PROPOSAL FOR HIGH-PRIORITY VARIABLES AND CORRESPONDING OBSERVATIONAL REQUIREMENTS FOR FLOODS

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RA VI Webinar on Regional Basic Observing Network (RBON)
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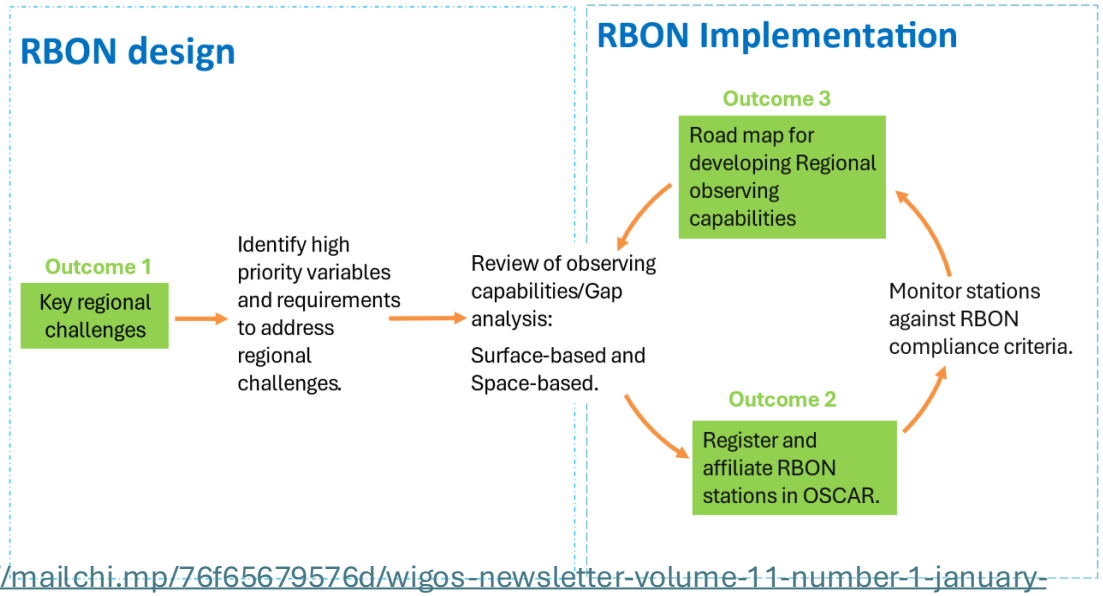
Regional Basic Observation Network

Towards full RBON implementation in support of Early Warnings for All

- **RBON RA VI Focus group** working – **Floods** most important of the identified priority hazards – RBON requirements in design, based on RRR
- Bojan Palmar has been a representative of **hydrology domain** – more support is welcome, since region has many sub-regional aspects on floods

- network of surface-based meteorological, hydrological and related observing stations/platforms to address the **key regional weather, water, climate and other environmental challenges**.
- leads to **improved services** by delivering more and enhanced observations to stakeholders.
- enables the **full benefit of regional and national observing capabilities** to be realized.
- is defined and adopted by the relevant **WMO Regional Association**



More info, recent WIGOS newsletter: https://mailchi.mp/76f65679576d/wigos-newsletter-volume-11-number-1-january-2025?e=e1fe6e3b5f#P0011

OVERVIEW OF THE PROCESS

- The focus group drafted an initial version of the variable listings.
- The list of hydrological variables for hydrological forecasting (4.1) under the Global RRR is still under development.
- A draft prepared by the SC-HYD team on RRR (Emmanuel Brocard and Cristina Prieto) served as the starting point.
- A preliminary round of consultations was conducted with colleagues from ECMWF, JRC, and SMHI, in addition to input from the focus group and the Secretariat.
- Broader consultations with RA VI will take place following this webinar.

