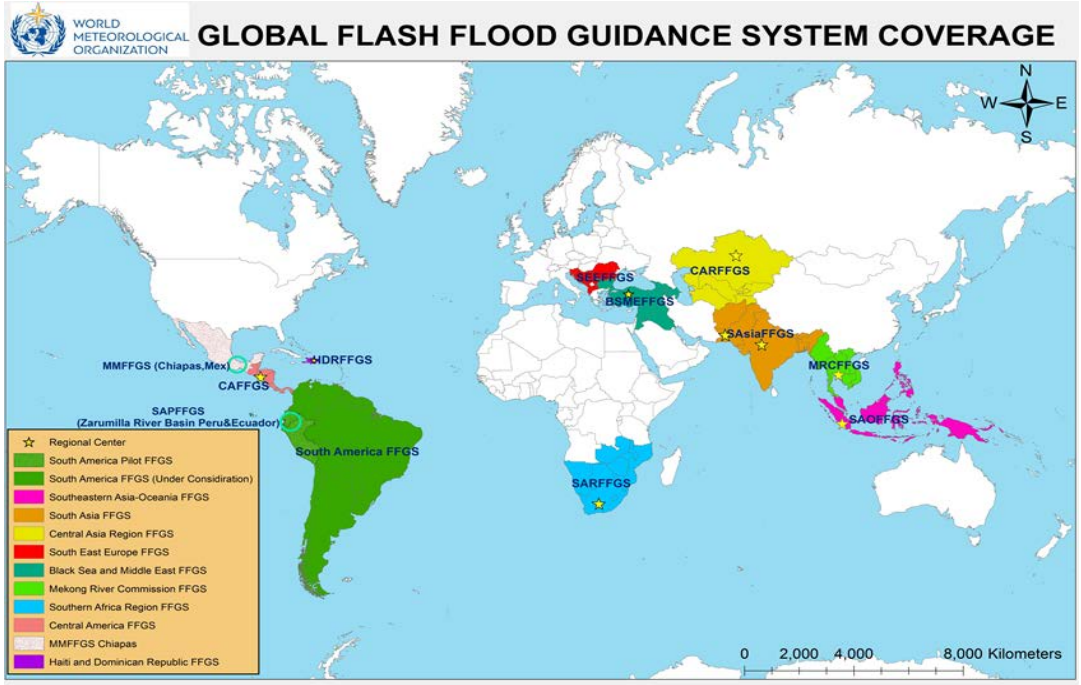
World Meteorological Organization

Weather • Climate • Water

Flash Flood Guidance (and Early Warning) System (FFGS)

Flash Flood Guidance System (FFGS)



It currently covers fifty two (52) countries and more than two billion people around the world contributing to saving lives and decreasing economic losses**.**

The WMO Commission for Hydrology (CHy) jointly with the WMO Commission for Basic Systems (CBS) and in collaboration with the US National Weather Service, Hydrologic Research Center (HRC), and USAID/OFDA have developed the concept of the Flash Flood Guidance System (FFGS) with global coverage.

The concept was endorsed by the Fifteenth WMO Congress and is being implemented through a series of regional projects with funding from USAID.

FFGS Regional Projects

The following regional Flash Flood Guidance (FFGS) projects are implemented, under implementation or under consideration:

- **Central America FFG** (**CAFFG**) (Operacional): Costa Rica (Regional Centre (RC)), Belize, Guatemala, Honduras, El Salvador, Nicaragua and Panama;
- **Southern Africa Region FFG** (**SARFFG**): (Operational) South Africa (RC), Botswana, Lesotho, Malawi , Mozambique, Namibia, Swaziland, Zambia, and Zimbabwe;
- **Mekong River Commission FFG (MRCFFG**) (Operational): Cambodia (RC), Lao PDR, Thailand, and Viet Nam;
- **Black Sea and Middle East FFG** (**BSMEFFG)** (Operational)**:** Armenia, Azerbaijan), Bulgaria, Georgia, Iraq, Jordan, Lebanon, Syria, and Turkey (RC);
- **South East Europe FFG (SEEFFG**) (under implementation): Albania, Bosnia and Herzegovina, Croatia, Moldova, Montenegro, Romania, Serbia, Slovenia, The Former Yugoslav Republic of Macedonia, and Turkey (RC);

GFFG Regional Projects (cont.)

- **South Asia FFG (SAsiaFFG**) (under implementation): Afghanistan, Bangladesh, Bhutan, Nepal, Pakistan, Sri Lanka, and India;
- **Central Asia Region FFG (CARFFG)** (under implementation**):** Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan;
- **South America Pilot FFG** (under implementation): Zarumilla River Basin (Peru and Ecuador);
- **Haiti-Dominican Republic FFG** (**HDRFFG**) (being developed): Dominican Republic and Haiti;
- **South Eastern Asia Oceania FFG (SAOFFG)** (under consideration): Brunei, Indonesia, Malaysia, Papua New Guinea, Philippines, Singapore, and Timor Leste.

