

Experience of the Romanian National Hydrological Forecast Center in using CryoLand Snow services

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Romanian National Hydrological Forecasts Centre

- The National Hydrological Forecasts Centre is part of the National Institute of Hydrology and Water Management (NIHWM), and is in charge with the operational hydrological short-range, medium and long-range forecasts and flood warnings in Romania.
- At the basin-level (the main major 11 river basins in Romania) the short-range forecasts are downscaled by the River Basin Hydrological Forecasts Centres of the eleven branches of the Romanian Water National Administration.
- The methods and procedures used for the hydrological forecasts elaboration are specific to each hydrological forecast category and vary from empirical relations to complex models.
- NHFC elaborate daily the hydrological forecast for the next 7 days on the Danube River for the discharge at the entrance in Romania (Bazias section) as well as for the levels and discharges at the main hydrometrical stations on the Romanian sector of the Danube.
- Also NHFC elaborate monthly long term hydrological forecasts for mean and extreme discharges on the Danube River at the entrance in Romania (Bazias section), and for the main hydrometrical stations and reservoirs from interior rivers, for the next 3 months.

Romanian National Hydrological Forecasts Centre

The hydrological forecasting and warning activity is based on:

- Hydrometeorological data and information (precipitation, levels, discharges, ice formations, snow cover) obtained from the national hydrological network under the administration of the Romanian Waters National Administration;
- Meteorological data (precipitation, air temperature, snow cover) obtained from the meteorological network under the administration of the National Administration of Meteorology;
- Meteorological forecasts (precipitation, air temperature) supplied by the National Meteorological Forecasts Centre from the National Administration of Meteorology;
- Hydrometeorological information data on levels, discharges, ice, snow cover, water and air temperature, precipitations as well as discharges and levels forecasts from the hydrological services in the neighbouring countries, on the basis of bilateral agreements, for the transboundary rivers.
- We are partner in EFAS European System.
- Any other real-time hydrometeorological data and products, CryoLand Snow services ...

Romanian National Hydrological Forecasts Centre

The HFMS forecasting system is composed of three main components, which were designed to simulate and forecast hydrological process at different spatial and temporal scales:

