# ANALYSING WEATHER MAPS, SATELLITE and RADAR PRODUCTS to DETECT FLASH FLOOD OCCURRED on 23 FEBRUARY 2015 in ÇEŞME USING FFGS



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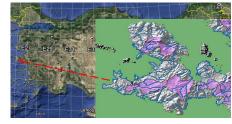
### Introduction:

Flash floods are among the world's deadliest natural disasters and require coordination between the National Meteorological and Hydrological Services and Disaster Management Agencies. Turkish State Meteorological Service gave early warning for the flash flood event before it occurred. Investigation and analysis of these events before, during and after the flash flood event play an important role in enhancing the experience of such natural disasters. In this study, this event was examined in terms of weather condition for flash flood occurred on February 23rd 2015 including local information, satellite, radar, numerical weather prediction mesoscale model, atmospheric instability indices and FFGS (Flash Flood Guidance System) products. Results show that FFGS products are very useful tools to detect flash flood and then to issue early warning before it happened. Key Words: Flash Flood, FFGS

## The purpose of this study is:

- to examine meteorological conditions in terms of rainfall intensity, synoptic analysis, radar and sounding that cause the FF event on 23 February 2015 in Cesme.
- to take into consideration of the effect of precipitation either increasing or decreasing in the next 24 hours
- to examine this information and knowledge with the support of FFGS products particularly soil moisture saturation (ASM), FFG and FFT products to ensure the success of making decision on FF occurrence.

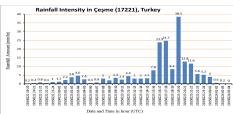
#### **Material and Method:**



Region of Study, Location of FFGS subbasins over Çeşme (WMO Synoptic Station No:17221 ICAO Name: CESM Elevation:5 m lat:38.3036 lon:26.3724)

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In this study, data from local information available at TSMS, Automated Weather Observation System, Satellite, Radar, Numerical Weather Prediction (ALARO) products, instability products (vertical sounding of Çeşme) and FFGS products were used and evaluated.



Rainfall intensity graph shows heavy precipitation measured at Çeşme between 19:00-20:00 UTC with the value reached its maximum at 38.5 mm/hr on 23 February 2015.

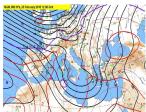
Methods used in this study include:

- analysing meteorological conditions that caused flash flood event on 23 February in Çeşme for synoptic scale weather patterns at surface, 850 hPa, 500 hPa and 300 hPa charts
- analysing satellite product using ECMWF surface chart for 24 hours precipitation (T+24) valid from 00:00UTC on 23 February 2015.
- analysing radar product using İzmir radar which is the nearest radar to Çeşme.
- analysing instability product using Skew T and Log P diagramme generated by University of Wyoming.
- evaluating FFGS products (particularly ASM and FFTs) to determine the possibility of flash flood.



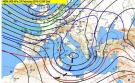
Surface Chart on 23 February at 12:00UTC

This system called baroclinic low which was developed over the island of Sicilia is known as a cold core cyclone or cold core low. A low pressure center with a presure value of 996 hPa was located in southern Italy on the island of Sicily. This frontal system associated with the low pressure affected western Turkey as surface pressure tendencies had negative values toward the east of the low pressure center, indicating that system will move toward east and southeast. This is a typical mediterranean cyclone also known as low or depression causing heavy frontal precipitation ahead of warm front and along the cold front.



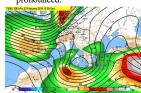
850 hPa Chart on 23 February 2015 at 12:00UTC

- Geopotential heights and temperature values at 850 hPa level with very nice trough over Tunisia were shown above.
- Cold air advection from northwest and warm air advection
- from southwest resulted in deepening of cyclones. Strong winds blowed in towards the centre and caused much
- cloud.



500 hPa Chart on 23 February 2015 at 12:00UTC

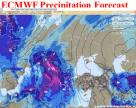
- Temperature at the surface chart over Cesme was 15 °C while -18 °C at 500 hPa level on 23 February 2015.
- The winds at 500 hPa are known as "steering winds. A trough was expanding over Tripoli through western Italy in the west of the trough, geopotential height contours were very close to each other indicating the presence of very strong winds. On the left side of Sicilian island (behind trough), the northern and north western wind streams cause subsidence and convergence space. In front of trough, atmospheric vertical motion with the south and south western winds were pronounced.



300 hPa Chart on 23 February 2015 at 12:00

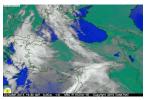
Jet Stream core located over Tunisia had a value of 9120 geopotential height with a wind speed of 110-120 knots flowing FFFT-06 from the northern and north western while wind stream was flowing from the south and south western with a wind speed of 70-80 knots over Çeşme.

#### CMWF Precinitation Forecast



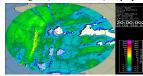
February 2015 at 00:00UTC over Çeşme.

**Satellite Image** 



EUMETSAT MSG IR channel 9

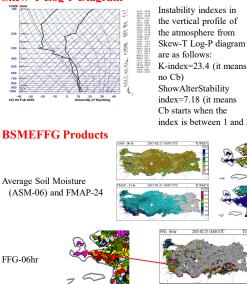
Satellite infrared (IR) image shows high cloud top temperature of the radiation-emitting surface on 23 February 2015 19:30 UTC indicating cloudness over Çeşme. Image taken at thermal IR wavelengths (10-12 microns) displays atmospheric emissions.



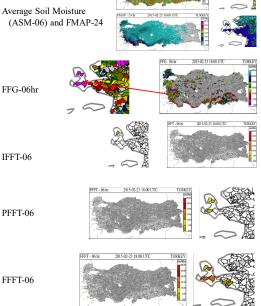
IZMIR Radar's MAX RAIN1 product on 23 February 2015 at 20:00 UTC

RADAR MAX image on 23 February 2015 20:00 UTC shows the rain accumulation in mm/hour. In case of Çeşme it indicated approximately 50 mm/hour. It also shows squall lines distinctively over Çeşme. In fact, squall lines' characteristics are similar to cold front behaviours; but they have no connection with the cold fronts. A squall line is a narrow line of thunderstorms that can form along or ahead of a cold front.

### **Skew-T Log-P Diagram**



index is between 1 and 3)



### RESULTS

- · A cold core cyclone or cold core low which was developed over the island of Sicilia has led flash flood event with warm front associated with the low pressure center on 23 February in Cesme.
- In this study, a top-down approach has been used for the analysis. In other words, We started with synoptic scale, mesoscale and nowcasting analyses and finally FFGS products were investigated and analyzed.
- ECMWF map predicted rainfall of 70 mm/24 hour on 22 As a result, the use of FFGS products to issue flash flood watches and warning is shown to be very effective and useful.