Objectives of the FFG System

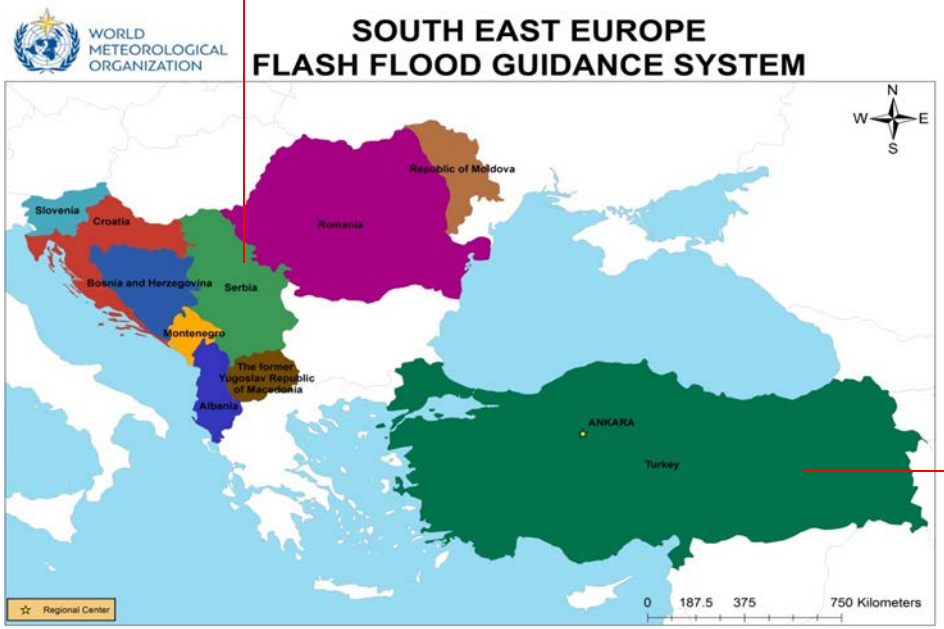
The main objective of the Flash Flood Guidance System with global coverage is to:

- Enhance NMHSs capacity to issue flash flood warnings and alerts to mitigate the adverse impacts of hydrometeorological hazards, by:
  - Using state-of-the-art hydrometerological forecasting models;
  - Enhancing collaboration between NMHSs and Emergency Management Agencies;
  - Providing extensive training, including on-line and operational training, to the forecasters;
  - Fostering regional development and collaboration.

Regional Perspective

Participating NMHSs:

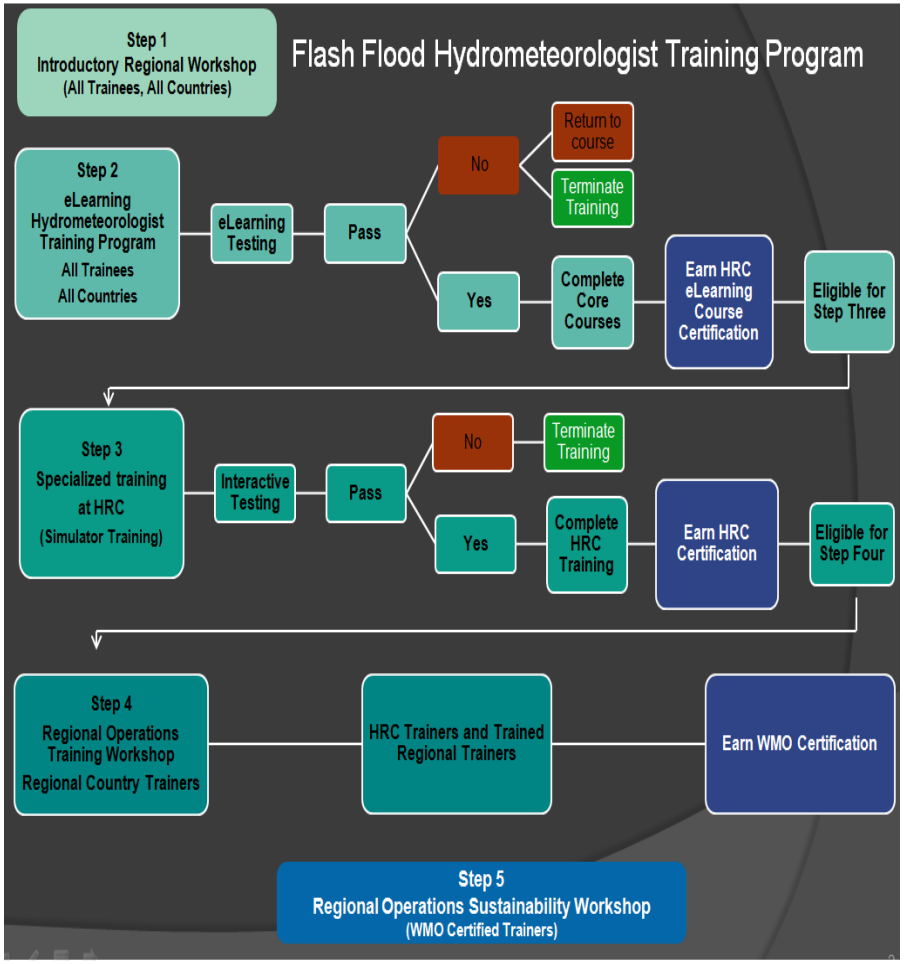
- Have good cooperation, collaboration, communication with the Regional Centre (RC) for the implementation of the project,
- Provide historical and in-situ local data to the FFG system developer through the RC,
- Prepare and issue flash flood warnings and alerts to the public and national agencies including Emergency Management Authorities,
- Participate in the Flash Flood Hydrometeorologist Training Programme (Steps 1-5),
- Conduct verification studies.



