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# Flash Flood Case Study NMH-Bulgaria

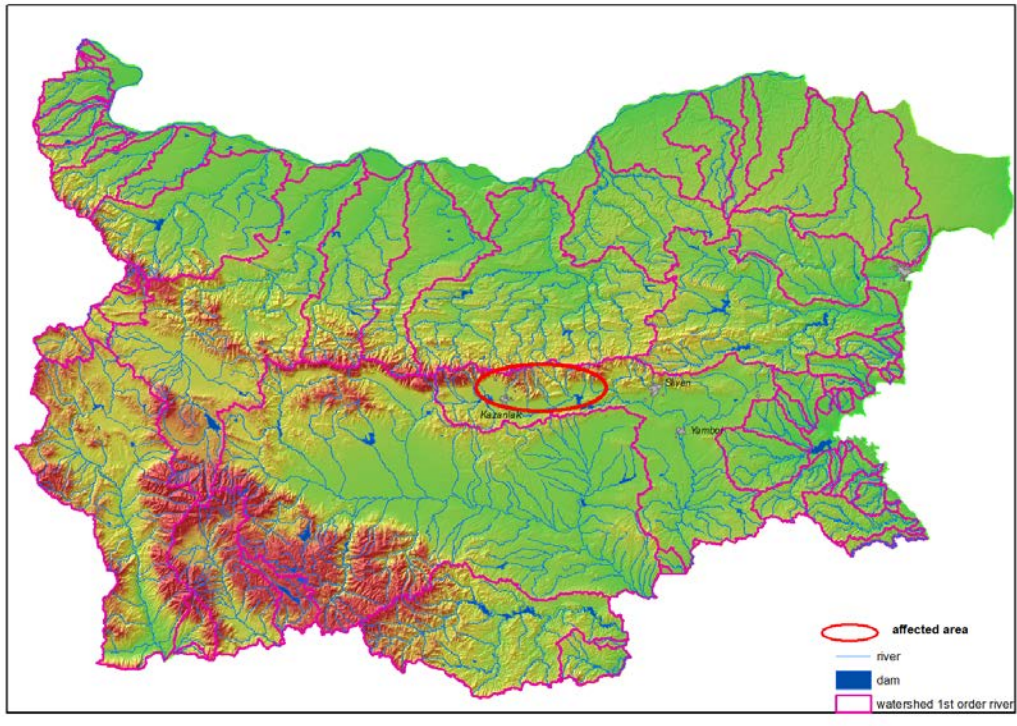
[www.meteo.bg](http://www.meteo.bg), [www.weather.bg](http://www.weather.bg), [www.hydro.bg](http://www.hydro.bg)

*Assoc. prof. Dr. eng. Snezhanka Balabanova*



## Flood in the town of Kazanlak and the region

Late in the evening (about 21 pm) on May 25th and about one o'clock in the morning on May 26th



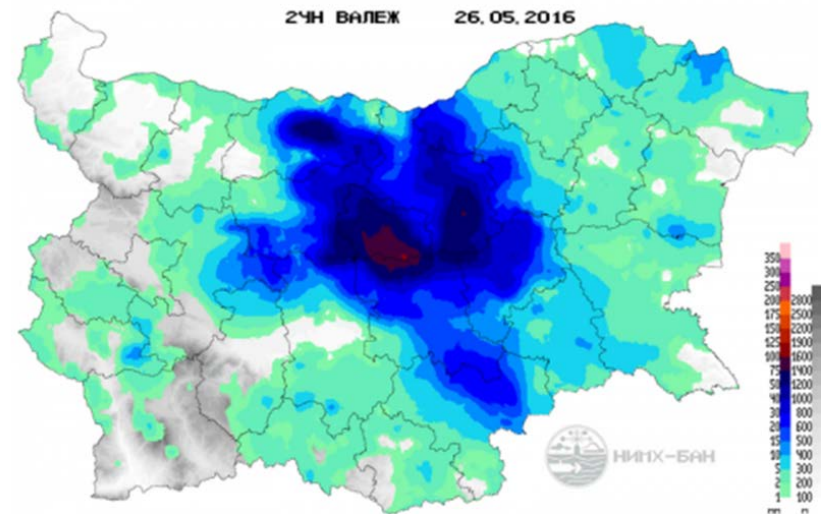


## Synoptic situation from 24th to 27th May 2016

During the period 24th – 27th May 2016 over Bulgaria passed a well developed cyclone (in the lowest part of the atmosphere and in the high levels, as well). The most significant rainfall is observed on May 25th. A cold front associated with the cyclone, passed through the country, decreasing the 850 hPa temperature from 10-12 degrees on May 24th, 00:00 UTC to 4-5 degrees on May 25th, 00:00 UTC.

The most significant rainfall amount of 64 mm (for 48-h period) in Kazanlak synoptic station (monthly rate is 67 mm),

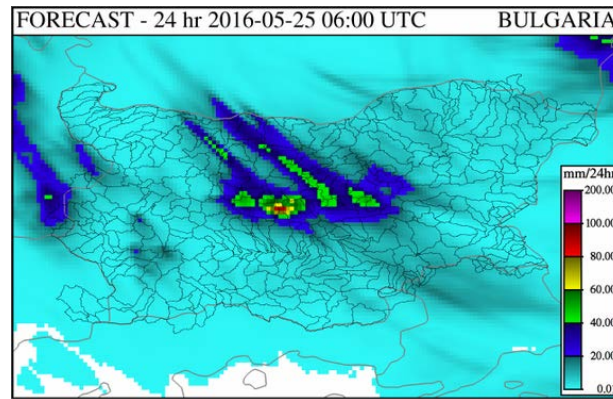
The data from automatic meteorological station Shipka on May 25th for 3-h period (16: 00-19: 00 local time) shows 28.6 mm, and for 9-h period (16: 00-24: 00 local time) - 61.9 mm rainfall.



