The Abdus Salam International Centre for Theoretical Physics

Application of the CHyM model: Case study of the Sava River flood in May 2014

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Introduction

- The Sava River flows through Slovenia, Croatia, Bosnia and Herzegovina, and Serbia, discharging into the Danube River in Belgrade.
- The Sava is 1,000 km long. It is the greatest tributary of the Danube River by volume of water.
- It has a great imapct on economy of the mentioned countries (eg. Agriculture, hydro-power prodaction).
- The average annual flow rate at confluence of the Sava River in Belgrade is equal to 1600 m^3/s.

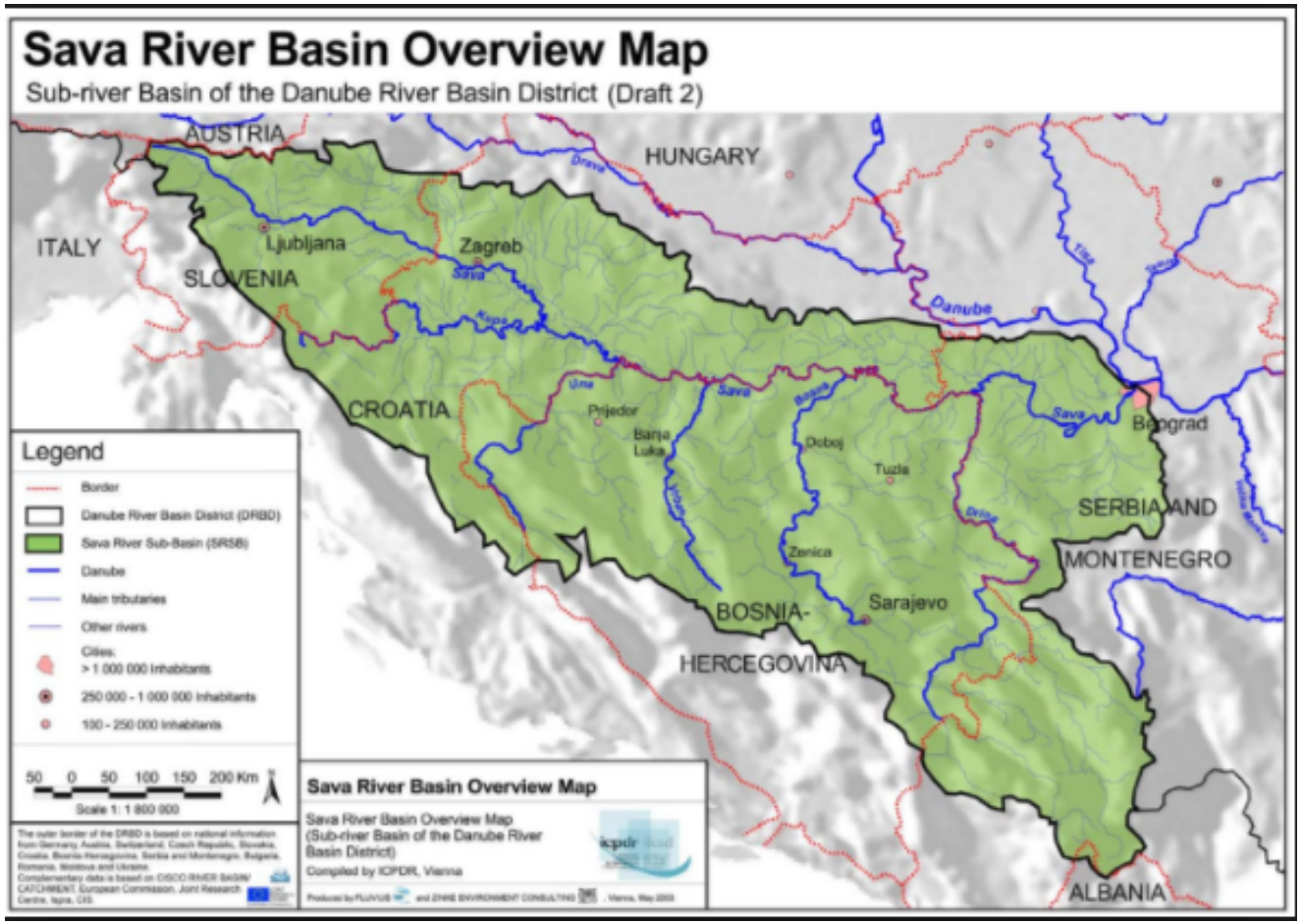


Figure 1. The Sava River basin.