The Regional Centre:

- Maintain FFG servers to provide products and data to the participating countries,
- Collaborate with WMO to implement the flash flood hydrometeorologist training programme,
- Evaluate FFG products from the regional perspective and conduct verification studies in collaboration with participating countries,
- Have good internet connection to download and exchange data.

Flash Flood Hydrometeorologist Training Programme



Training is an integral part of regional FFG Systems and consists of five steps:

Step-1: Introductory in-country workshops and meetings such as Steering Committee Meetings;

Step-2: On line eLearning comprises elements of meteorology, hydrology, flash flood guidance, GIS, and remote sensing;

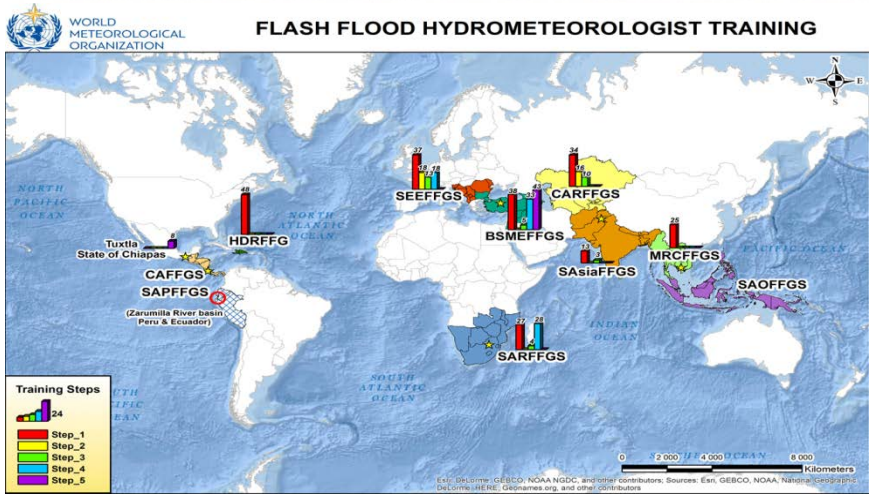
Step-3: Advanced operations and interactive simulator training at the Hydrologic Research Center (HRC), USA;

Step-4: Regional operations training workshop toward qualification of WMO flash flood trainer certificate; and

Step-5: Regional operation sustainability workshop provided by the WMO certified trainer.

SEEFFG Trainees for On-line (Step 2) and Operational Training at HRC (Step 3)

Country	Names
Albania	Klodian Zaimi
Bosnia and Herzegovina	Azra Babic
Bosnia and Herzegovina	Milica Djordjevic
Croatia	Petra Mutic
Croatia	Toni Jurlina
Moldova	Gherman Bejenaru
Serbia	Jelena Jerinic
Slovania	Saso Petan
Slovenia	Andrej Golob and Saso
The former Yugoslav Republic of Macedonia	Vasko Stojov



SEEFFG Regional Operational Training (Step 4)

- Regional Operational Training took place in Zagreb, Croatia from 9 to 13 May 2016. A total of 35 participated from the NMHSs, WMO and Hydrologic Research Center (HRC).
- Trainees who have successfully completed Step 2, 3, and 4 training received WMO trainer Certificates.

WORLD METEOROLOGICAL ORGANIZATION

This is to certify that

MS. PETRA MUTIC

has successfully completed, **effective June 2016,** all requirements of
the Flash Flood Hydrometeorologist Training Programme associated with the South East Europe Flash Flood Guidance (SEEFFG) system
and is qualified as a
Flash Flood Guidance Programme Trainer