Map with spatial distribution of the precipitation amount from 7:30 h on 25.05.2016 - 7:30 h on 26.05.2016

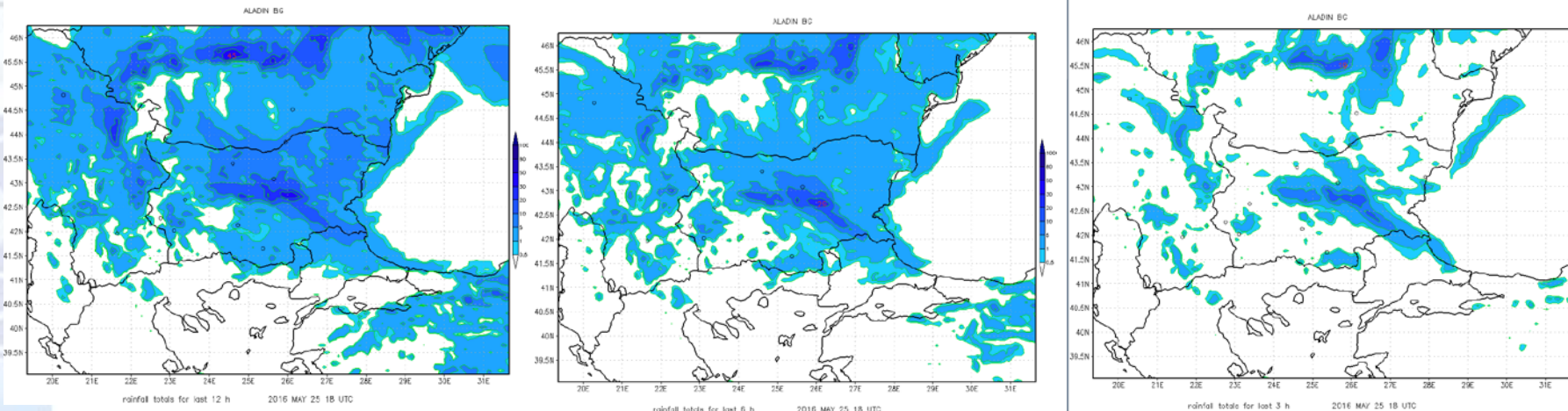


# Forecasted 24 hr Aladin Model Precipitation Forecast 06:00 UTC from BSMEFFG

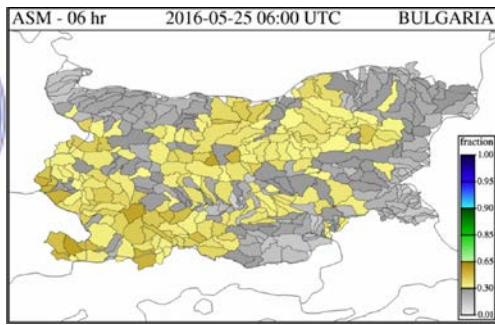


A significant rainfall in the next 24 hours in the watersheds of the Vit river, Osam river, Yantra river and Tunja river. In the upper catchment of the Tundzha river forecasted rainfall 60 mm -90 mm for the next 24 hours.

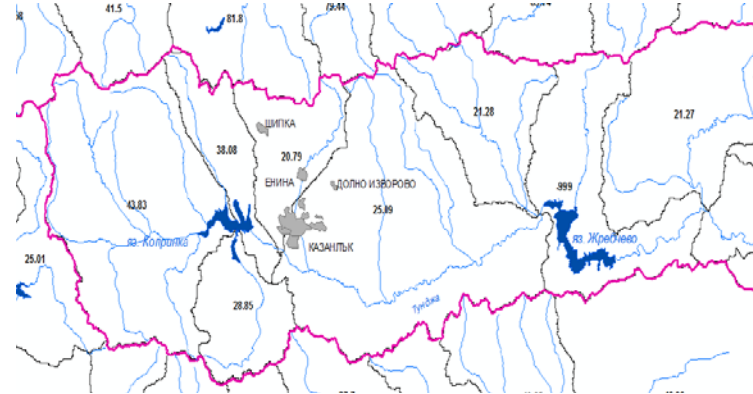
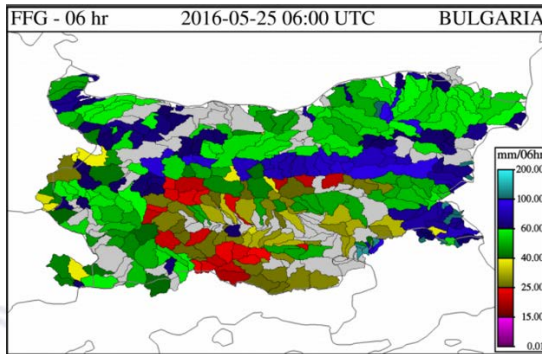
## Forecasted precipitation with the model ALADIN Bulgaria 06:00 UTC



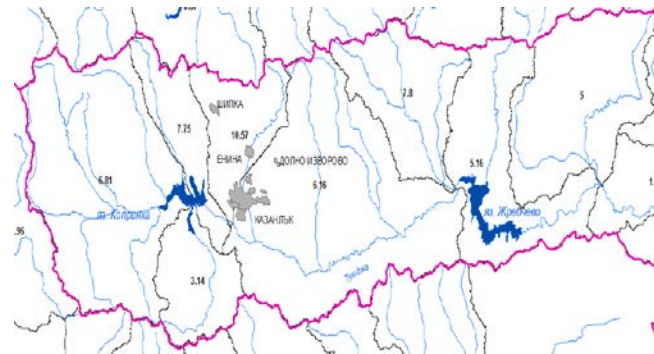
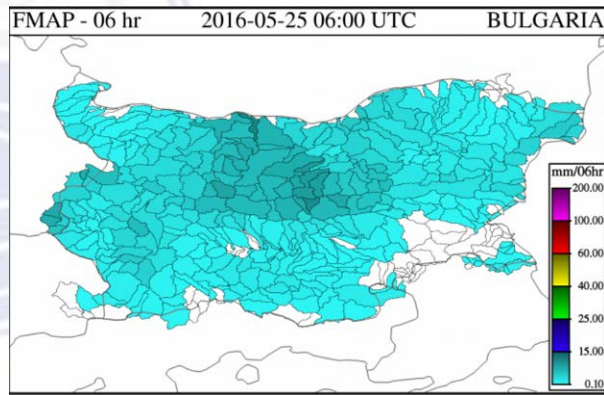
In the period 06:00 UTC - 18 UTC (09: 00h- 21: 00h local time) the more significant are the accumulated precipitation over 6 hours (12:00 UTC -18: 00 UTC) and over 3 hours (15:00 UTC - 18 : 00 UTC - 18:00 - 21:00 local time)