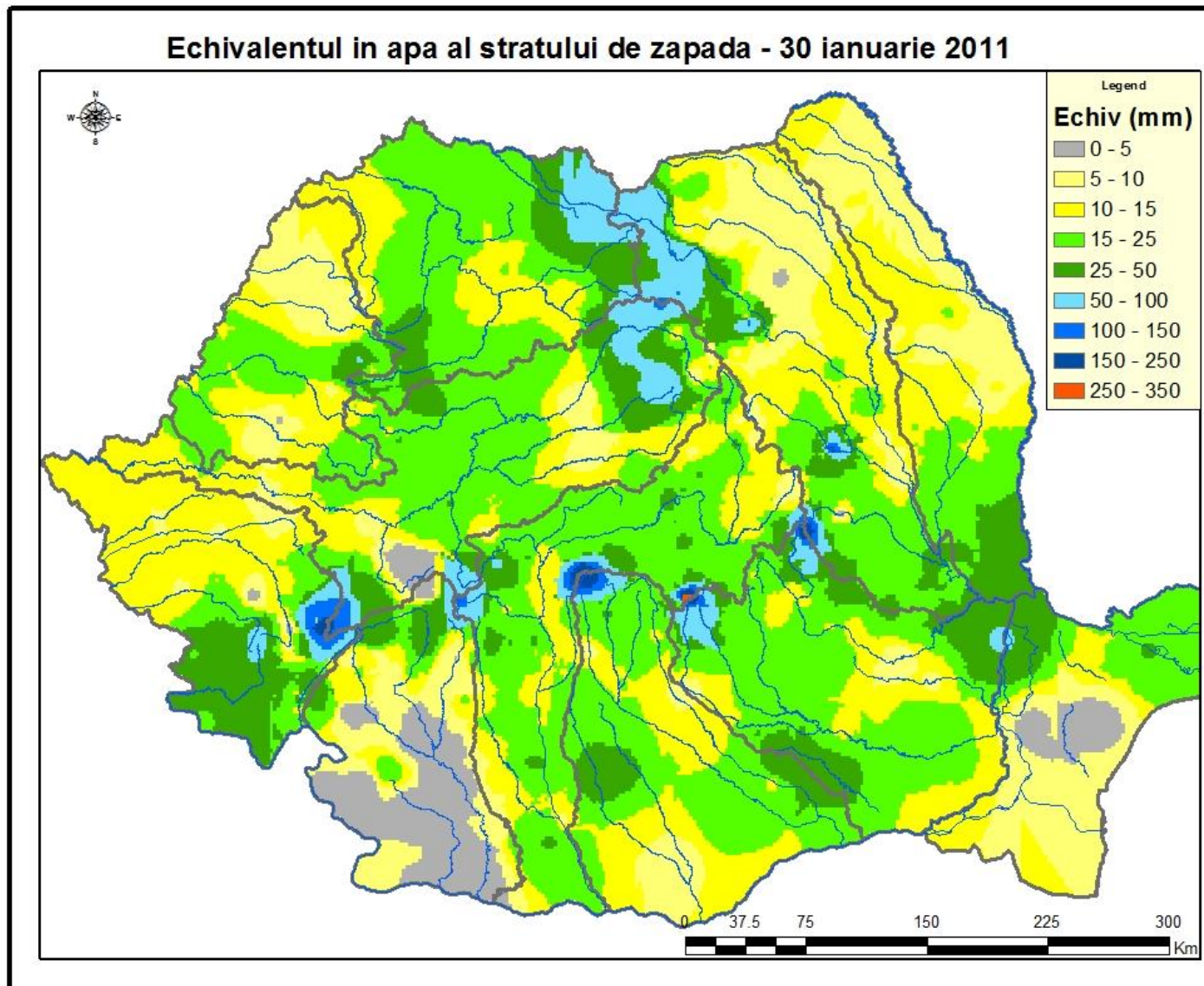
- The conceptual hydrological forecasting model – “National Weather Service River Forecasting System” (NWSRFS) - with global parameters, for basins with areas larger than approximately 200 km²;
- The distributed hydrological model - “NOAH- R”; for physically based detailed simulation of the hydrological processes, 1 km resolution for rainfall-runoff processes and 100 m resolution for routing.
- The Romanian Flash Flood Guidance System (ROFFG) – for real-time estimation of flash flood occurrence risk, for small basins mean areas of approximately 30 km².
- All the main hydrological modeling components of the National Hydrological Forecasting and Warning System contain a module for snow accumulation and melting simulations, having specific state parameters associated with the snow pack characteristics.
- The most important state parameter for the hydrological models is the snow water equivalent.

CryoLand Snow services

Daily_FSC_PanEuropean_Optical – Daily Fractional Snow Cover from Optical Satellite Data covering the Pan-European Area