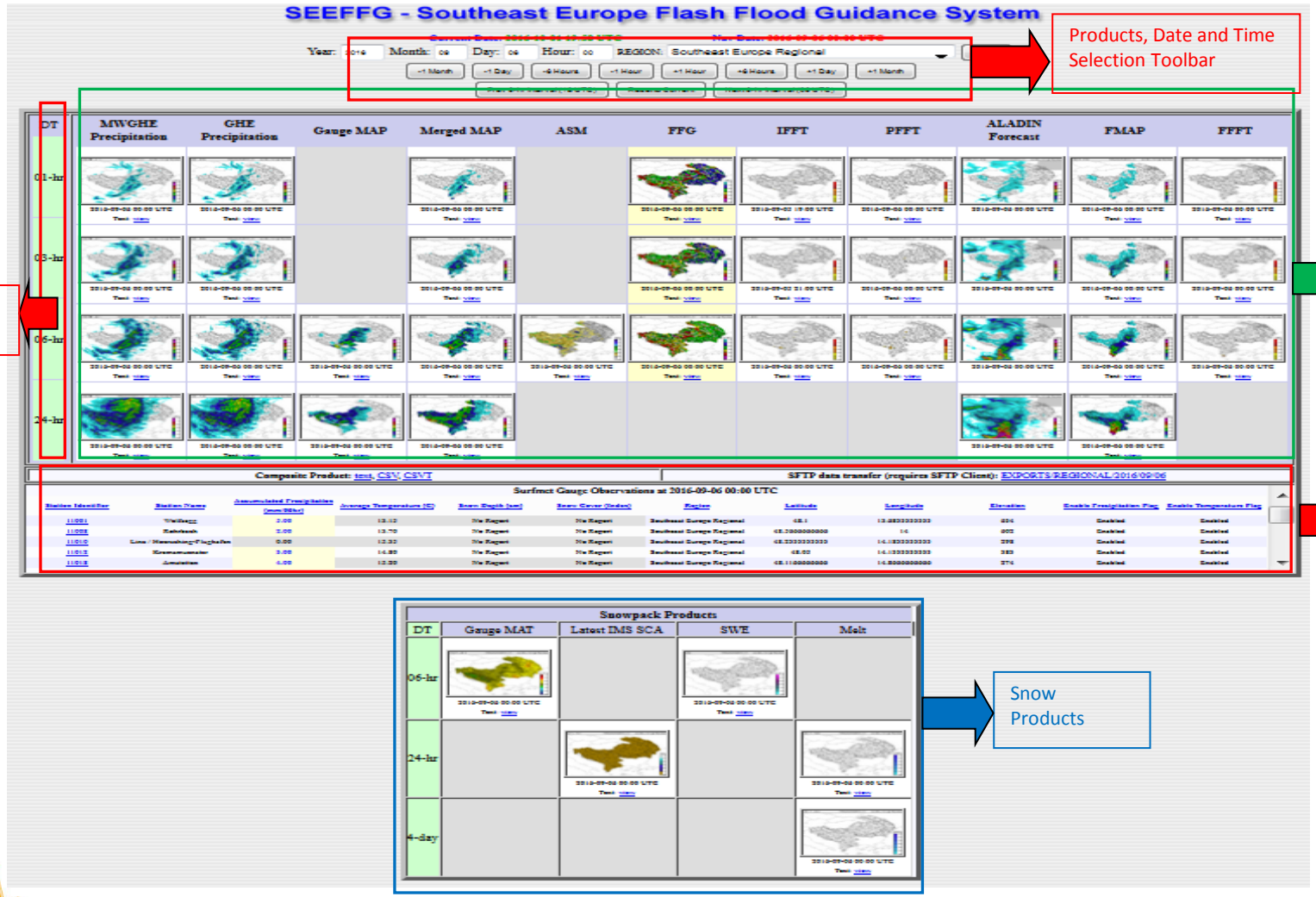
Dr Johannes Cullmann
Director, Climate and Water Resources Department, WMO

Dr Paul Pilon
Chief, Hydrological Forecasting and Water Resources Management, WMO

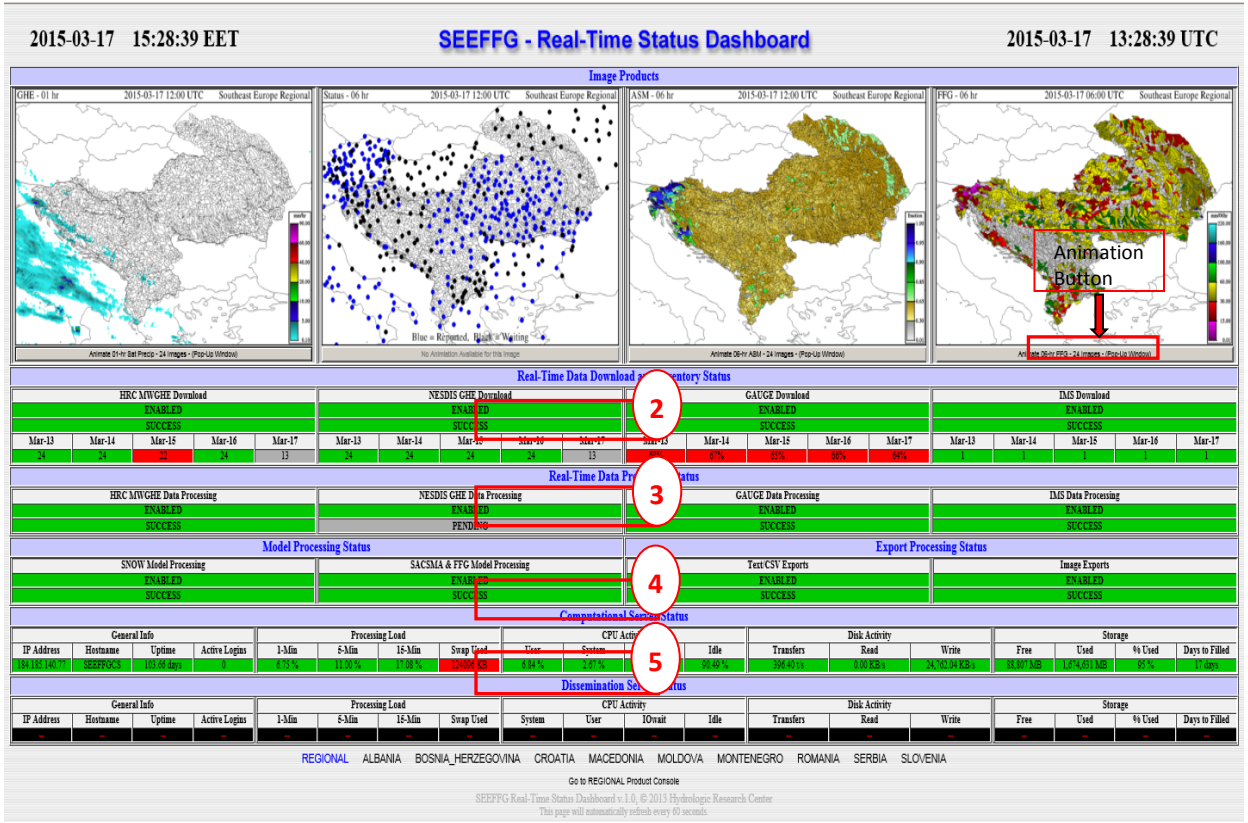
Mr Claudio Caponi
Chief, Capacity Building in Hydrological Forecasting and Water Resources, WMO