Introduction

- The Sava River Basin was hit in May, 2014 by the biggest floods ever recorded in history, in which several people were killed and many went missing.
- Many towns and villages in Bosnia and Herzegovina, Croatia and Serbia were under water.
- The flood also caused great damage to the industry in these countries.

Figure 2. Obrenovac City during the flood in 2014.

Figure 3. Thermo-power plant „Nikola Tesla“.

Introduction

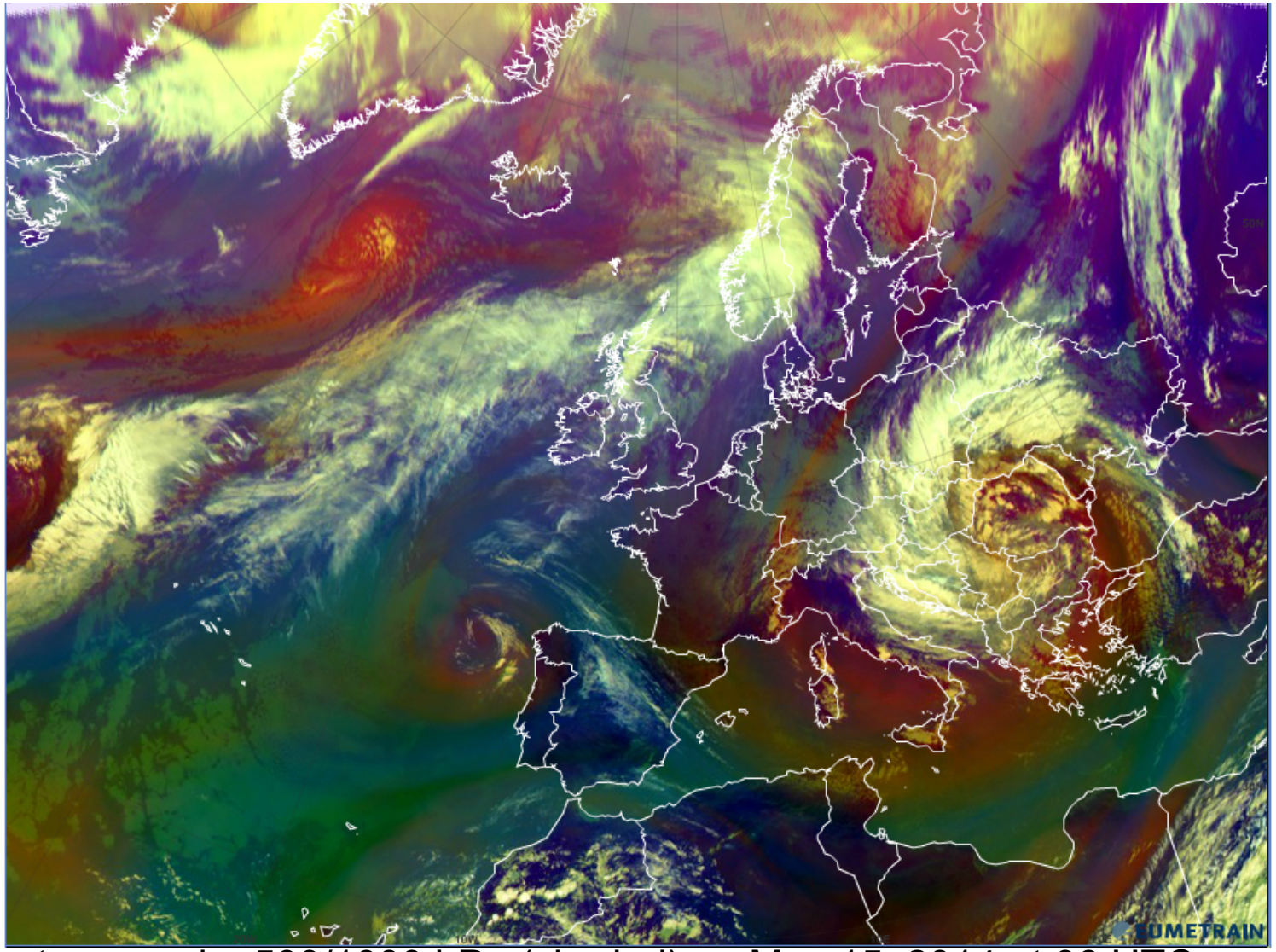
- The floods affected 1.6 million people of Serbia and 1.0 million people of Bosnia and Herzegovina.

