USEFULNESS OF METEOSAT-9 INFORMATION FOR FOG TOP DETECTION IN BRAZIL: FIRST MEASUREMENTS

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ABSTRACT

The present work describes the usefulness of RGB composite technique to detect horizontal extent of fog tops over south-eastern Brazil. The 1.5 level data from Meteosat-9 over this region for 15th September 2011 are used for the determination of fog tops. A RGB composite technique for detection of potentially hazardous fog tops is based on a threshold technique which is applied to the Meteosat-9 of brightness temperature differences. The results show the potential of long wave infrared data of Meteosat-9 in detecting 24-hours fog tops.

1. INTRODUCTION

South-eastern Brazil is badly affected by fog mainly during winter and early spring months. Fog is meteorological phenomena with numerous impacts, directly or indirectly on human life. Most important direct impact is on aviation, land transportation and air quality due to low visibility caused by fog. Pollutants trapped underneath a temperature inversion are incorporated in fog droplets. At the same time, reduced visibility entails severely reduced traffic safety. Fog top detection is overall intended to be based on a threshold technique which is applied to geostationary satellite of brightness temperature differences, day (Ferreira *et al.* 1998) and night.

Here, it is shown an illustrative case for the fog event that occurred over the south-eastern Brazil, on 15th September 2011. During this event in São Paulo city, some flights at Guarulhos Airport were cancelled or delayed. Almost 300-vehicle crash hours before a series of pileups killed 1 person and injured 30 others on Imigrantes road nearby São Bernardo do Campo (Fig. 1). Some cars were crushed beneath the heavier trucks (http://www1.folha.uol.com.br/cotidiano/975971-engavetamento-mata-1-e-envolve-300-carros-diz-pm-pista-da-imigrantes-e-liberada.shtml). In this study, in order to obtain spatially relevant results the methodology is mainly based on the Meteosat-9 Spinning Enhanced Visible and InfraRed Imager (SEVIRI) RGB color composite. The operational implementations of fog top schemes are based on the SEVIRI data available at Federal University of Alagoas (UFAL).

Figure 1. Fog event that occurred over the south-eastern Brazil, on 15th September 2011 and cars crushed.

2. DATA AND METHOD

The SEVIRI data is received at LAPIS (Laboratório de Análise e Processamento de Imagens de Satélites in Portuguese – http//www.lapismet.com) laboratory through the EUMETCast service. This service based on standard Digital Video Broadcast (DVB) technology that uses commercial telecommunication geostationary satellites (NSS-806 at present) to distribute files and allows users (LAPIS laboratory) to receive images and data in nearly real time. It provides SEVIRI images processed to Level 1.5, obtained through the processing of satellite raw data (designated as Level 1.0

data). The three different IR bands (IR8.7, IR10.8, and IR12) from SEVIRI level-1.5 data for 15 September 2011 are used for fog top detection. Analyses of SEVIRI data have been carried out by using open source components developed by LAPIS laboratory at UFAL.

A RGB composite technique for 24-hour detection of potentially hazardous fog tops is based on difference of emissivity of cloud water droplet in the three bands (IR8.7, IR10.8, and IR12). In order to assess RGB composites, ASCII files regarding the 3 spectral bands were extracted using open-source software tools (e.g., EUMETSAT WaveLet Transform Software used to decompress SEVIRI HRIT data files (EUMETSAT, 2009c); Geospatial Data Abstraction Library used to read and write many geographic data formats), to allow data to be analyzed. These are spectral radiance displayed: brightness temperature (K) in the thermal bands. This processing level corresponds to image data corrected for radiometric and geometric effects, geo-located using a standard projection, finally calibrated. Analysis of RGB composite images from SEVIRI is based upon the combination of bands (IR12μm – IR10.8μm; IR10.8μm – IR8.7μm; IR10.8μm). This RGB composition is widely used methods by EUMETSAT (http://www.eumetsat.int). To interpret the RGB composite, bluish colors indicate fog top or low-level stratiform cloud and red colors indicate very cold cloud tops.

Table 1. Range and enhancements for 24-h RGB's determining fog tops.

	24-hours fog RGB		
	Band	Range (K)	Gamma
R	IR12 – IR10.8	-5 to +3	1.0
G	IR10.8 – IR8.7	+3 to +5	2.0
B	IR10.8	265 to 295	1.0

3. RESULTS AND CONCLUSION

The spatial extent of fog affecting the south-eastern Brazil, on 15th September 2011 at 12:00 UTC, can be observed in Figure 3, representing the fog RGB map over a selected window. It is possible to see in bluish colors. These regions (bluish colors) are therefore identified as fog source regions. It is important to note that the methodology defines the "fog source region" as an area in which an air parcel absorbed significant amounts of moisture (high amount of small droplets suspended in the air). Otherwise, reddish colors indicate regions where high-level ice clouds dominate. Consequently, air masses located over these regions display a loss of moisture, and these regions are identified as moisture sink. The results discussed above suggest that fog tops were successfully detected over south-eastern Brazil for 15th September 2010 by using RGB composite technique for three SEVIRI bands IR12, IR10.8, and IR8.7.

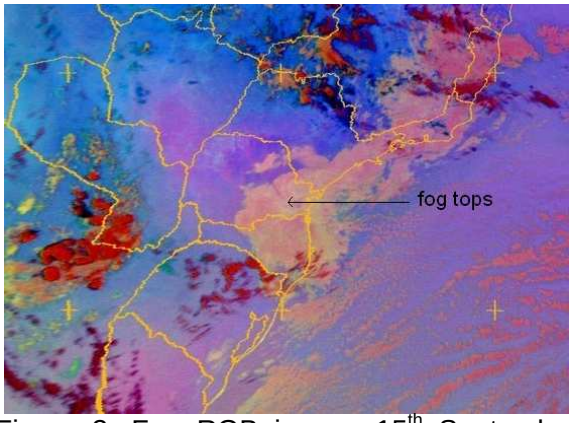

Figure 3. Fog RGB image, 15th September 2011, 12:00UTC. Determination of fog tops (bluish colors) from SEVIRI.

4. REFERENCES

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