Mr Ayhan Sayin
Scientific Officer, Hydrological Forecasting and Water Resources, WMO

SEEFFGS Forecaster Console



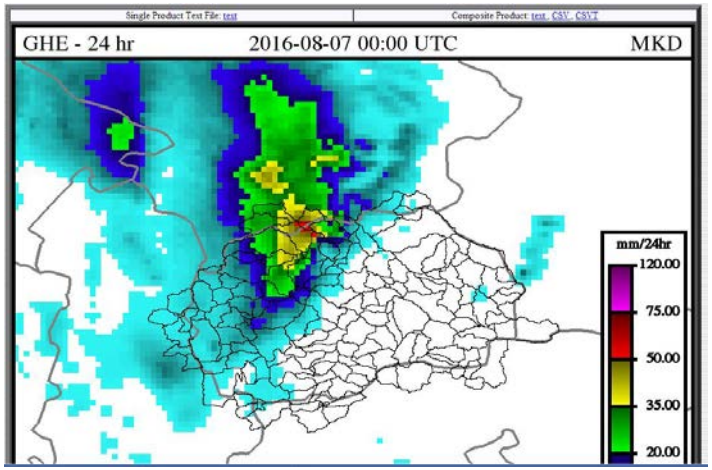
SEEFFGS Dashboard



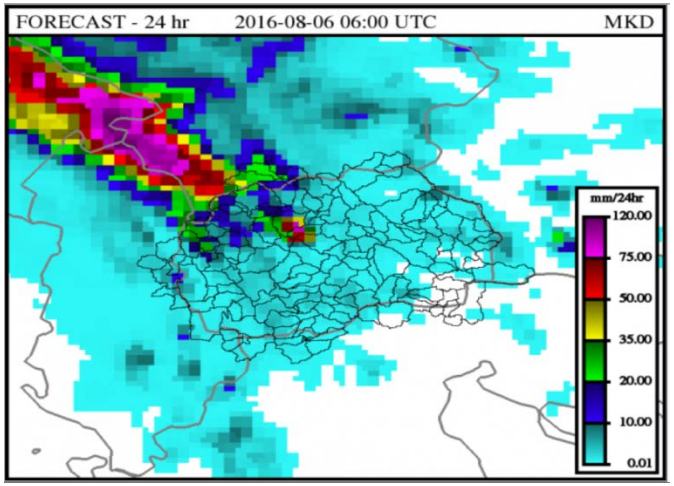
Dashboard console is designed to monitor server processes and :

- (**2**) Real-Time data downloads and inventory status;
- (**3**) Real-Time Data processing status;
- (**4**) Computational server status; and
- (**5**) Dissemination server status.

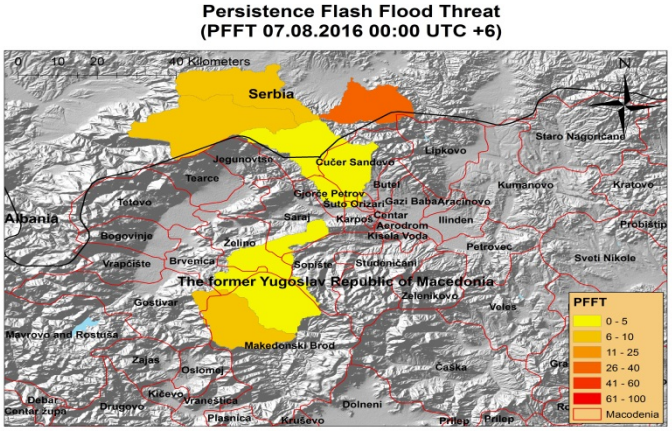
Products: Flash Flood Event in the Former Yugoslav Republic of Macedonia (07.08.2016)



