Hopalong Flash Flood Event
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Hop town is located in northeast of Turkey on the Black Sea Coast.

Eastern Black Sea region has the highest annual rainfall accumulation in Turkey. It is over 2000 mm.

24 h precipitation accumulation for 25.08.2015 at 06 UTC is shown on the image.
Daily precipitation accumulation is shown in the above Figure that, on August 25th, it was of 221 mm.
The measured precipitation data were the extrem values for the period of 1965-2015.
Rainfall intensity graph shows that heavy precipitation lasted for 4 hours from 07-11 UTC with the values of 48.7, 37.4, 55.1 and 40.2 mm.
A low pressure center with a value 1000 hPa was located in the southeast region of the Turkey and ground pressure varies between 1010-1012 hPa. There is no significant pressure changes. Pressure has continuously rising trend during rains.
Synoptic Analysis -850 hPa on August 24, 2015

850 hPa geopotential height, vertical velocity and temperature values are shown on the 24th, August, at 00:00 UTC (left) and 12:00 UTC (bottom).

There is a cyclonic circulation over the East Black Sea Region and cold advections behind of the cyclonic rotation.

Low pressure center geopotential height is of 147 hPa. Isoterm value is of 15 °C over the East Black Sea Coast.
500 hPa geopotential height and temperature values were shown on the 24th, August, at 00:00 UTC (left) and 12:00 UTC (bottom).

There is south-western flow with cold trough in the north of the region at the 500 hPa level.

Isotherm value is around -10 °C over east Black Sea Coast and -17 °C in the further north at the 500 hPa level.

Slow movement of the low center here has provided continuity of heavy precipitation.
Jet Stream on August 24, 2015

Jet stream exist in the middle Anatolia from Ege region to East Black Sea region having jet core wind speed of 100 knots (yellow).

- At 06:00 UTC (upper) and 12:00 UTC (bottom) 300 hPa maps show that jet core moved to the northeast and bringing warm air to East Black Sea region and make system of heavy rain move in the northeast direction.
K Indeks

TT Indeks

Sweat Indeks

All index values are close to the extrem values.
Temp Analysis on August 24, 2015 at 00 UTC

- The nearest sounding station to the region Dzugba, No: 37011, in Russia.

- All index values are close to the ektsrem values.

- K index, TT index and Sweat index shows values 45, 62 and 425 respectively.

- Temperature, humidity and wind is very suitable for precipitation.
Satellite images on 24.08.2014 at 00:00UTC (top) and at 06:00 UTC (bottom) show cloudiness over East Black Sea Coast in grey scale.

- It should be noted that Cb (Cumulonimbus) clouds that are associated with convection exist along the East Black Sea Coast that could be due to both frontal and orographical lifting.
Satellite images on 24.08.2014 at 09:00UTC (top) and at 12:00 UTC (bottom) show cloudiness over East Black Sea Coast in grey scale.

It is clearly seen that cloudiness is moving in the direction of north east when compare with previous time.

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PPI Radar images on 24.08.2014 at 03:00 UTC (upper-right) and at 12:00 UTC (bottom-left) show density of the precipitation over East Black Sea Coast in colour scale at the bottom right.

As seen in the 03:00 UTC and 06:00 UTC map, there is mostly yellow color along the region. That means, based on the scale, heavy rain shower.
Along almost all East Black Sea is in colour that varying from yellow to dark red at 09:00 UTC Radar image. It means that severe thunderstorm and heavy rain shower continues along the coast based on the scale.

Red dot on the map shows place in East Black Coast where rain shower is the most severe. That place is the Hopa district of the Artvin.

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Thunderstorm Areas for 3 hours between August 24, at 08:00 UTC – August 24, at 11:00 UTC
Forecasts and Warnings

- Weekly Weather Forecast for dates between 22 – 28/08/2015 published by Analysis Division of the TSMS.

- It was expressed that there would be heavy rainfall on the Eastern Black Sea Coast since August 21, 2015. Watch out!!

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Forecasts and Warnings

➢ Meteorological warnings and evaluations for heavy and severe rain around the Eastern Black Sea coast, particularly for the province of the Artvin, Rize, Trabzon and Giresun, for 24th day between 00.00-23.59 lokal and 23/08/2005 at 12:00 UTC published by Analysis Division of the TSMS.