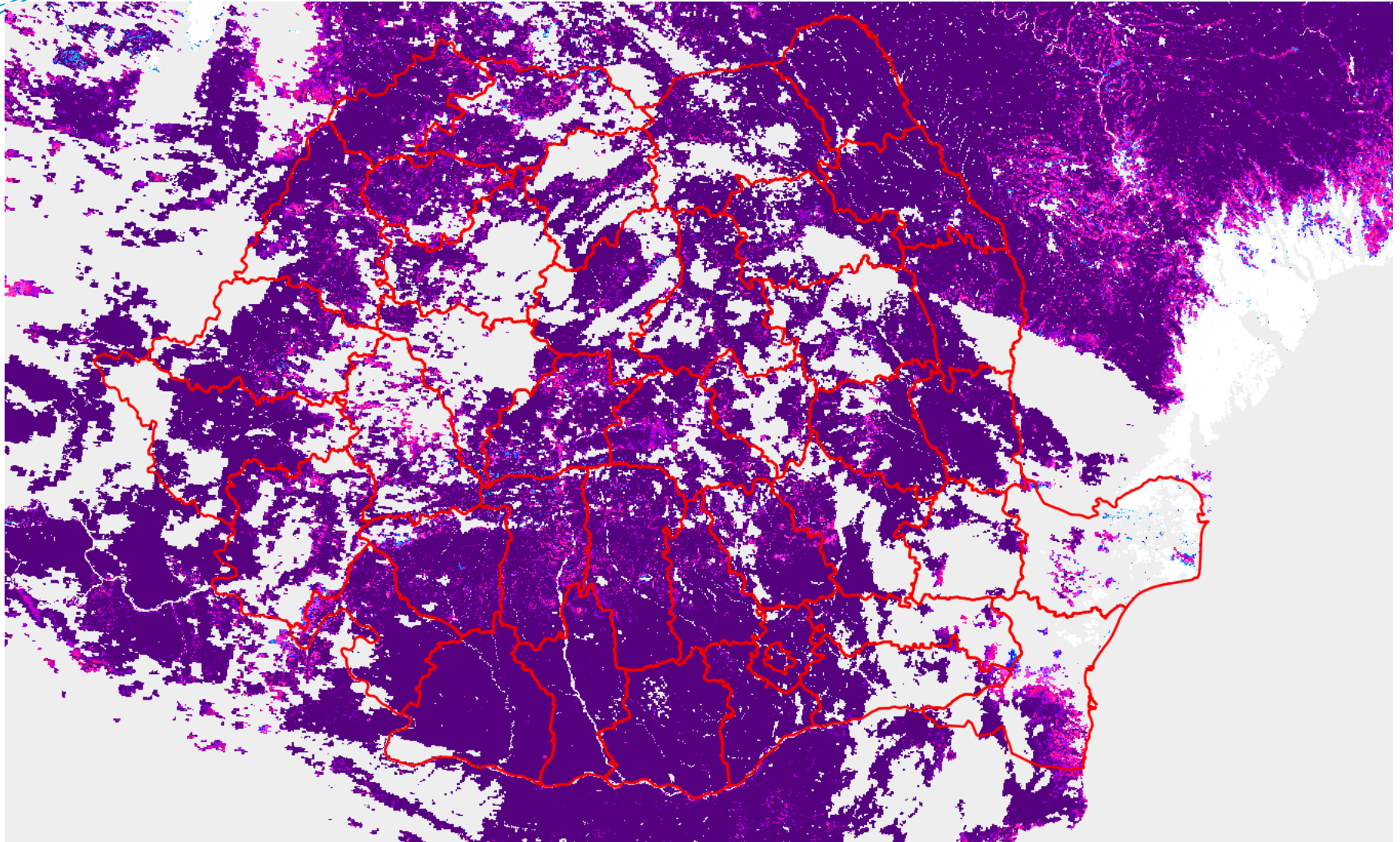
- we are using this information as input in our internal semi-automatic analysis procedure for estimating the snow water equivalent at a certain moment;*
- advantage: easy access, the product is generated daily in near-real time and is updated at the CryoLand GeoPortal.*
- the resulting snow water equivalent estimations are used to update the internal states within the operational hydrological forecasting models, and also to estimate the total snow water volume available in the upstream river basin, for the most important reservoirs;*
- provide a better information for the area not covered by snow, than the information from the monitoring network;*
- processing scripts are done using R and GrassGIS;*
- used now for Romania area;*
- we will start to use it for the entire Danube River Basin next year;*

Snow water equivalent products



Snow water equivalent products





SWE Generated with the NIHWM procedure / 10.02.2012

ECHIVALENTUL APEI DIN STRATUL DE ZAPADA
ESTIMAT PENTRU DATA DE 10.02.2012

Legenda:

Orase

- reședințe de județ
- municipii

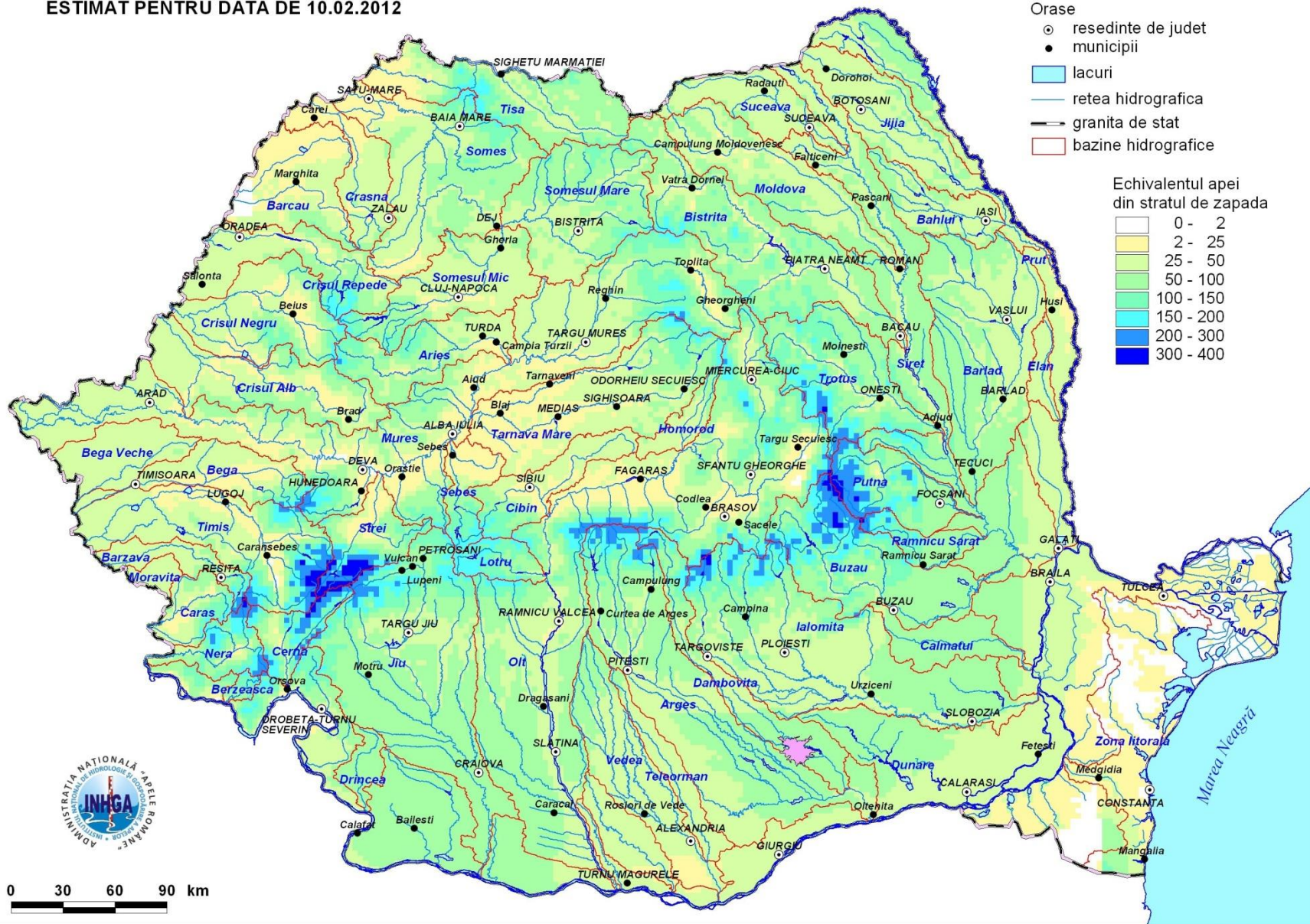
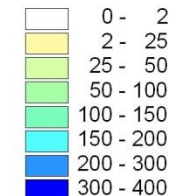
lacuri