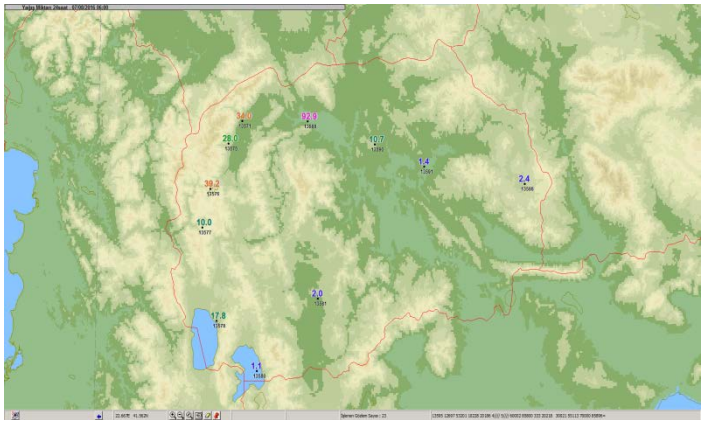
24-hr Global Hydro Estimator (GHE)



24-hr ALADIN NWP precipitation forecast

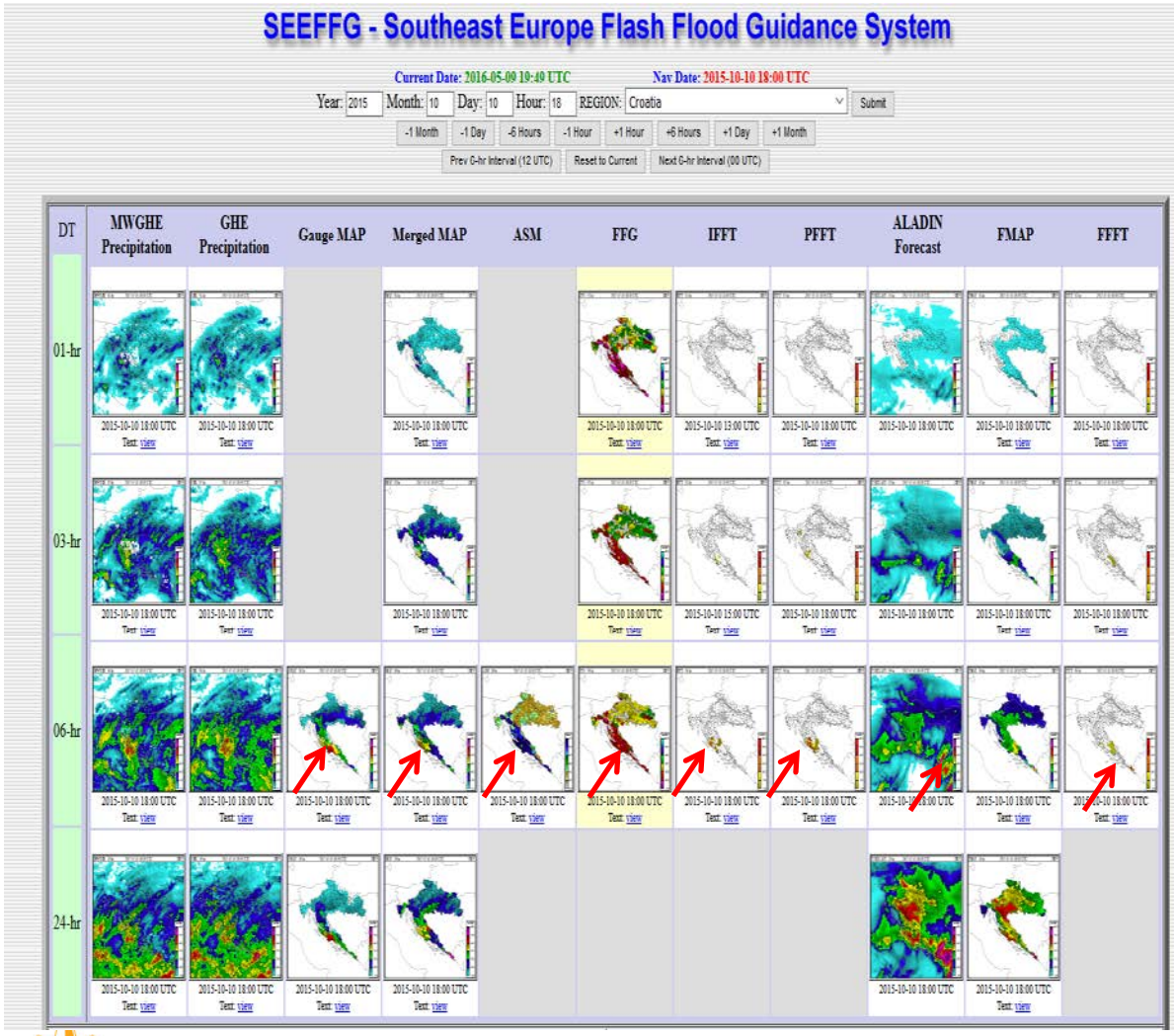


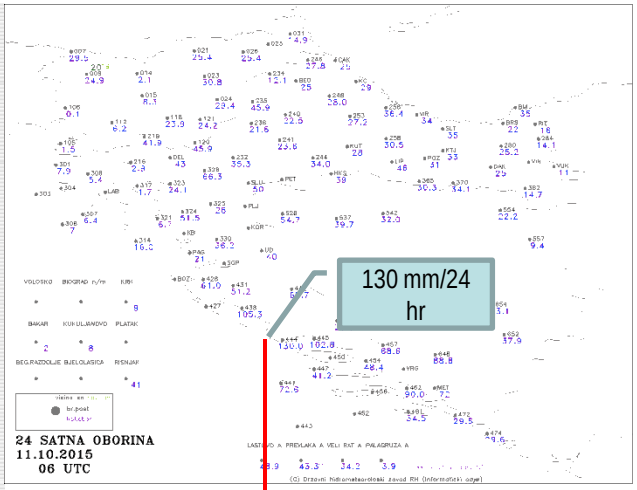
6-hr Persistence Flash Flood Threat (PFFT)



24-hr Precipitation accumulation measured at the Skopje station

Products: Flash Flood Event in Croatia (10.10.2015)





Verification Results of Croatia NMHS

