EVALUATION OF METEOSAT SECOND GENERATION (MSG) DATA AND SYNOPTIC ANALYSIS OF A CASE STUDY FOR FLASH FLOOD IN GÖKÇEADA/TURKEY

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Introduction

According to IPCC fifth assessment report, climate change will effect Mediterranean Area and Black Seas (2013). It could certainly observed that intensity of rainfall increased in contrast with frequency decreased (Dankers and Feyen, 2009). Besides, insensible urbanization and constructions in stream bed cause not only pecuniary loss and intangible damages but also loss of lives. Floods are the second most destructive type of natural disaster in Turkey, after earthquakes. Approximately 30% of all the natural disasters in the country consist of flood events. According to EM-DAT database, 34 flood events occurred in Turkey between 1950 and 2007 and 1016 people died, and about 1.5 million people were affected (EM-DAT, 2010).

In this paper, it is aimed to understanding 2014, 2 May Gökçeada flood dynamics. The paper is organized as follows. Section 2 describes the study region and evaluated rainfall about 144 mm from 00:00 AM to 04:00 AM on May 2 2014. Section 3 aims at synoptic and MSG data analysis and RGB applications for different channels. Section 4 summarizes results are outlined.

Study Area and Data

Study area is Gökçeada, the biggest island with a 287 km^2 surface area, which is located in western part of Turkey. It spans from 40° 05' 42.87" N to 40° 14' 24.12" N in latitude, and from 25° 39' 53.23" E to 26° 00' 57.71" E in longitude (Figure 1).

Figure 1: Location of Study Area – Gökçeada.

According to Meteorological State Service data, rainfall started from 00:10 AM to 04:00 AM. Total amount of precipitation is 144.4 mm in this time period and break a new record. Mr. Ünal Çetin, Gökçeada Mayor, indicated that the conditions of district was considerable desperate. He also wanted that the area was urgently announced as a disaster area and create a commission to determine and repair damage. There were many things to be damaged such as vehicles, houses, offices, of course people and animals (Fig. 2 and Fig. 3).

Figure 2 and 3: Examples of Damaged Market and Cars.

Figure 4 illustrates MSG satellite channels normalized weighting function. In this paper, WV 7.3 µm channel that get information from 500 hPa level and IR 10.8 µm that is sensitive to clouds' top temperature.

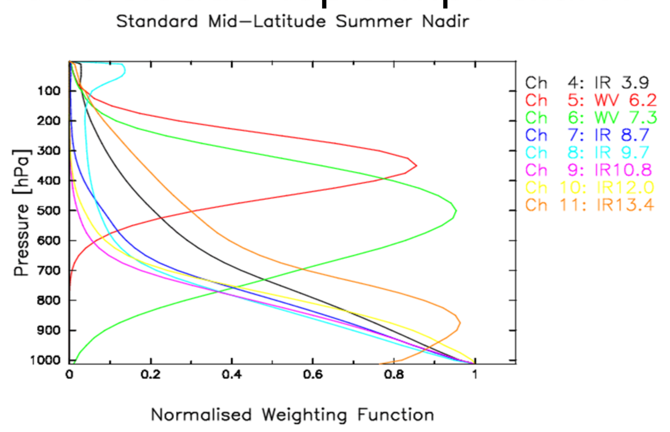

Figure 4: MSG Channels with Normalized Weighting Functions.

Results

According to figure 5, there is a trough, low pressure area or cyclone in Aegean Sea at 9 PM before flood. On the other hand, low pressure area was occurred near Gökçeada because of this trough. Existence of this occluded system shows us to be developed this time period. Scale of supercell over Gökçeada is small because front area is not very large.