Average Soil Moisture - soil water saturation (0.4 - 0.5)



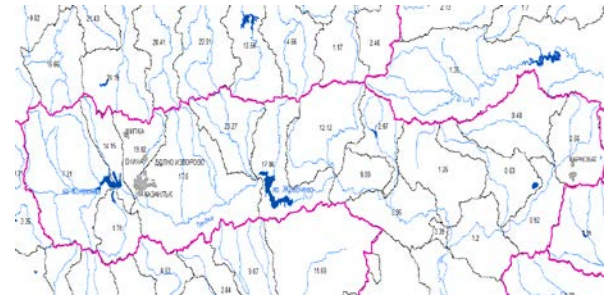
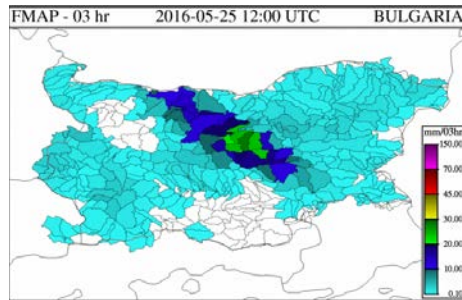
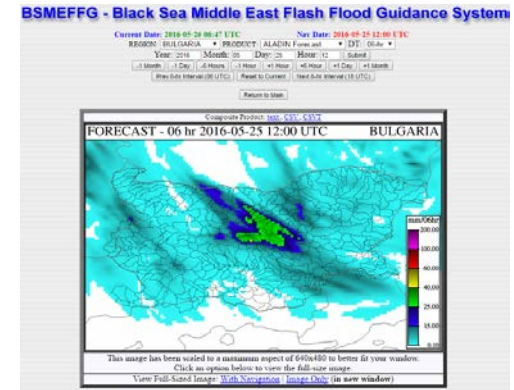
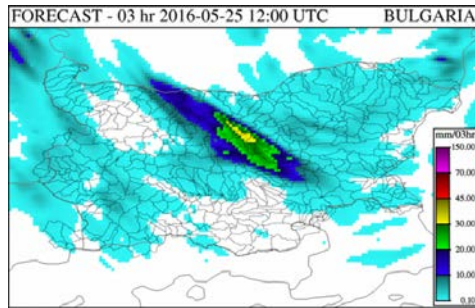
Required rainfall to cause bankfull flow over the next 6hrs (21 mm - 44 mm)



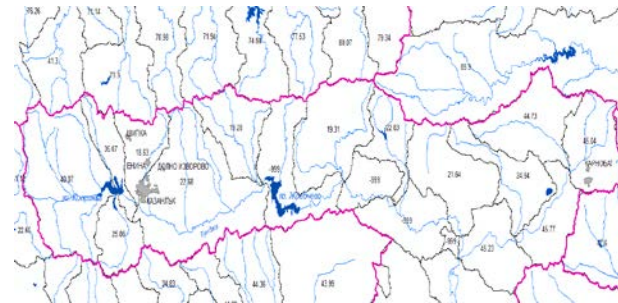
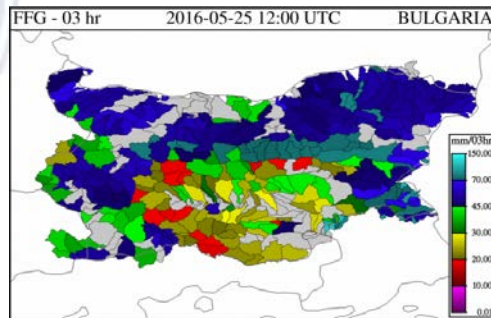
Forecasted Mean Areal Precipitation over 6 hours are below the FFG  
In the next six hours is not expected flash flood in the area



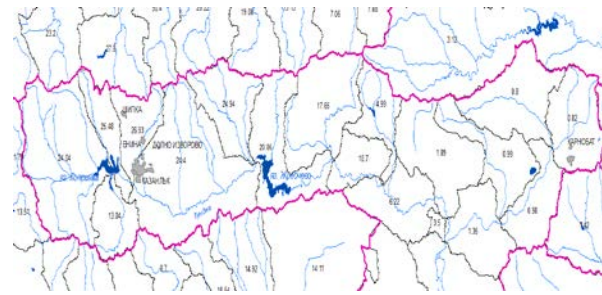
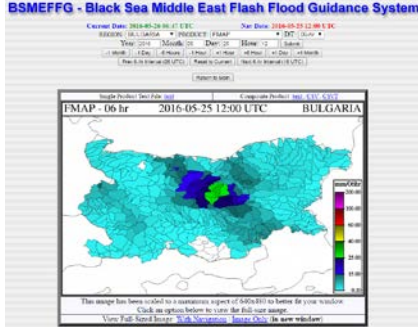
ALADIN 12 UTC (15:00 local time) is for significant rainfall in the next 3 hours and 6 hours



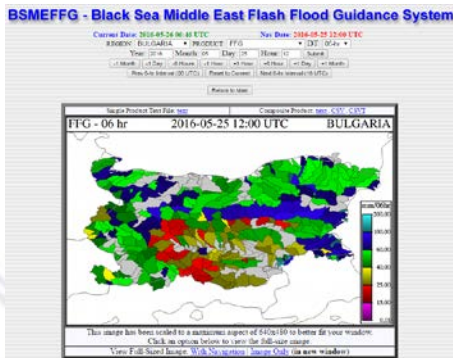
The forecasted average for each watershed accumulated rainfall over 3 hours is between 2mm and 28mm



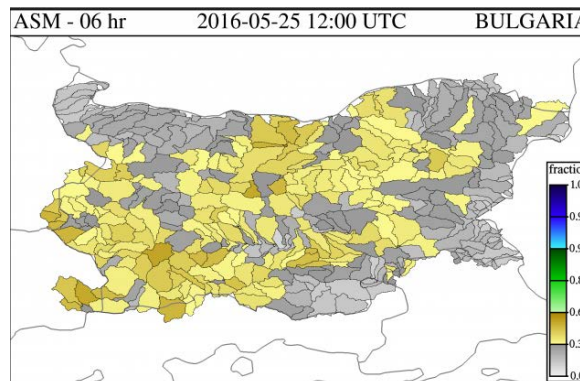
FFG shows values between 19 mm and 40 mm over next 3 hours



The forecasted 6 hour accumulated rainfall, average for each watershed is between 2 mm and 30 mm



The FFG shows values between 21 mm and 49 mm over 6 hours.