- The total damage caused by this flood event is estimated as:

  - 200 mil. EUR (Croatia)
  - 1 700 mil. EUR (Serbia)
  - 2 000 mil. EUR (BIH)

Figure 4. Satelite data: Flooded area for the Sava River basin in May, 2014.

Case study



topography 500/1000 hPa (shaded) on May 15, 2014 at 06 UTC.

Figure 7. MSG-10 RGB Airmass on May 15, 2014 at 06 UTC.

Methodology

- The observatory data of the Sava River was collected from Sremska Mitrovica station and compared to the CHyM hydrological model output for the same station.

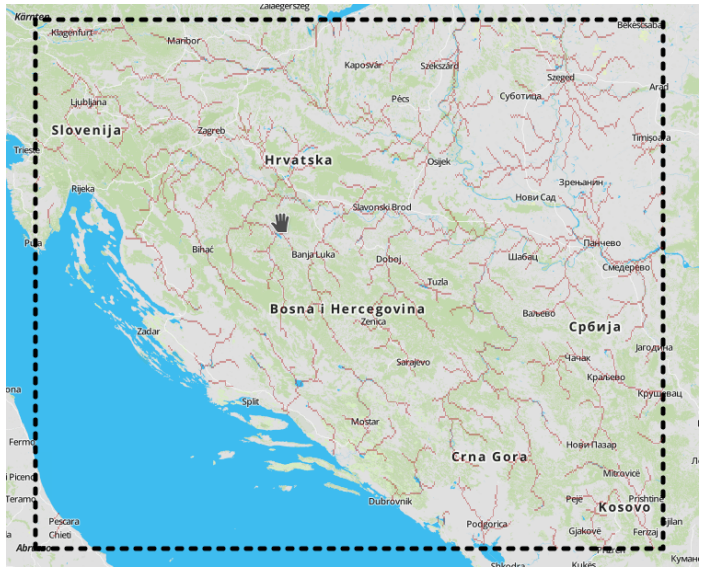
CHyM model setup and inputs:

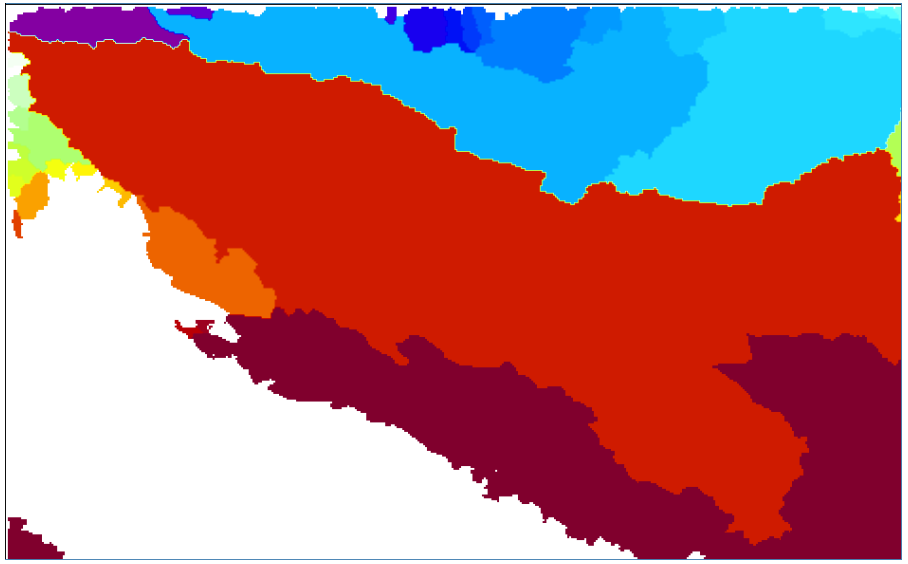
- Domain:
  - lat: 42.23° – 46.72° N
  - lon: 13.88 °– 21.36° E
- Resolution : ~1.5 km
- Period: 01-25.05.2014.
- DEM:

  Hydrosheeds World DEM (90 m)
- Temperature data:

  ERAInterim (0.75°)
- Precipitation data:

  TRMM (0.25°) and ERAInterim (0.75°)
- Return flow factor: 10^{-6} (default 4.8 10^{-7})





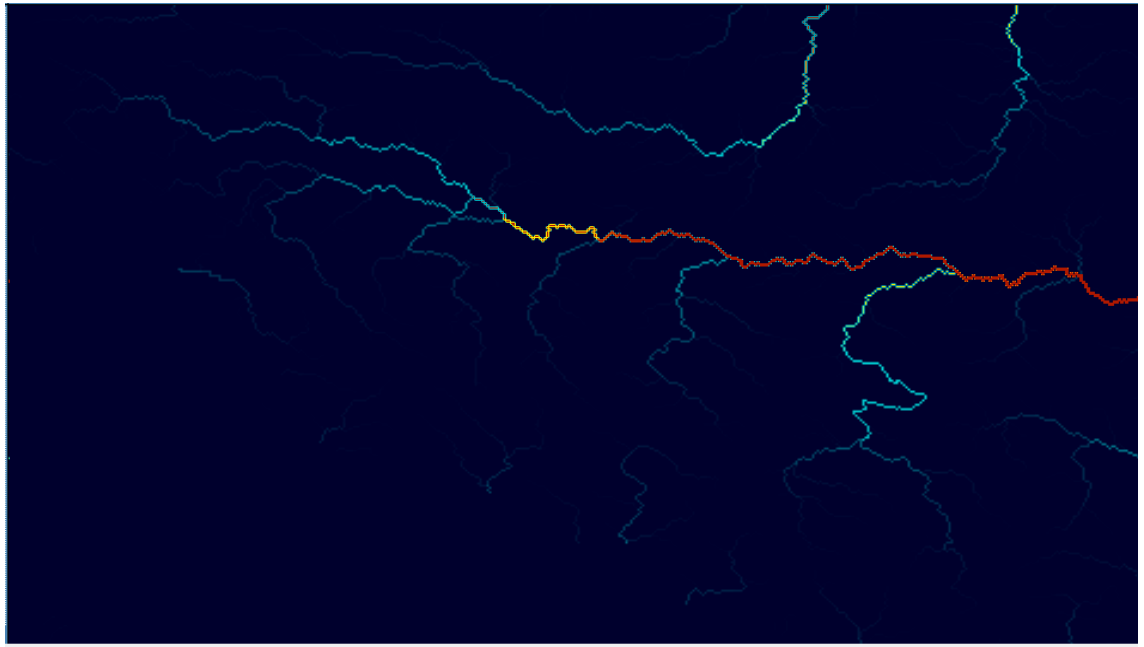


Figure 8. Study area: domain (upper left), basin (upper right) and drainage network (bottom).