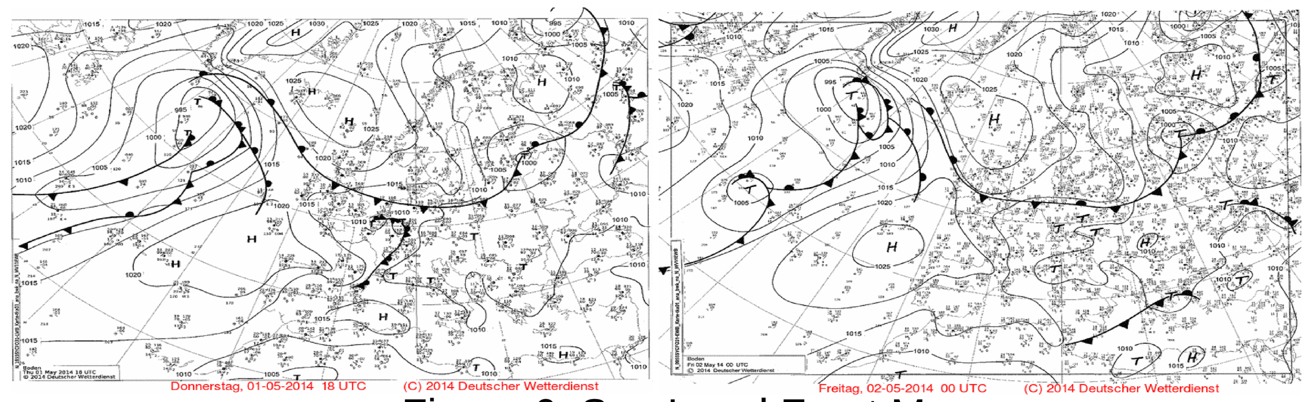

Figure 6: Sea Level Front Maps.

In figure 6, there is 6°C isotherm is on Gökçeada. Circulation of wind brings warm air this area. This circulation cause developing this supercell system.

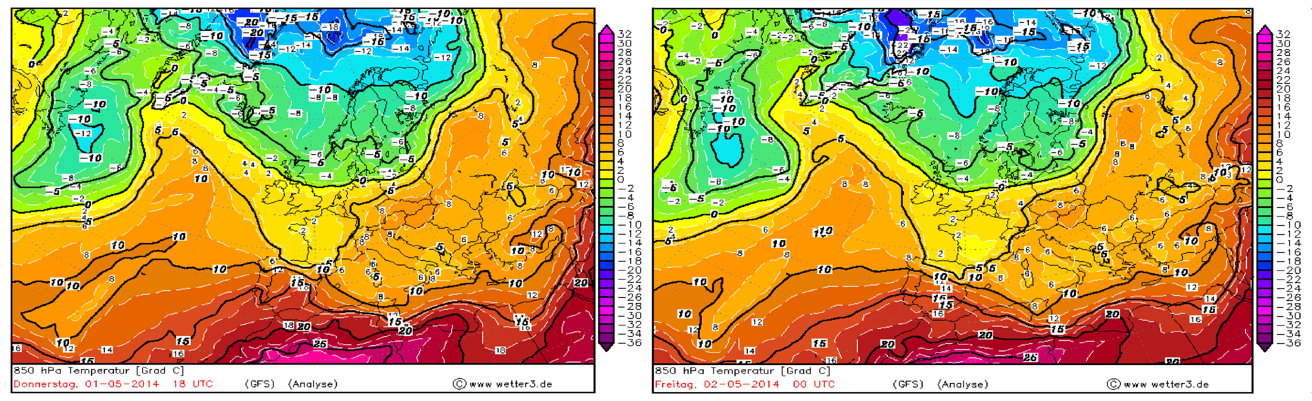

Figure 6: 850 hPa Temperature Maps.

In Figure 7, there is a depression South Marmara which creates a positive vorticity area northern Aegean Sea including Gökçeada. This situation appears upward vertical wind. That is why supercell develops in a short time period.

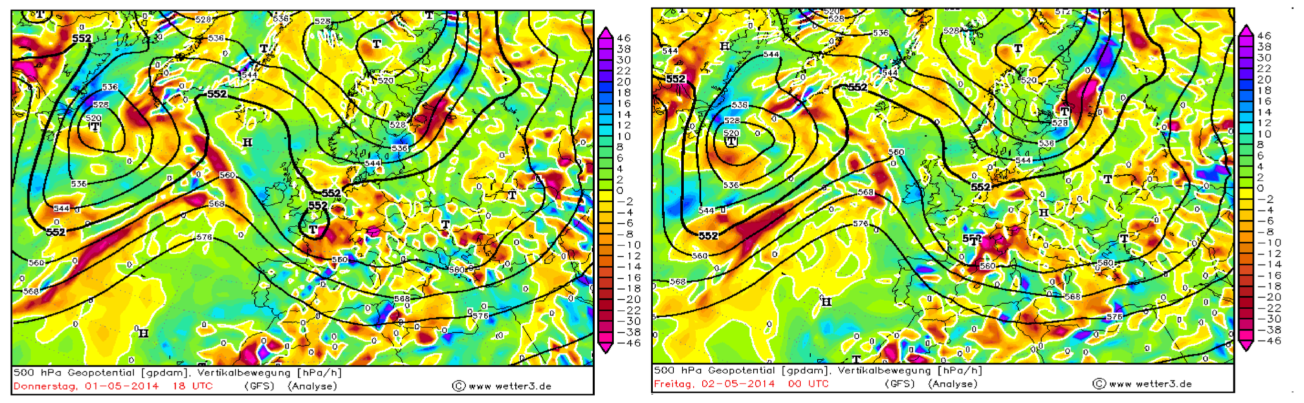

Figure 7: 500 hPa Geopotantial Lines, Vorticity.