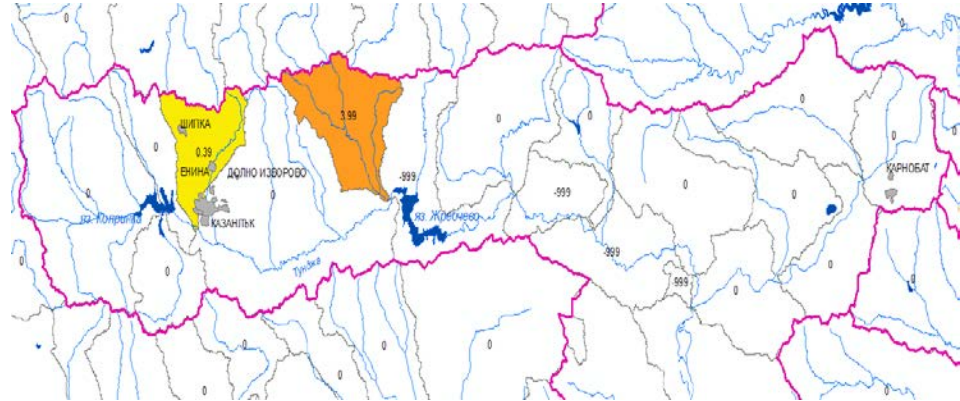
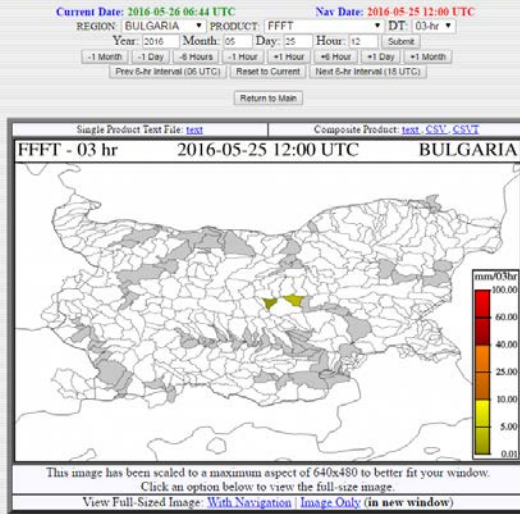


During this period no change in the map of soil moisture

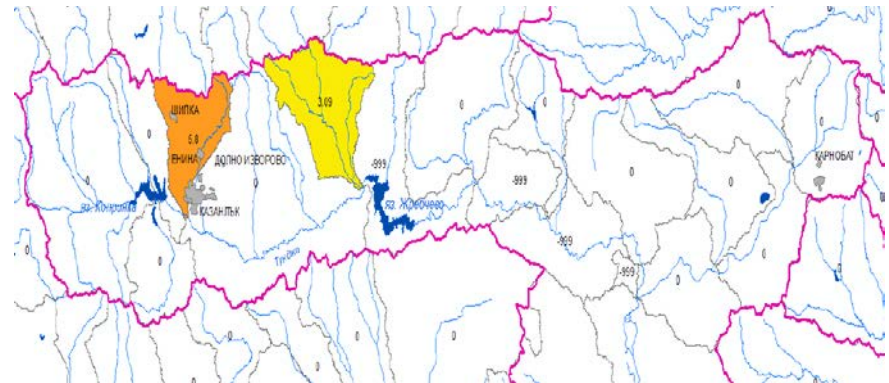
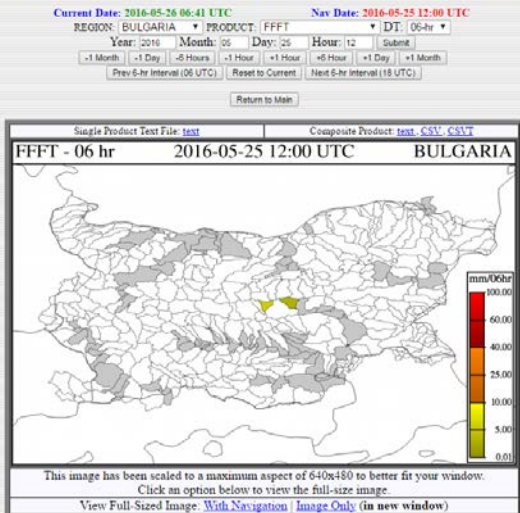


# The system forecasts the risk of flash flood in two watersheds These are the watersheds of the river Eninska and the river Radova

## BSMEFFG - Black Sea Middle East Flash Flood Guidance System



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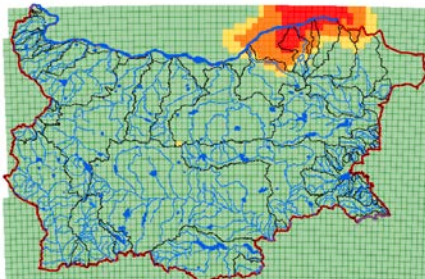






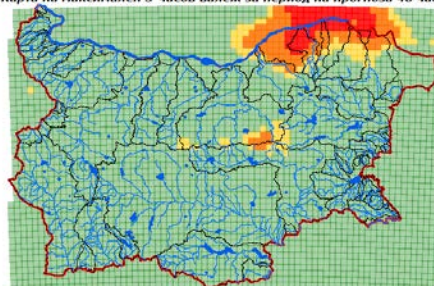
# Monitoring and processing the information from the numerical model ALADIN-Bulgaria and forecasted with the model intensive rainfall

Карта на максимален едночасов валеж за период на прогноза 48 часа



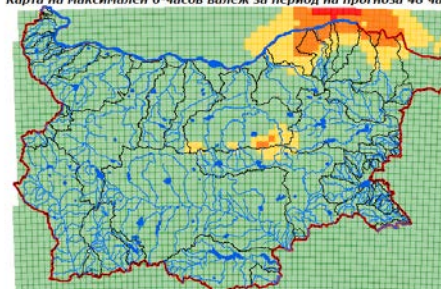
Легенда:  
■ няма данни;  
■ Без интензивни валежи;  
■ Валежи от 10 до 15 mm/h;  
■ Валежи от 15 до 30 mm/h;  
■ Валежи над 30 mm/h;  
— Реки;  
— Водосборни.