➢ According to the warning, 100 mm rainfall was expected around the province of Rize and Artvin.

➢ Expected to flash flood event and landslide
Flash Flood Guidance (FFG) is the actual rainfall that may cause just bankfull at the outlet of a sub-basin for a given duration. 1-hr, 3-hr and 6-hr FFG values are estimated at model runtimes 00, 06, 12 and 18 UTC. It is a function of threshold runoff, and soil moisture deficit. The lower FFG, the higher the occurrences of flash floods.

6-hr FFG product (upper-right) shows predominantly 25-40 mm (yellow colour) for areas around Hopa and even 15-25 mm (red colour) for some certain small place on 24.08.2015 at 06 UTC.
FMAP provide 1-hour, 3-hour, 6-hour and 24-hour accumulations of mean areal precipitation (mm) for each sub-basin produced by using numerical forecasts from the Aladin model.

- 24-hour FMAP maps shows possible heavy rainfall around the East Black Sea Coast.
- Especially, it is clearly seen that heavy precipitation area around the East Black Sea Coast is having the maximum values 100-200 mm over the province of the Artvin in the 24-hour FMAP at 18:00 UTC on August 23, 2015. (Bottom-left)
On 24.08.2015 at 06:00 UTC (left) and 12:00 UTC (right), ASM images show that more sub-basin upper soil saturated associated with continues rainfall in the region. Particularly, sub-basins in the province of ARTVİN were remained saturated up to 24 hours making the region very vulnerable to flash flood occurrences.

ASM map shows %90 soil moisture for some sub-basins around the East Black Sea Coast.

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It was advised to issue flash flood warning so that a BSMEFFG flash flood Bulletin was to be prepared by using one of GIS tools and available raw data on the user interface page.

For the 24.08.2014 flood events in BSMEFFG, partial content of BSMEFFG flash flood bulletin are shown. Then, Bulletin must be distributed to responsible organizations e.g., emergency management, municipality.
➢ Forecast Mean Areal Precipitation Map at 06:00 UTC on August 24, 2015.
➢ This map is formed by hydrometeorology division of TSMS by using the GIS tools and raw data on the user interface page.
➢ FMAP shows possible heavy rainfall along the East Black Sea Coast.
➢ 24-hr FMAP on 24.08.2015 at 06:00 UTC depicts that over the next 24 hours precipitation accumulation changed from 21-35 mm to 120 mm over the East Black Sea Coast.
Forecast Flash Flood Threat (FFFT) Map at 06:00 UTC on August 24, 2015.

- This map provides a 6-hour forecast of Flash Flood Threat (mm) for each sub-basin. The values indicate the difference of the FMAP of the given duration and the corresponding current FFG of the same duration.

- FFFT map shows possible heavy rainfall around the East Black Sea Coast especially Hopa, Murgul and Borçka districts of the Artvin.

- 6hr FFFT on 24.08.2015 at 06:00 UTC depicts that over the next 6 hours precipitation accumulation that exceeds the threshold level changed from 5 mm to 100 mm over the East Black Sea Coast.
8 people lost their lives in the flood disaster, three citizens lost and 27 people were injured.

6 buildings were destroyed. There are 17 heavy and 11 moderately damaged buildings and also evacuation demand was conducted for 24 buildings.

There are 1208 victims in Hopa, 216 in Arhavi and 10 in Borçka.
Conclusion

- 535 mm rainfall was measured monthly in Hopa district of the Artvin in August, 2015. This rainfall is the second highest value after the rainfall measured monthly as 588.9 mm in August, 1988.

- While 100 mm rainfall fell in Hopa between 1-20 August 2015, 66.5 mm rainfall was recorded on August 21, 2015.

- Precipitation occurred over the sea as mass in the direction of western, as well as convective precipitation in the direction of southwestern.

- Turkey's northeast region is always more affected by the western flow. When orographic conditions of the Eastern Black Sea basin is considered, it is the highest potential rainfall place.

- Effective precipitation in the Hopa basin with an area of 71 square kilometers failed to reach the sea at one point and so flooding has caused landslides.

- Timely meteorological forecasts and warnings and also the occurrence of flooding during daylight hours reduced to a minimum loss of life and property.
Thank you for your kind Attention...