To be noted

- The RBON for Hydrology/Floods has been drafted for the first time any of the regions for RA VI.
- The proposed requirements may be too ambitious; feedback will be collected to better understand what Members are realistically able to provide.
- The challenges related to sharing hydrological variables (policies) are acknowledged. It may be possible to limit the sharing of certain variables (e.g., water level and discharge) to transboundary basins only.

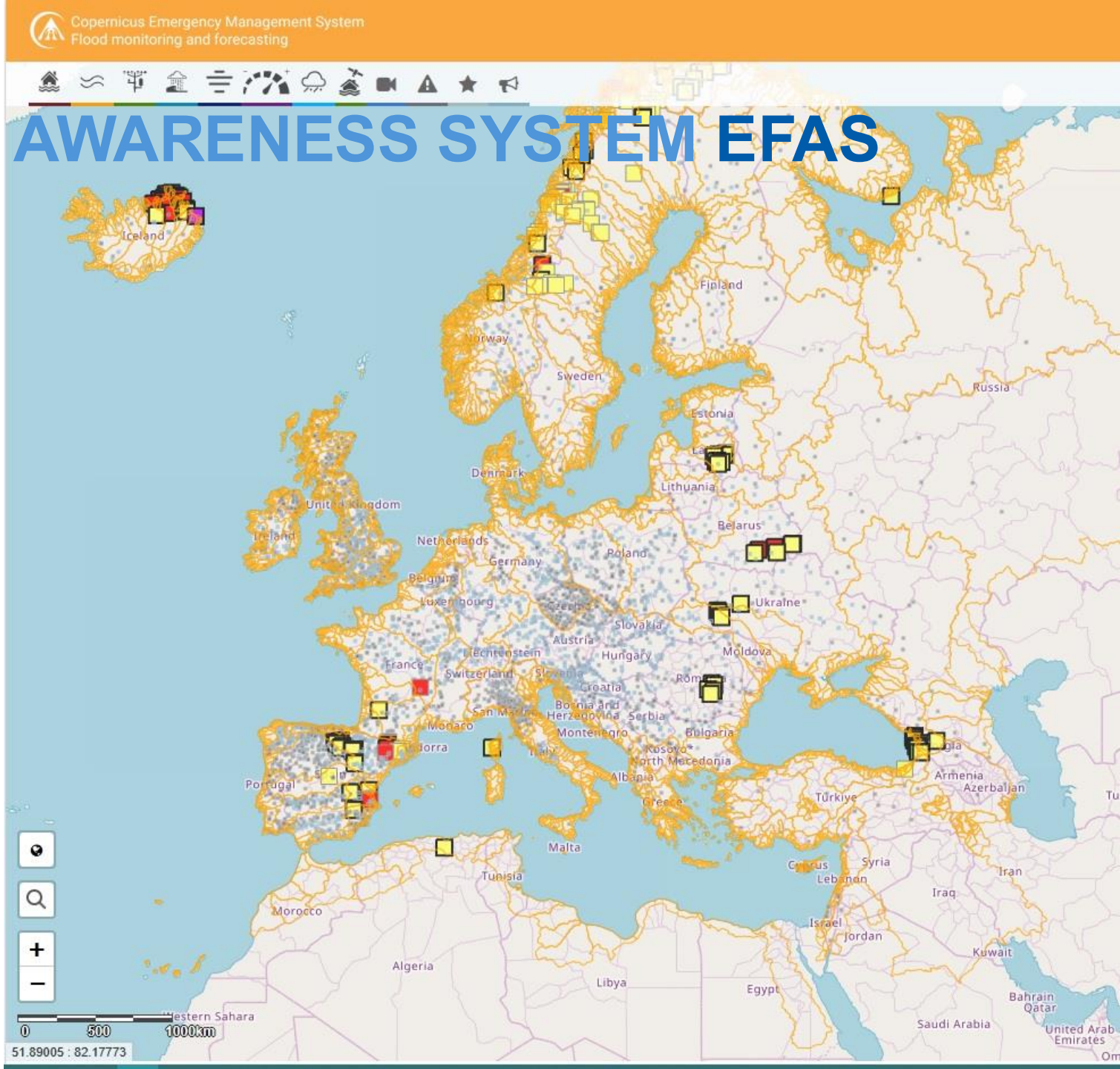
OSCAR

- Earth System Application Category: 4. Hydrological and Terrestrial Applications
- Application Area: 4.1 Hydrological Forecasting and Real-time Monitoring