Карта на максимален 3-часов валеж за период на прогноза 48 часа



Легенда:  
■ няма данни;  
■ Без интензивни валежи;  
■ Валежи от 10 до 15 mm/3h;  
■ Валежи от 15 до 30 mm/3h;  
■ Валежи над 30 mm/3h;  
— Реки;  
— Водосборни.

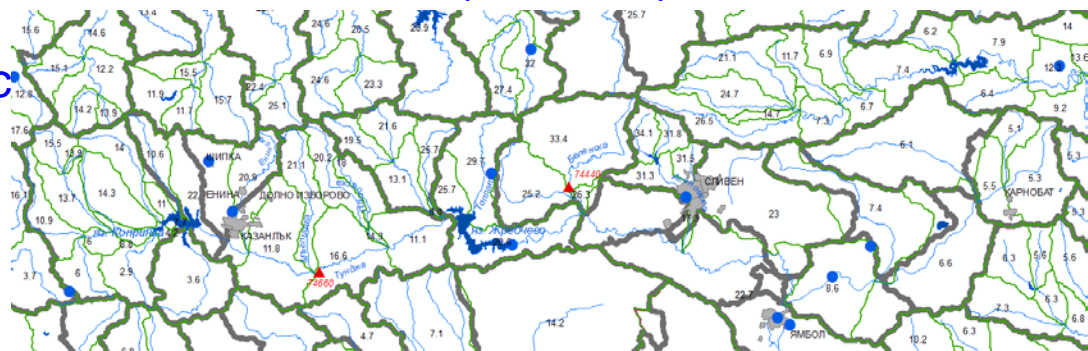
Карта на максимален 6-часов валеж за период на прогноза 48 часа



Легенда:  
■ няма данни;  
■ Без интензивни валежи;  
■ Валежи от 15 до 30 mm/6h;  
■ Валежи от 30 до 60 mm/6h;  
■ Валежи над 60 mm/6h;  
— Реки;  
— Водосборни.

*Forecasted with the model ALADIN BG 25.05.2016 (07:00 LT) intensive rainfall*

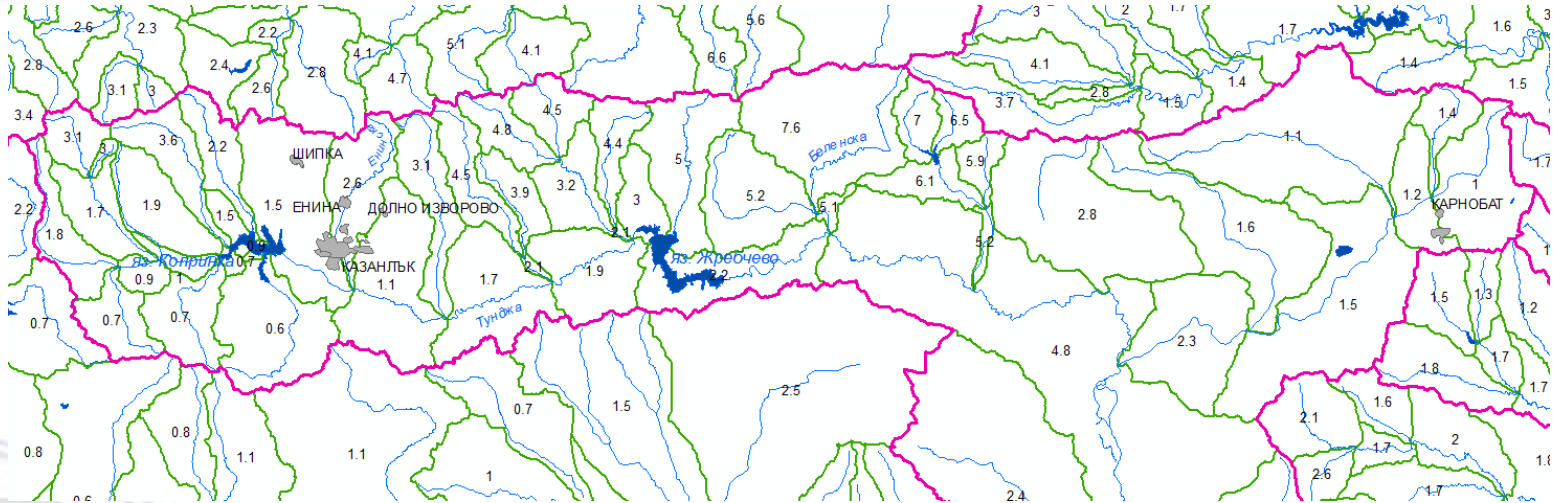
ALADIN\_BG is regional hydrodynamic model with high resolution (7 km)  
ALADIN\_BG is run twice per day  
06:00UTC and 18:00UTC



Based on ALADIN -BG for each watershed are forecasted:  
Accumulated average precipitation over 1 hour for the next 72 hours  
Maximum accumulated average precipitation over 1 hour in the next 72 hours  
Maximum accumulated average precipitation over 3 hours in the next 72 hours  
Maximum accumulated average precipitation over 6 hours in the next 72 hours  
Maximum accumulated precipitation over 1 hour for the next 72 hours  
Maximum accumulated precipitation over 3 hours in the next 72 hours  
Maximum accumulated precipitation over 6 hours in the next 72 hours



In GIS is presented the forecasted over 1 hour average and maximum rainfall in each watershed (1088 watershed) for the next 72 hours.  
ALADIN-Bulgaria 06: 00h UTC (09:00 local time) 25.05.2016