- Contingency table of FF warnings for Croatia in the period 10.10.2015-29.02.2016

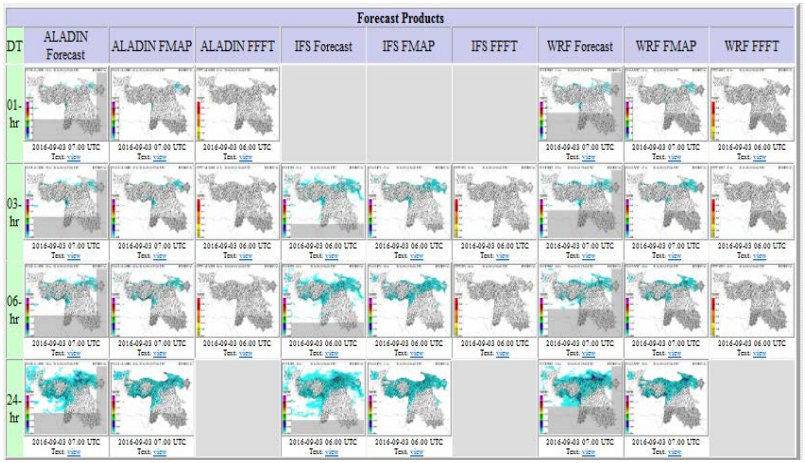
FORECASTED EVENTS

OBSERVED EVENTS	Y	N	Σ
Y	21 (a)	1 (b)	22
N	7 (c)	113 (d)	120
Σ	28	114	142

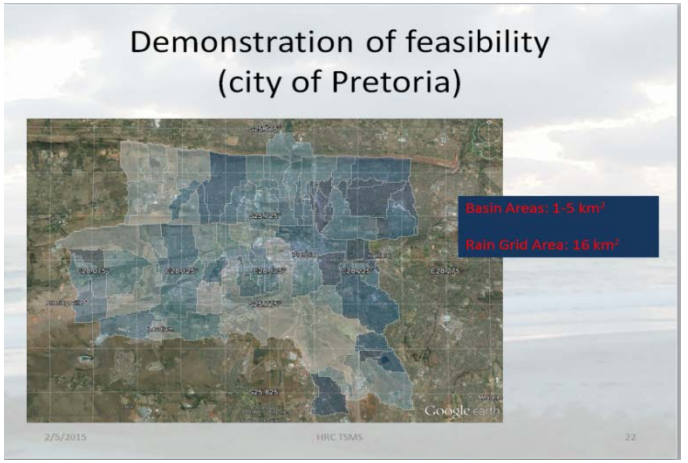
Hit Rate (POD): a/(a+c)	**0.75**
False Alarm Ratio (FAR): b/(a+b)	0.045
False Alarm Rate (POFD): b/(b+d)	0.009
Threat Score: a/(a+b+c)	0.72