Id	Variable	Layer	App Area	ATP	Uncertainty	Layer/s Quality	Coverage Quality	Stability / decade	Hor Res	Ver Res	Obs Cyc	Timeliness	Coverage	Conf Level	Val Date	Source
1124	Accumulated precipitation	Near Surface	4.1 Hydrological Forecasting and Real-time Monitoring		0.5 mm				10 km		60 sec	1 sec	Global	reasonable	01.05.2024	Emmanuel Brocard
					2 mm				30 km		3 sec	5 sec				
					5 mm				100 km		12 sec	30 sec				
1074	Water level	Near Surface	4.1 Hydrological Forecasting and Real-time Monitoring													
1035	Discharge	Land surface	4.1 Hydrological Forecasting and Real-time Monitoring													

EUROPEAN FLOOD AWARENESS SYSTEM EFAS

- Jointly developed by the European Commission and the European Centre for Medium-Range Weather Forecasts (ECMWF).
- EFAS couples state-of-the art weather forecasts with a hydrological model at continental scale.



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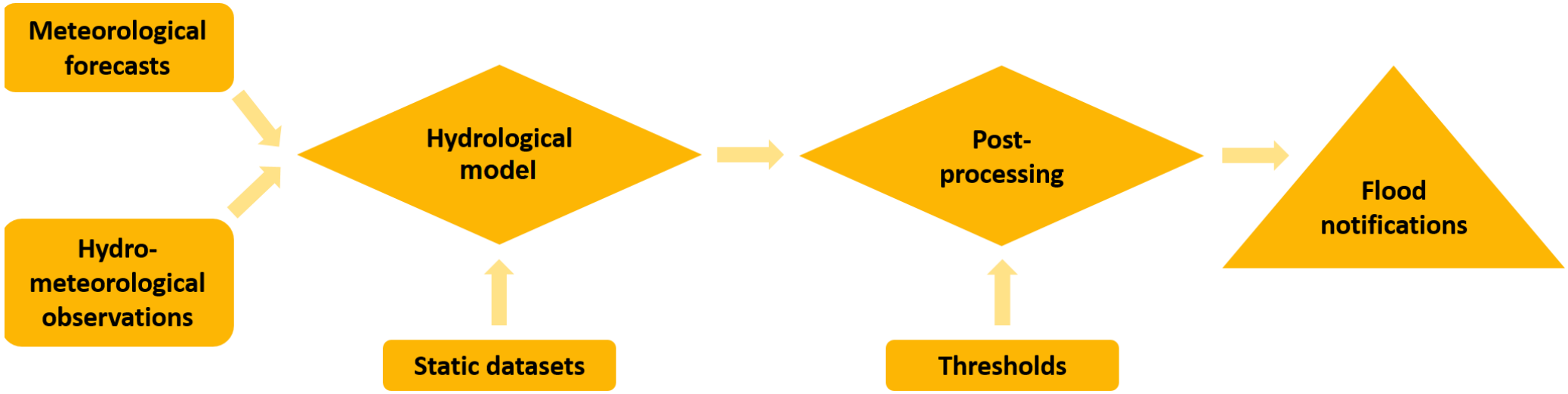
EFAS HYDROLOGICAL FORECASTING CHAIN

- Meteorological forcing
- Real-time hydro-meteorological observations necessary to define initial conditions
- Static maps (Land surface data)
- Hydrological model