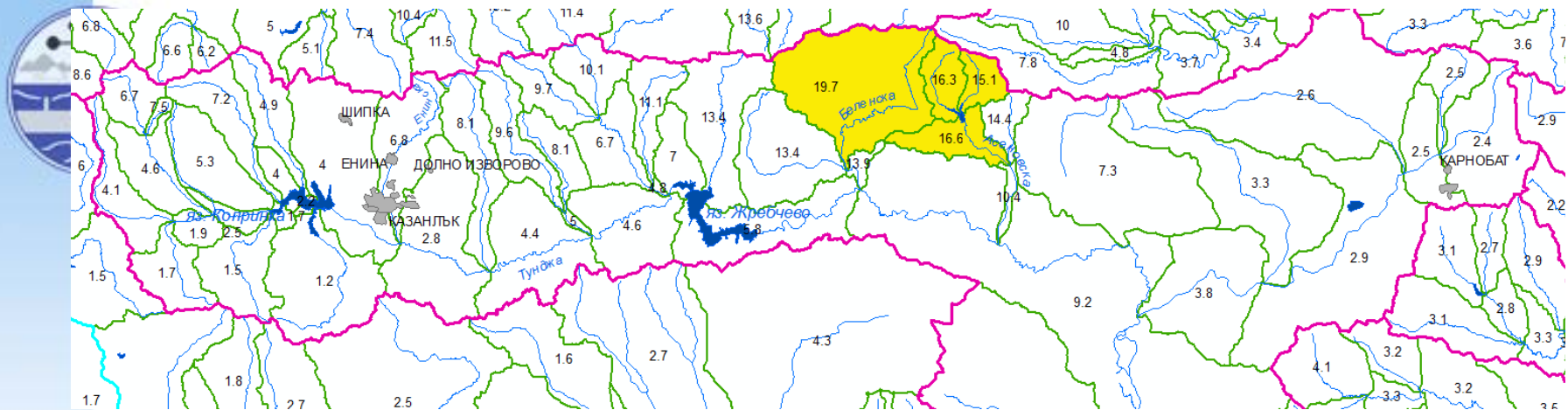


The greatest average 1 hour rainfall in the area is at 16:00 UTC - (19:00 local time) and values 2mm - 7.6 mm. The biggest values are forecasted in watersheds of Belenska river and Asenovska river

for 1hour accumulated precipitation

- No intensive precipitation;
- Precipitation from 10 mm/h to 15 mm/h; (attention)
- Precipitation from 15 mm/h to 20 mm/h; (warning)
- Precipitation over 20 mm/h; (alert)

According to the accepted categories for intensive rainfall, forecasted hour rainfall is below the thresholds for warning

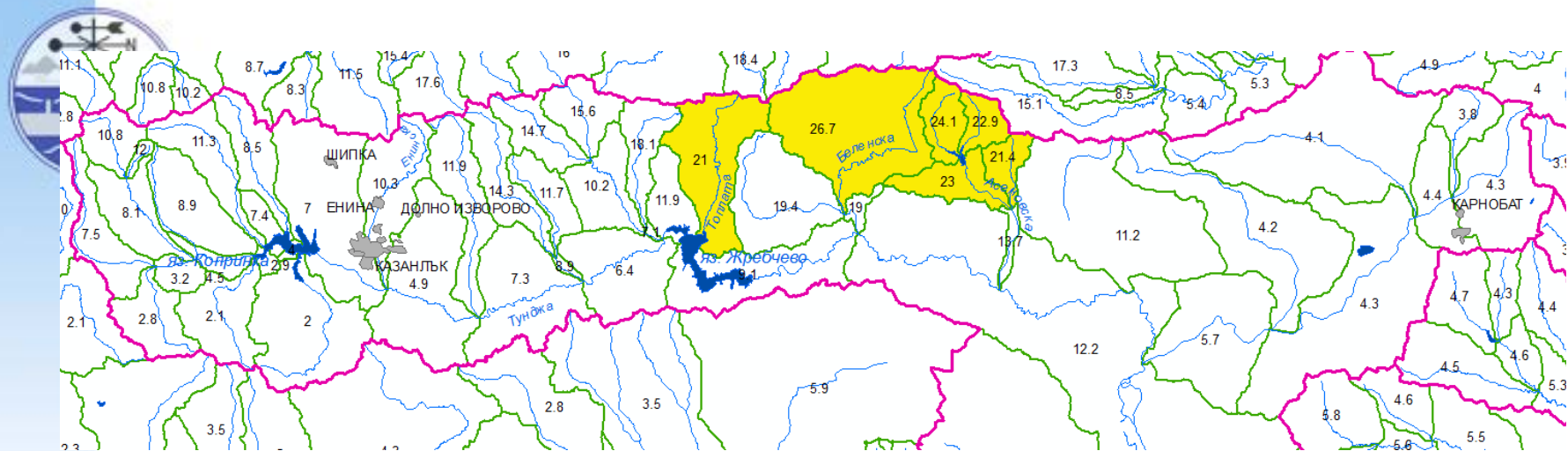


The maximum accumulated average precipitation over 3 hours is in the interval 15:00 UTC -17: 00 UTC (18: 00-20: 00 local time).

for 3 hours accumulated precipitation

- No intensive precipitation;
- Precipitation from 15 mm/3h to 20 mm/3h; (attention)
- Precipitation from 20 mm/3h to 30 mm/3h; (warning)
- Precipitation over 30 mm/3h; (alert)

According to the accepted categories for intensive rainfall (mm/3h), the forecasted rainfall for three hours for watersheds of Belenska river and Asenovska river are in the category “attention” (precipitation from 15 mm/3h to 20 mm/3h)



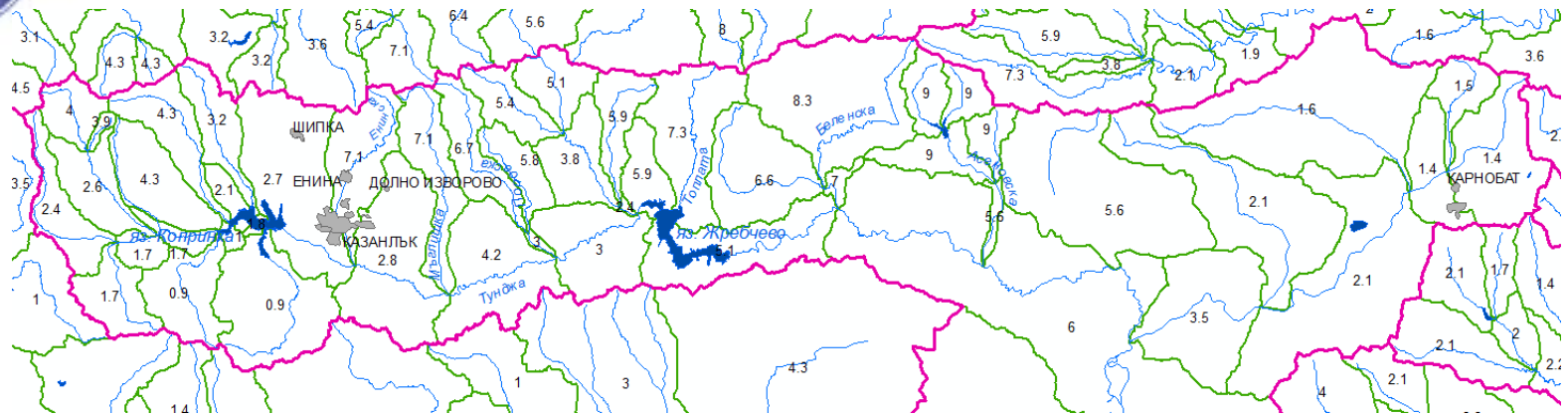
The maximum accumulated average precipitation over 6 hours is in the interval 14:00 UTC -19:00 UTC (17:00-22:00 local time)