In Figure 8, lifted index (LI) and convective available potential energy (CAPE) values are respectively -2 and 700 over Aegean Sea. These high values supplies energy for developing supercell. Intensity of supercell may be increased by these conditions.

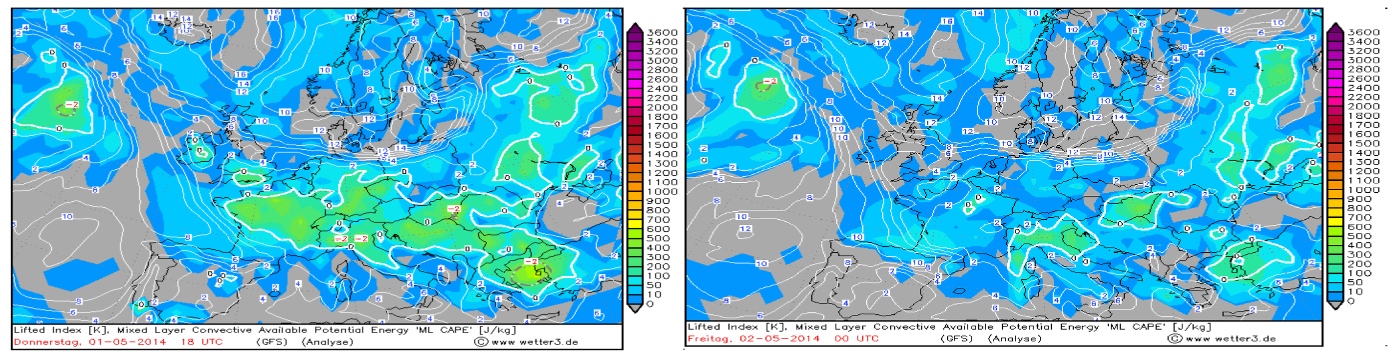

Figure 8: Lifted Index [K], Mixed Level Convective Available Potential Energy ML CAPE [J/kg].

Figure 9 illustrates the beginning, development, and dispersion of supercell with 30 minutes timestamp. Especially, maximum energy can be seen at 02:30 and 03:00 AM. Its dispersion gets faster after 04 AM by jet streams.

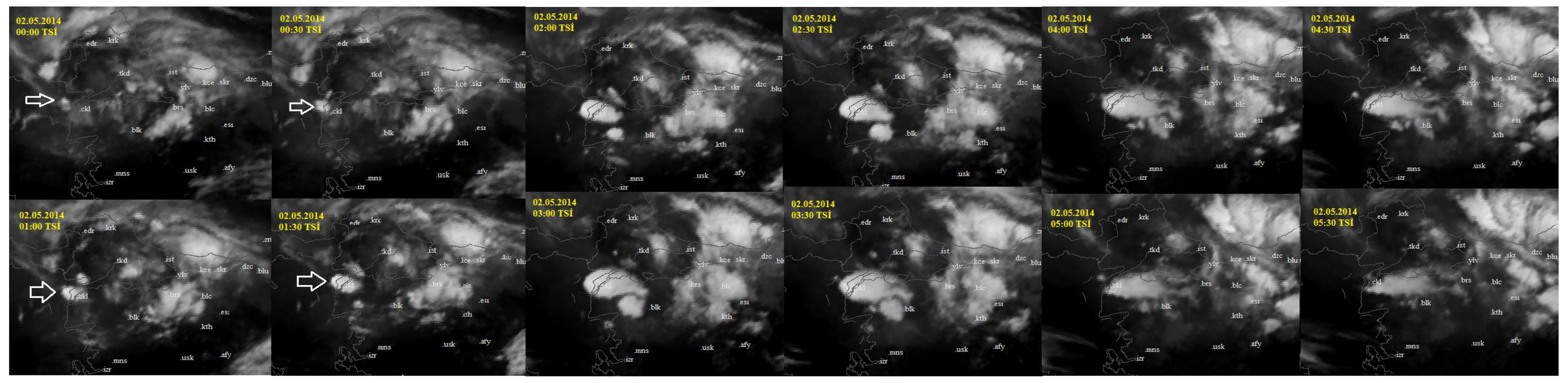

Figure 10: WV Channel 7.3 TMetVis Visualizations.

