other convective related NWC SAF products.

To this end, Clear Air products and collocated NWC SAF convection related products and independent data (Radar, lightning, surface observations,…) should be read in order to create datasets. Validation methodologies and data sets should be designed to be easily reused for new algorithm versions or other test algorithms. The performance of the validation objective application could be done in the framework of the NWCSAF Visiting Scientist Program.

Recommendation 3 (subjective application validation): to keep on using case studies as a subjective application validation.

4. LINK TO THE PRESENTATIONS

Author	Organization	Title
Li, Jun	CIMMSS UW (USA)	Development of physical retrieval algorithm for clear sky atmospheric profiles from SEVIRI and GOES Sounder IR radiances http://nwcsaf.inm.es/Physical_retrieval_WS/Abstract_workshop_retrieval_Jun%20Li_development.pdf
Hultberg, Tim	EUMETSAT (Germany)	Physical Retrieval from IASI
Stengel, Martin	SMHI (Sweden)	Presentation of an optimal estimation based retrieval method adapted to SEVIRI infra-red measurements
König, Marianne	EUMETSAT (Germany)	The MSG Global Instability Indices Product
Martínez, Miguel A.	NWC SAF INM (Spain)	Current status of the NWCSAF/MSG Clear Air Products
Preusker, Rene	Institut für Weltraumwissenschaften Freie Universität Berlin (Germany)	Overview about MERIS NRT WV product utilizing WV absorption in the 0.9µm band.
Li, Jun	CIMMSS UW (USA)	Main preliminary outcomes of the VSA on Physical Retrieval for NWCSAF
Schulz, Jörg	CM-SAF DWD (Germany)	Humidity Products with Climate Quality from Infrared Geostationary Imaging
Cuevas, Gabriela	NWC SAF INM (Spain)	Validation results of the NWCSAF/MSG Clear Air Products
Struzik, Piotr	Institute of Meteorology and Water Management (Poland)	Experiences with use of EUMETSAT MPEF GII product for convection/storm nowcasting
Vazquez , Ramón	INM (Spain)	MSG derived instability products for three severe weather events in Spain.
Fernández, Pilar	INM (Spain)	SAF NWC Requirements

APPENDIX I: WORKSHOP AGENDA

FIRST DAY (09:00 Start)

09:00-09:30: Registration.

09:30-09:45: Welcome.

09:45-10:00: Workshop Plan and Objectives. Manso, Marcelino (INM, Spain).

+ 10:00-10:30: "Development of physical retrieval algorithm for clear sky atmospheric profiles from SEVIRI and GOES Sounder IR radiances". Li, Jun. (CIMMSS. UW-Madison. USA).

+ 10:30-11:00: "Physical Retrieval from IASI". Hultberg, Tim. (EUMETSAT, Germany).

11:00 Coffee break

+ 11:30-12:00: "Presentation of an optimal estimation based retrieval method adapted to SEVIRI infra-red measurements". Stengel, Martin. (SMHI, Sweden).

+ 12:00-12.30: "The MSG Global Instability Indices Product". König, Marianne. (EUMETSAT, Germany).

+ 12:30-13:00: "Current status of the NWCSAF/MSG Clear Air Products". Martínez, Miguel Angel. (INM, Spain).

13:00-14:30 Lunch

+ 14:30-15:00: "Overview about MERIS NRT WV product utilizing WV absorption in the 0.9μm band". Preusker, Rene. (FUB, Germany).

+ 15:00-15.30: "Main preliminary outcomes of the VSA on Physical Retrieval for NWCSAF". Li, Jun. (CIMMSS. UW-Madison. USA).

+ 16:00-16:30: "Humidity Products with Climate Quality from Infrared Geostationary Imaging". Schulz, Jörg. (CM-SAF–DWD, Germany).

15:30 Coffee break

+ 16:30-17:00: "Validation results of the NWCSAF/MSG Clear Air Products". Cuevas, Gabriela. (INM, Spain).

SECOND DAY (09:00 Start)

+ 09:00-09:20: "Experiences with use of EUMETSAT MPEF GII product for convection/storm nowcasting". Struzik, Piotr et al .(Institute of Meteorology and Water Management, Poland)

+ 09:20-09:40: "MSG derived instability products for three severe weather events in Spain". Vazquez, Ramón. (INM, Spain)

+ 09:40-10:00: "SAF NWC Requirements." Fernández, Pilar (INM, Spain)

➢ 10:00-11:30: Workshop working groups:

✓ Working group #1: Discussion on the Algorithm proposal.

✓ Working group #2: Discussion on the Validation methods.

11:30 Coffee break

➢ 12:00-13:00: Plenary session: Summary conclusions and future activities

APPENDIX II: LIST OF PARTICIPANTS

NAME	AFFILIATION	E-MAIL
Araujo Moreira, Nuno M.	Instituto de Meteorologia PORTUGAL	nuno.moreira@meteo.pt
Cuevas, Gabriela	Instituto Nacional de Meteorología SPAIN	gcuevas@inm.es
Fernández Serdán, José M	Instituto Nacional de Meteorología SPAIN	serdan@inm.es
Fernández, Pilar	Instituto Nacional de Meteorología SPAIN	pif@inm.es
Hultberg,Tim	EUMETSAT	Tim.Hultberg@eumetsat.int
König, Marianne	EUMETSAT	marianne.koenig@eumetsat.int
Li, Jun	CIMMSS UW-Madison USA	Jun.Li@ssec.wisc.edu
Manso, Marcelino	Instituto Nacional de Meteorología SPAIN	marcelino@inm.es
Marcos, Cecilia	Instituto Nacional de Meteorología SPAIN	cmarcos@inm.es
Martínez, Miguel Á.	Instituto Nacional de Meteorología SPAIN	mig@inm.es
Melfi, Davide	Italian Air Force Meteorological Service ITALY	melfi@meteoam.it
Preusker, Rene	Institut für Weltraumwissenschaften Freie Universität Berlin GERMANY	rene.preusker@gmx.de
Rodríguez, Antonio	Instituto Nacional de Meteorología SPAIN	tea@inm.es
Sánchez, Ana	Instituto Nacional de Meteorología SPAIN	asanchez@inm.es
Sánchez, Gemma	Instituto Nacional de Meteorología SPAIN	gsanchez@inm.es
Santos, Carlos	Instituto Nacional de Meteorología SPAIN	csantos@inm.es
Sanz, Adrián	GMV SPAIN	adsanz@gmv.com
Schueller, Lothar	EUMETSAT	Lothar.schueller@eumetsat.int
Schulz, Jörg	CM-SAF –DWD GERMANY	joerg.schulz@dwd.de
Stengel, Martin	SMHI, Swedish Meteorological and Hydrological Institute SWEDEN	martin.stengel@smhi.se
Struzik, Piotr	Institute of Meteorology and Water Management POLAND	piotr.struzik@imgw.pl
Vázquez, Ramón	I Instituto Nacional de Meteorología SPAIN	vazquezr@inm.es
Velázquez, Mercedes	Instituto Nacional de Meteorología SPAIN	mvelazquez@inm.es