- No intensive precipitation;
- Precipitation from 20 mm/6h to 30 mm/6h; (attention)
- Precipitation from 30 mm/6h to 40 mm/6h; (warning)
- Precipitation over 40 mm/6h; (alert)

According to the accepted categories for intensive rainfall (mm/6h), the forecasted rainfall for six hours for watersheds of Toplata river, Belenska river and Asenovska river are in the category “attention” (precipitation from 20 mm/6h to 30 mm/6h)



## Analysis of the data for the maximum rainfall in watersheds for each hour of the 72 hour forecast of ALADIN-Bulgaria 06:00 UTC

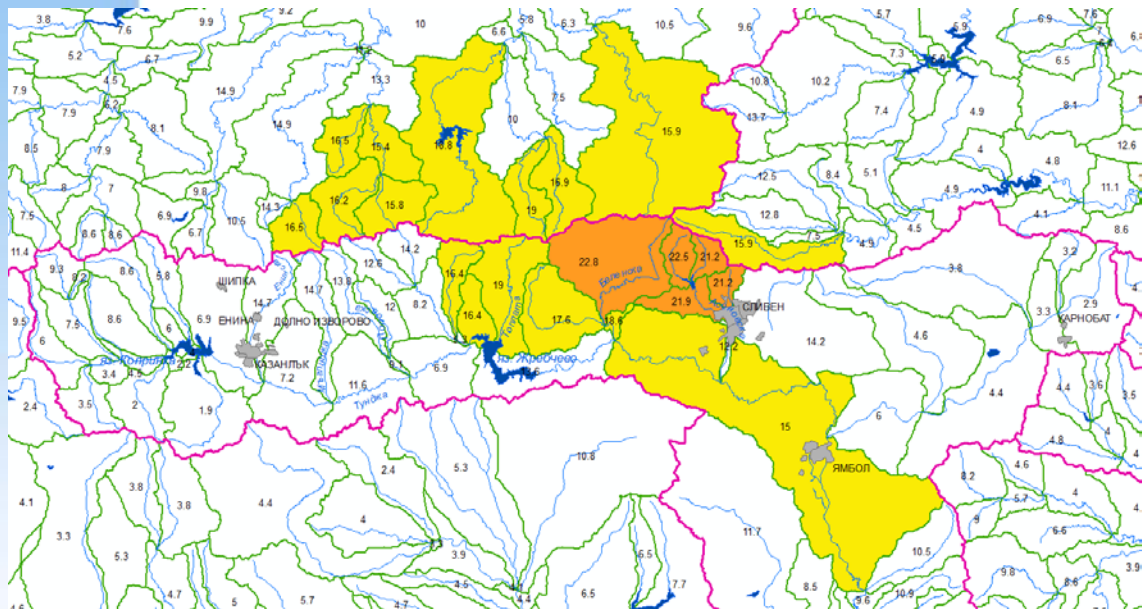


The Maximum accumulated precipitation over 1 hour is at 16:00 UTC - (19:00 local time) and the value is 9 mm

for 1hour accumulated precipitation

- No intensive precipitation;
- Precipitation from 10 mm/h to 15 mm/h; (attention)
- Precipitation from 15 mm/h to 20 mm/h; (warning)
- Precipitation over 20 mm/h; (alert)

According to the accepted categories for intensive rainfall, forecasted hour rainfall is below the thresholds for warning



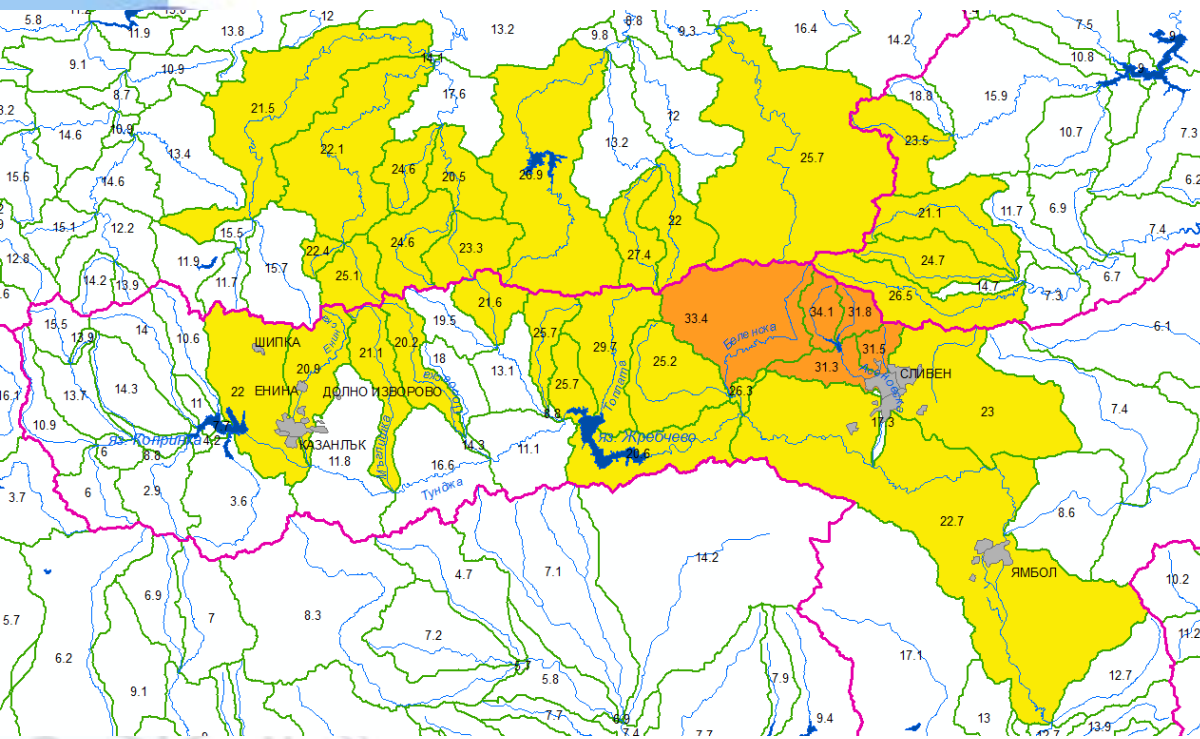
The maximum accumulated precipitation over 3 hours is in the interval 15:00 UTC -17:00 UTC (18:00-20:00 LT)