It is used IR channel 10.8 µm which is sensitive to temperature and supercell values -55°C from 01:30 AM to 03:30 AM. Temperature legend is between -20°C and -60°C to focus on better visualization of supercell (Figure 10).

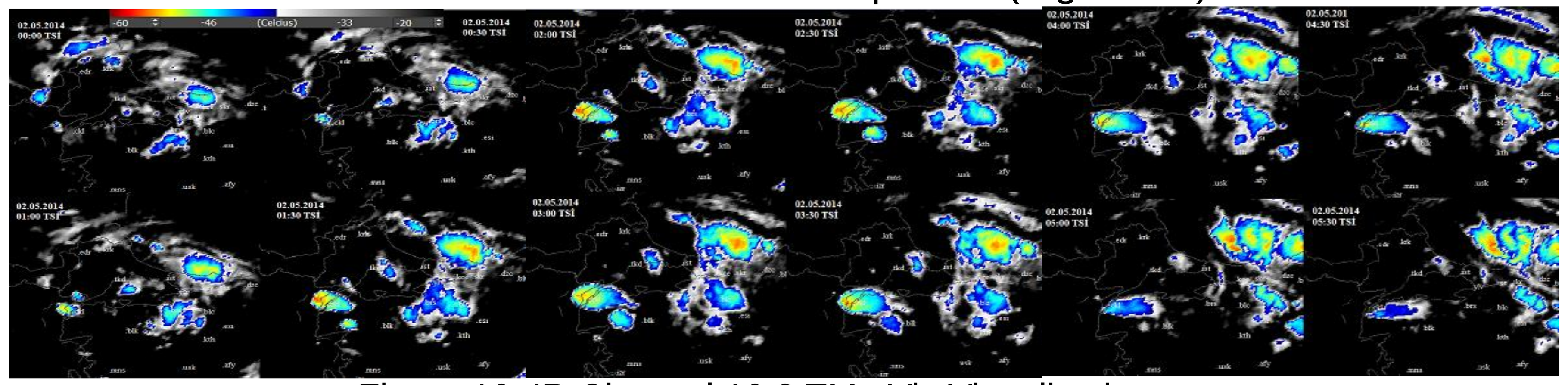

Figure 10: IR Channel 10.8 TMetVis Visualizations.

Figure 11 illustrates RGB AirMass application with TMetVis that could be visualizing clearly development of supercell.

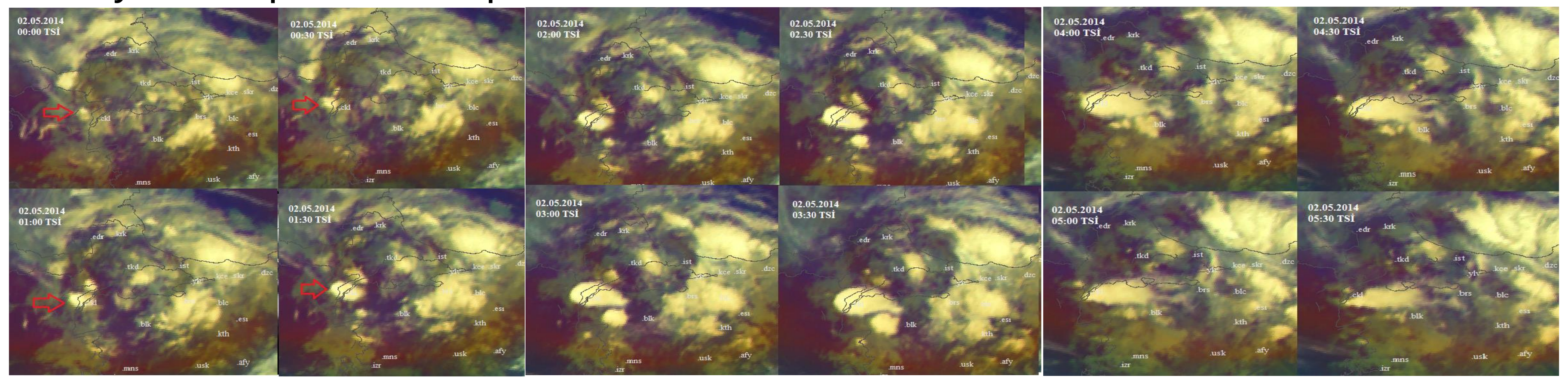

Figure 11: AirMass RGB Applications with TMetVis.

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