Source: Petra Mutic of the MHS of Croatia

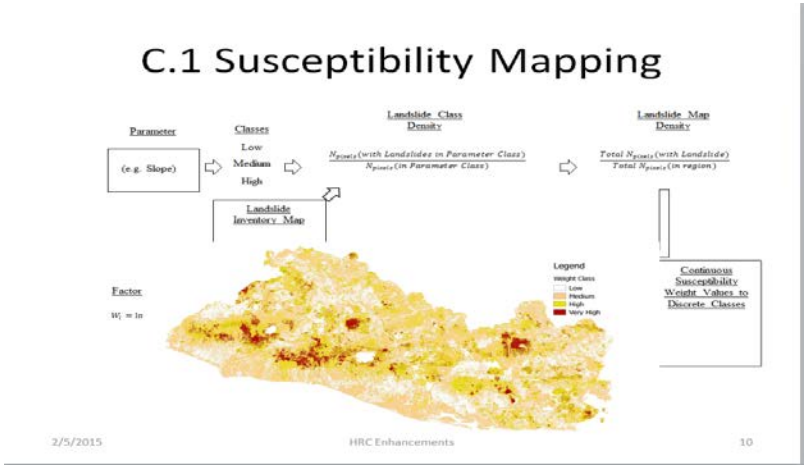
Advances



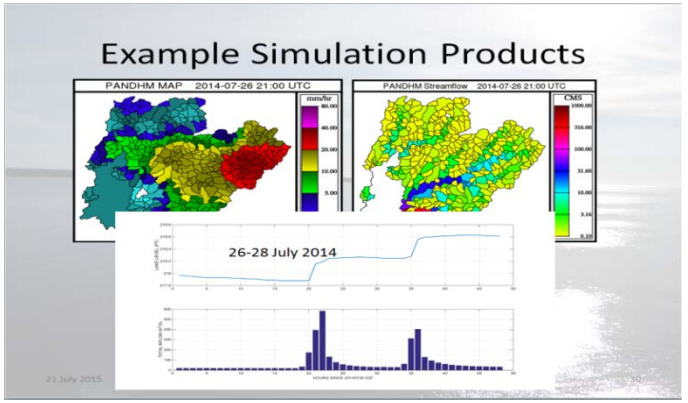
Multi-NWP Model ingestion



Urban Flash Flood Early Warning System

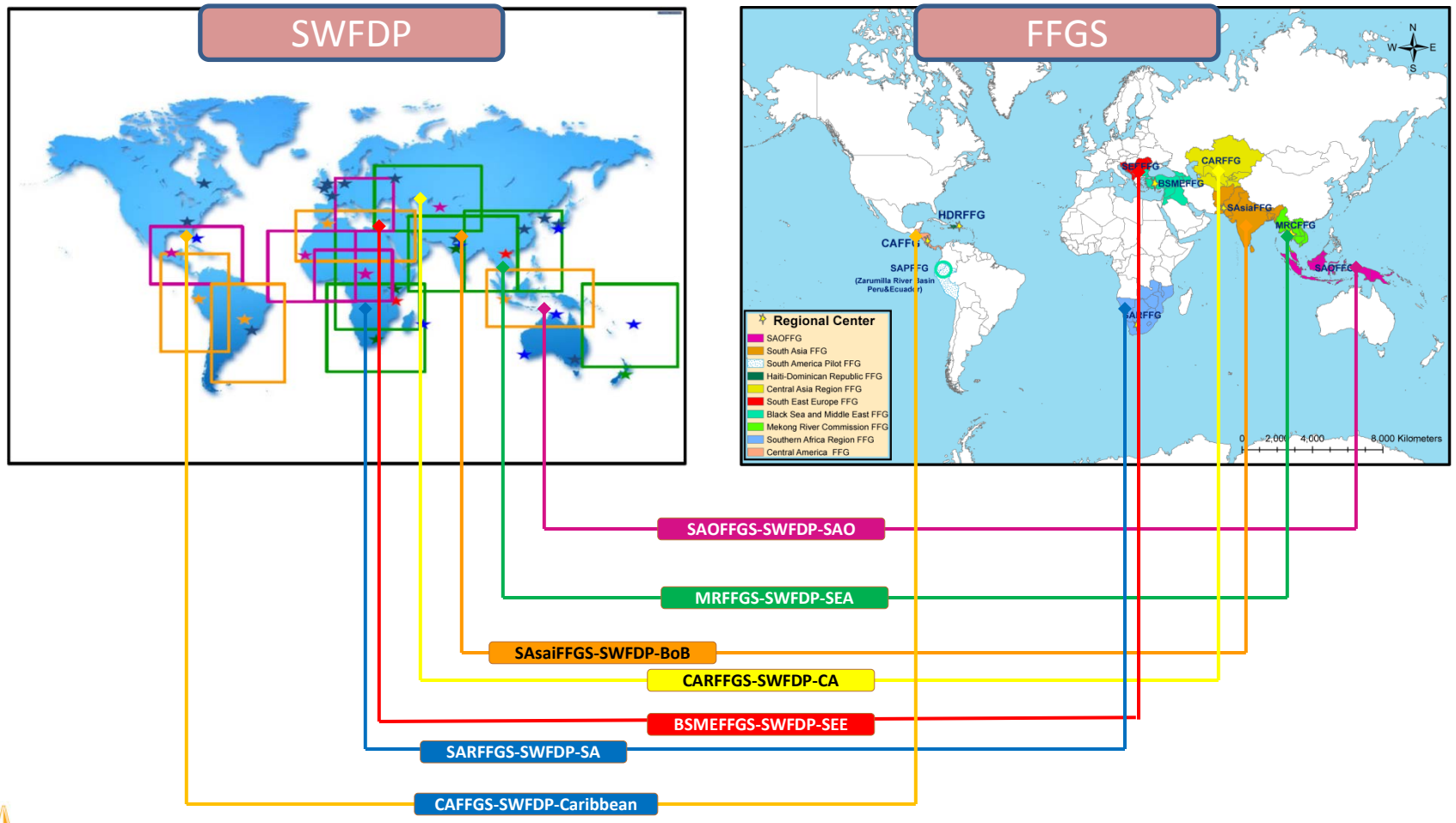


Landslide Susceptibility Mapping



Expandable and Scalable Riverine Routing

Linkage between SWFDP and FFGS



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Thank you for your attention

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