rețea hidrografică

granița de stat

bazine hidrografice

Echivalentul apei din stratul de zapada

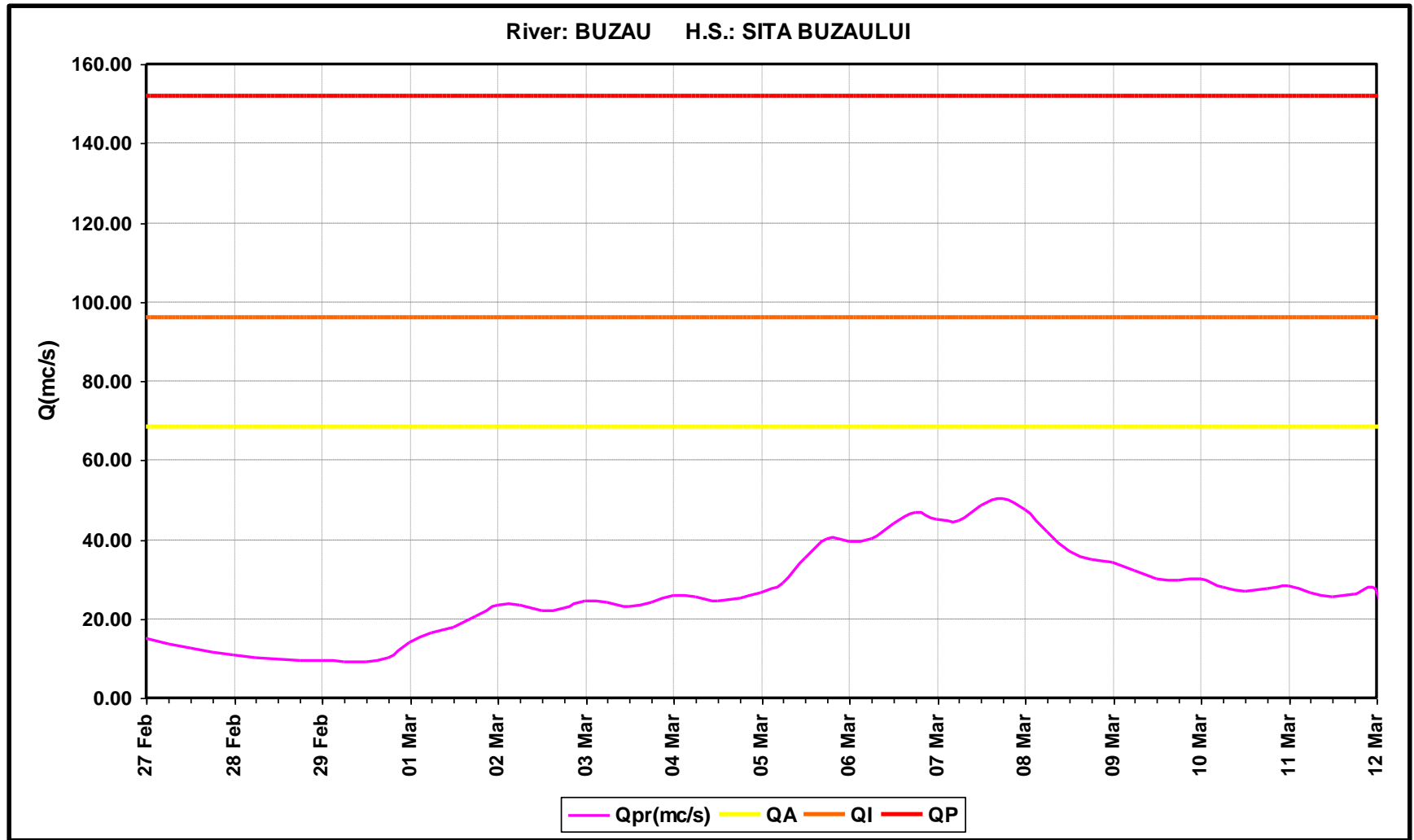


0 30 60 90 km

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- *During periods with significant snow pack we are doing in operational scenarios type of simulations, for the next 15 days.*
- *Usually the following scenarios are used:*
 - *air temperature evolution from NMP models; no precipitation;*
 - *air temperature and precipitation evolution from NMP models;*
 - *air temperature evolution from NMP models; and a selected scenario of liquid precipitations;*