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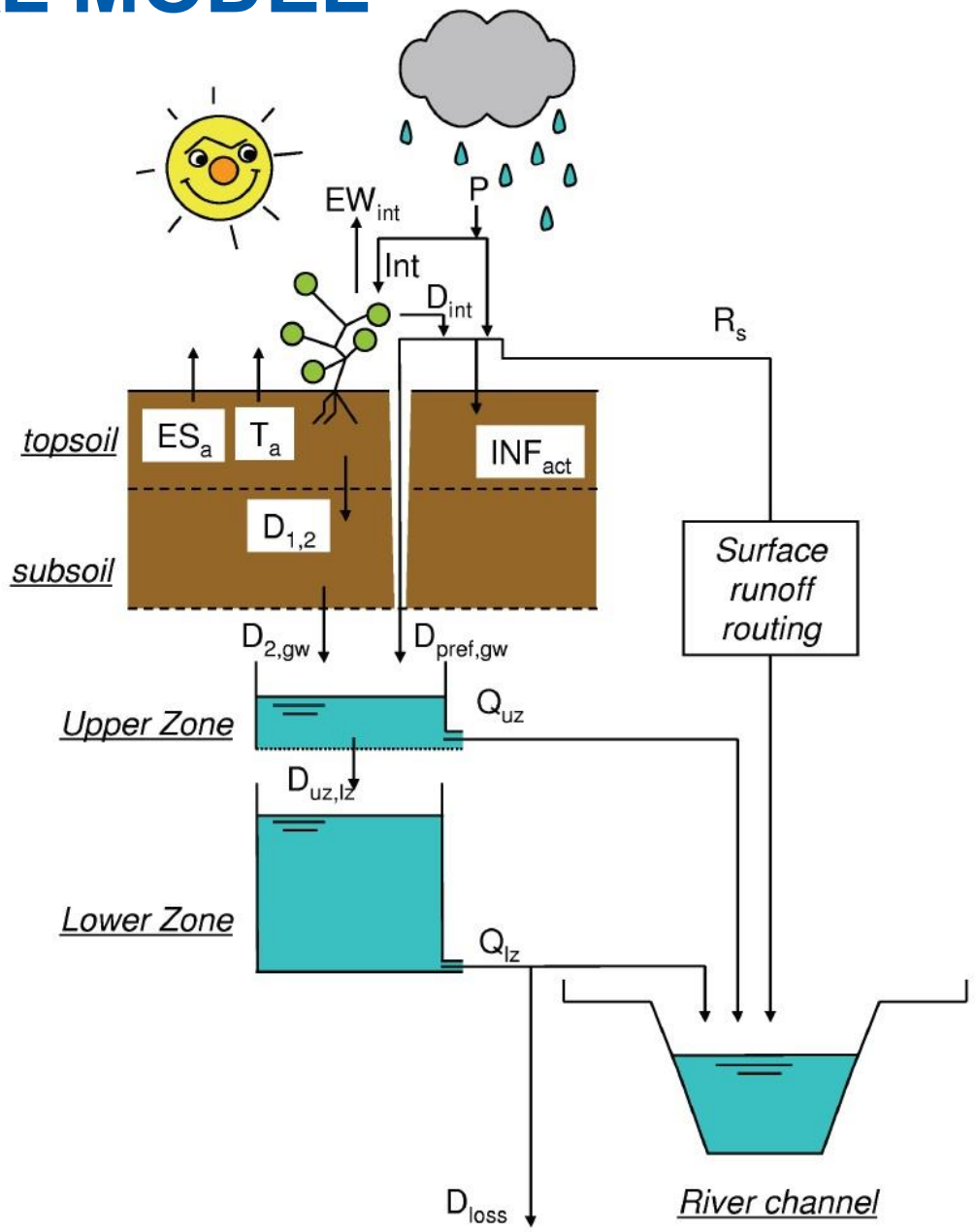
LISFLOOD HYDROLOGICAL MODEL