According to the accepted categories for intensive rainfall (mm/3h), the forecasted rainfall for three hours for watersheds of Belenska river and Asenovska river are in the category “warning” (precipitation from 20 mm/3h to 30 mm/3h); watersheds of the Belitsa river, Djulunitsa river, Lefedja river, Lazova river, Toplata river, main river between Sliven and Yambol are in the category “attention” (precipitation from "15 mm/3h to 20 mm/3h)

for 3 hours accumulated precipitation

- No intensive precipitation;
- Precipitation from 15 mm/3h to 20 mm/3h; (attention)
- Precipitation from 20 mm/3h to 30 mm/3h; (warning)
- Precipitation over 30 mm/3h; (alert)



- No intensive precipitation;
- Precipitation from 20 mm/6h to 30 mm/6h; (attention)
- Precipitation from 30 mm/6h to 40 mm/6h; (warning)
- Precipitation over 40 mm/6h; (alert)

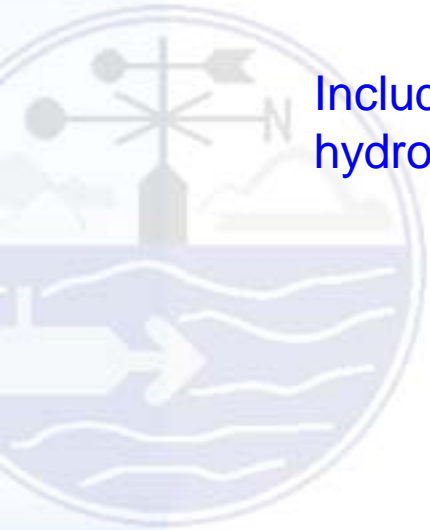
The Maximum accumulated precipitation over 6 hours is in the interval 15:00 UTC - 20: 00 UTC (18: 00-23: 00 local time)

According to the accepted categories for intensive rainfall (mm/6h), the forecasted rainfall for six hours for watersheds of the river: Belenska and Asenovska are in the category “warning” (precipitation from 30 mm/6h to 40 mm/6h); watersheds of the river: Eninska, Maglizhka, Popovska, Radova, Iazova, Toplata and Tundja between dam Jrevchevo and Yambol, Belitsa, Djulunitsa, Lefedja are in the category “attention” (precipitation from "20 mm/6h to 30 mm/6h)



**Източнобеломорски басейн:** Днес (25.05) се очакват повишения на водните нива на реките в горното и средно течение на водосбора на р. Тунджа и в средното и долното течение на р. Марица. Значителни повишения се очакват във вечерните часове на 25.05 и ранните сутрешни часове на 26.05 в притоците на р. Тунджа - р. Лазова, р. Топлата, р. Беленска и р. Асеновска, както и в притоците ѝ и основната река в горното течение. От 26.05 и 27.05 ще има повишения на водните нива на река Марица, а в периода 26-28.05 се очаква повишение на водните нива в средното и долно течение на р. Тунджа.

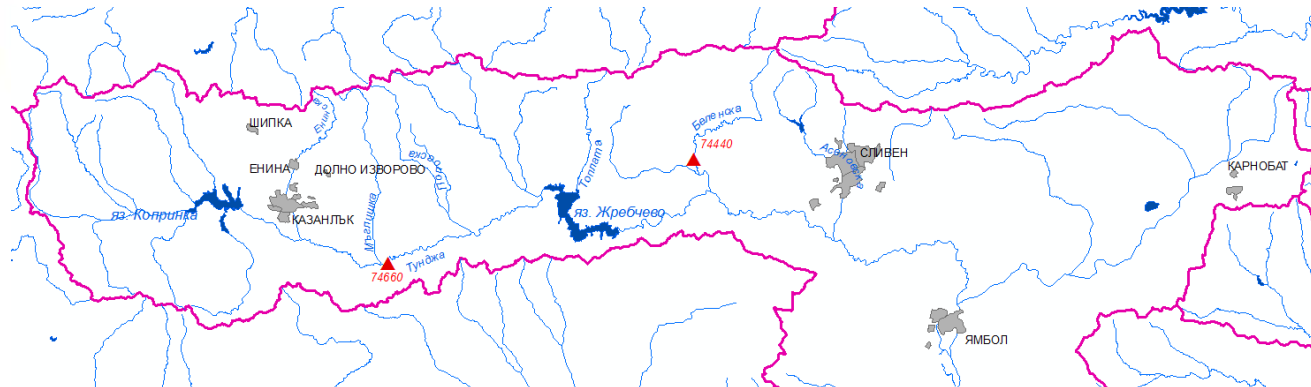
Included a warning for the mentioned above watersheds in daily hydrometeorological bulletin







# Validation of the event



At automatic hydrometric stations in the Tundzha river watershed - 74660 Tundzha at Yagoda and 74440 Belenska at Chumerna were registered rapid increases in water levels and water discharges





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# Thank you for your attention

<http://www.meteo.bg>

<http://hydro.bg>



NIMH  
BAS

**The Black Sea and Middle East Flood Guidance (BSMEFFG) System  
Tbilisi, Georgia, from 28 to 30 June 2016**