EUMETSAT AND NOWCASTING FOR DEVELOPING NATIONS

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ABSTRACT

This paper provides an overview over established nowcasting techniques based on Meteosat Second Generation (MSG) satellite observations. Applications range from the use of pure imagery data, mainly on channel combinations as e.g. channel differences or RGB composites, to more elaborate higher level products. A wealth of nowcasting products is provided through the software of the EUMETSAT Satellite Application Facility in Support to Nowcasting and Short-range Weather Forecasting (NWC-SAF), but also through products derived centrally at EUMETSAT and made available to users through the EUMETCast broadcasting service. The paper also gives examples of recent research activities, initiated through collaboration with individual weather services or other science groups.

1. INTRODUCTION

Since 2002, EUMETSAT operates the advanced generation of geostationary imagers, the SEVIRI (Spinning Enhanced Visible and Infrared Imager) onboard the Meteosat Second Generation (MSG) satellites. Two MSG satellites have been launched since then and are operated under their operational names Meteosat-8 and Meteosat-9. MSG-3, which will be renamed to Meteosat-10, is scheduled for launch in June 2012.

Meteosat-9 performs full disc scans with 15 minute repeat cycles from the 0 deg longitude position, while Meteosat-8 performs the so-called rapid scan service, providing scans of the European area every 5 minutes. The MSG SEVIRI channel selection allows for the detection of specific surface, cloud and atmospheric features, e.g. identification of fog, dust storms, fires, air mass properties, cloud microphysics and many more.

2. IMAGE PRODUCTS

Channel difference imagery or colour composites, so-called RGB (red-green-blue) composites, combine the spectral information of several channels and thus highlight certain features which are less evident on a single channel image. Certain patterns and textures together with continuity in the time domain are well preserved. Typical applications are detection of fog, dust storms, volcanic ash, general airmass characteristics and cloud microphysical properties. A full list of these imagery applications together with the concrete RGB “recipes” can be found on the MSG Interpretation Guide, available at http://oiswww.eumetsat.org/WEBOPS/msg_interpretation/index.php.

3. DERIVED PRODUCTS

3.1 NWC-SAF

The EUMETSAT Satellite Application Facility in Support to Nowcasting and Short-Term Forecasting (NWC-SAF) provides software which extracts a number of Level 2 products from the MSG images, relevant for nowcasting and short term prediction purposes. The NWC-SAF software package is freely available after a licensing process. It is intended to be installed locally and works with the real-time MSG data feed together with local forecast model fields. A full description of the NWC-SAF software

package, the underlying algorithms, validation reports, the actual package and product demonstrations can be found on the SAF website at http://www.nwcsaf.org.

3.2 EUMETSAT CENTRAL APPLICATION FACILITY

Two products, which are relevant for nowcasting applications, are derived centrally at EUMETSAT and are made available to users via EUMETCast: the fire detection product (FIR) and the Global Instability Indices product (GII).
The FIR product detects wild fires and other fires on a pixel basis, although small fires remain undetected due to MSG's limited spatial pixel resolution.
The GII product is derived over cloud free scenes and includes a number of instability indices together with layer and total precipitable water. The product aims at providing forecasters with a first awareness concerning the convection potential of the atmosphere. Its value has been shown in numerous case studies and through detailed presentations given e.g. at training sessions.

4. INTERNATIONAL COLLABORATION AND LATEST RESEARCH AREAS

A number of activities were carried out in the past years or are still ongoing regarding the use of MSG data for nowcasting:
In 2005, the South African Weather Service (SAWS) expressed great interest in the EUMETSAT GII product. Through collaboration with EUMETSAT, SAWS installed the GII retrieval software locally, using their own mesoscale model as input data. The product was developed further within SAWS, e.g. studies were done regarding a further combination of the provided indices to produce lightning probability maps for the entire Southern Africa region.

Regarding the early convection phase, a number of science studies were done with the University of Alabama in Huntsville regarding the use of MSG data for the detection of the convective initiation. Aim here is to detect a growing cumulus cloud before it appears in radar data. It was demonstrated that this convective initiation product has lead times of up to 60 minutes with respect to radar data.
Detection of overshooting tops and areas of strong updrafts are commonly done visually in order to nowcast the severest areas of a mature convective storm. First attempts at a more quantitative approach show a relation to the cloud microphysical parameters retrieved from the satellite data.
Much of the MSG related convection nowcasting work is discussed and coordinated through the Convection Working Group (http://ww.convection-wg.org). Members of this group have recently compiled a "Best Practice" document, describing established convection nowcasting methods. Membership to the group is open to anybody interested.

5. CONCLUSIONS

The multi-spectral capabilities of MSG have opened many new possibilities for nowcasting applications. It can be well expected that these possibilities will be further explored with the advent of the next generation of geostationary satellites as GOES-R and Meteosat Third Generation (MTG). Better resolution in space and time will allow an even more precise localisation of a relevant event, while the new instruments as the MTG Infrared Sounder and the lightning instruments will provide further information regarding the pre-convective environment and the cloud processes leading to lightning.