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CryoLand Snow services

Daily_SWE_PanEuropean_Microwave – Daily Snow Water Equivalent from Microwave Radiometer covering the Pan-European Area

- *We started to research how to use Snow Water Equivalent (SWE) product for Romania area, but our main interest will be to use it for the entire Danube River Basin.*
- The intention is to use it as supplemental input data to our procedure for estimating the snow water equivalent.
- Current limitations:
 - Only nonmountainous areas are currently covered by the product.
 - Coarse resolution, the Pan-European SWE maps have a pixel size of $0.10^{\circ} \times 0.10^{\circ}$, which is approximately 10 km x 10 km.
 - 2 days delay after satellite image acquisition; this could be an issue during the intense snowmelt periods.

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Other products we will look for the future:

River ice products:

- Could be very useful also for some rivers in Romania, especially for extreme situations*
- Perhaps the first potential extension could be to propose to generate such product for Danube River, the most international transboundary River Basin.*

Standardized Snow Pack Indicator:

- avg_10day_SSPI & avg_30day_SSPI Standardized Snow Pack Indicator for Pan-Europe derived from Snow Water Equivalent of Microwave satellite data*
- information on the relative volume of the snow pack on a 10 daily and 30 daily (monthly) basis compared to the reference period 1979 – 2010.*

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https://www.efas.eu

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European Commission JOINT RESEARCH CENTRE EFAS European Flood Awareness System

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European Flood Awareness System (EFAS)

The European Flood Awareness System (EFAS) is the first operational European system monitoring and forecasting floods across Europe. It provides complementary, flood early warning information up to 10 days in advance to its partners: the National/Regional Hydrological Services and the [European Response and Coordination Centre \(ERCC\)](#).



EFAS consortia

The Operational EFAS consists of four centres executed by different consortia

- EFAS Computational centre - [European Centre for Medium-Range Weather Forecasts \(UK\)](#) executes forecasts and hosts the EFAS-Information System platform
- EFAS Dissemination centre - [Swedish Meteorological and Hydrological Institute](#), [Rijkswaterstaat \(NL\)](#) and [Slovak Hydro-Meteorological Institute](#) analyse EFAS on a daily basis and disseminate information to the partners and the ERCC
- EFAS Hydrological data collection centre - [REDIAM \(ES\)](#) and [ELIMCO \(ES\)](#) collect historic and realtime discharge and water level data across Europe
- EFAS Meteorological data collection centre - Collects historic and realtime meteorological data across Europe. Currently still managed by the Joint Research Centre (JRC).

EFAS is an operational service under the umbrella of the [Copernicus emergency management service](#) and is fully operational since October 2012.

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*Thank you very much for your
attention!*

Specific needs for Snow and River Ice Satellite derived products - CryoLand User Requirement Workshop - Alpine Areas was held in Vienna, Austria, on 24 May 2011

Product	Spatial resolution	Temporal resolution	Format	Projection
Snow Cover Extent	500-1000m	1-5d	NetCdf, HDF, ASCII, GeoTiff	Stereo70, GCS_WGS84
Fractional Snow Cover	500-1000m	1-5d	NetCdf, HDF, ASCII, GeoTiff	Stereo70, GCS_WGS84
Snow Water Equivalent	1000m	1-5d	NetCdf, HDF, ASCII, GeoTiff	Stereo70, GCS_WGS84
Snow Depth	1000m	1-5d	NetCdf, HDF, ASCII, GeoTiff	Stereo70, GCS_WGS84
Snow Surface Temperature	1000m	1-5d	NetCdf, HDF, ASCII, GeoTiff	Stereo70, GCS_WGS84
Snow Surface Wetness	1-5km	1-8d	NetCdf, HDF, ASCII, GeoTiff	Stereo70, GCS_WGS84
Lake/River Ice	5-10m	24h	NetCdf, HDF, ASCII, GeoTiff	Stereo70, GCS_WGS84