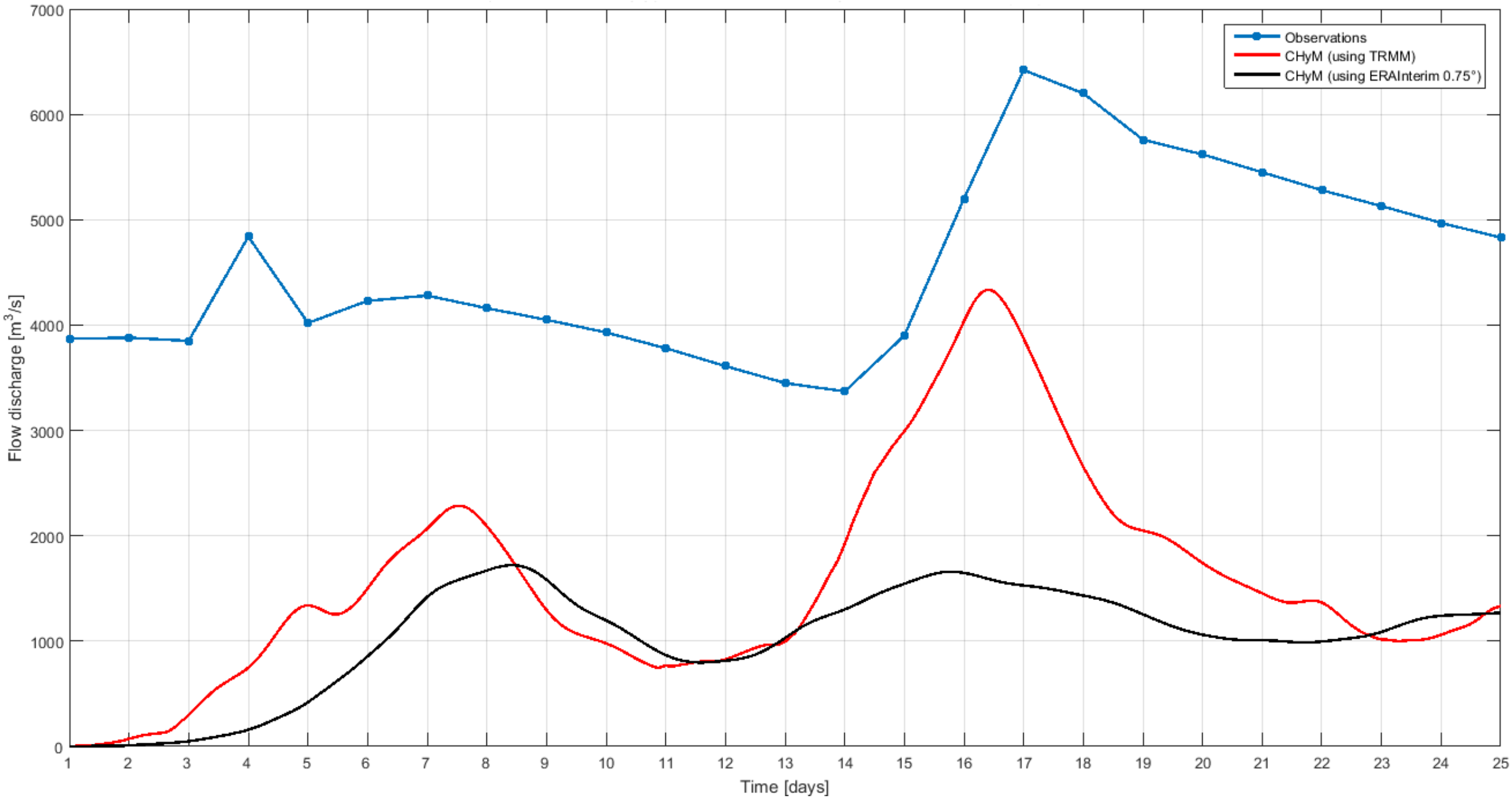


Figure 9. Observed and modelled flow during the flood event in May 2014 at Sremska Mitrovica h.s. (the Sava River).

Conclusions

- The CHyM hydrological model reproduces the dynamics of the observed flood event of the Sremska Mitrovica hydrological station.
- It reproduces complex hydrograph during the flood which is consisted of two flood wave peaks.
- The snow-related processes have an impact on the upper part of the Sava River basin (Alpine region) which significantly can increase the base flow during the flood events.
- The magnitude of the flood is underestimated due to the fact that snow melt/ accumulation is not taken into account in this simulation.
- The results suggest that the CHyM model can be used for forecasting the flood events for the Sava River basin.
- Recomendation: CHyM simulation can be improved if the initial conditions estimated from observed flows at the start of a flood event are taken into account.

Thank you for attention!