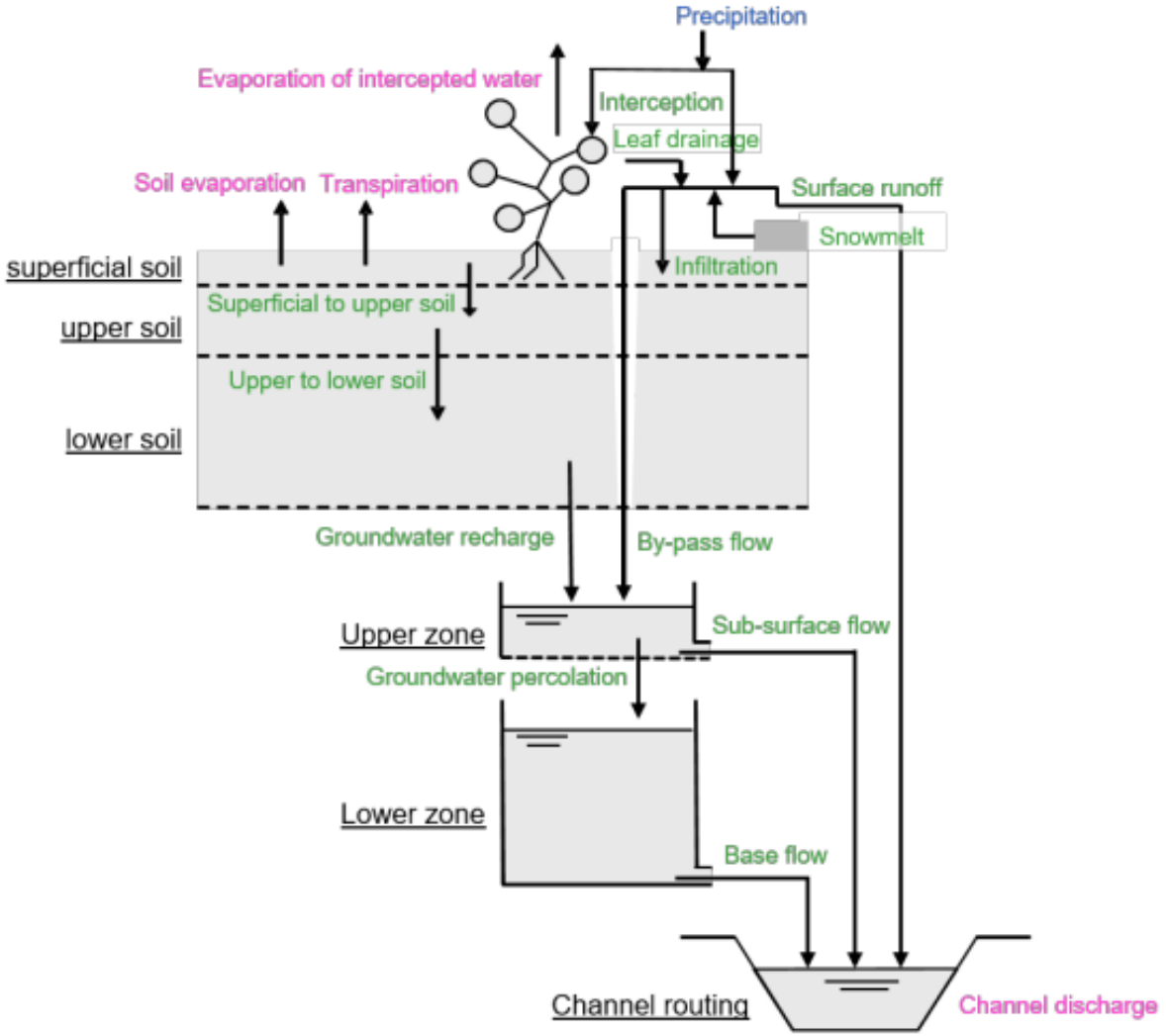
- Spatially distributed rainfall-runoff-routing model
- Driven by meteorological forcing data
- The runoff produced at every grid cell is routed through the river network using a kinematic wave approach
- LISFLOOD and its associated tools are all open-source



LISFLOOD HYDROLOGICAL MODEL

Sub-models

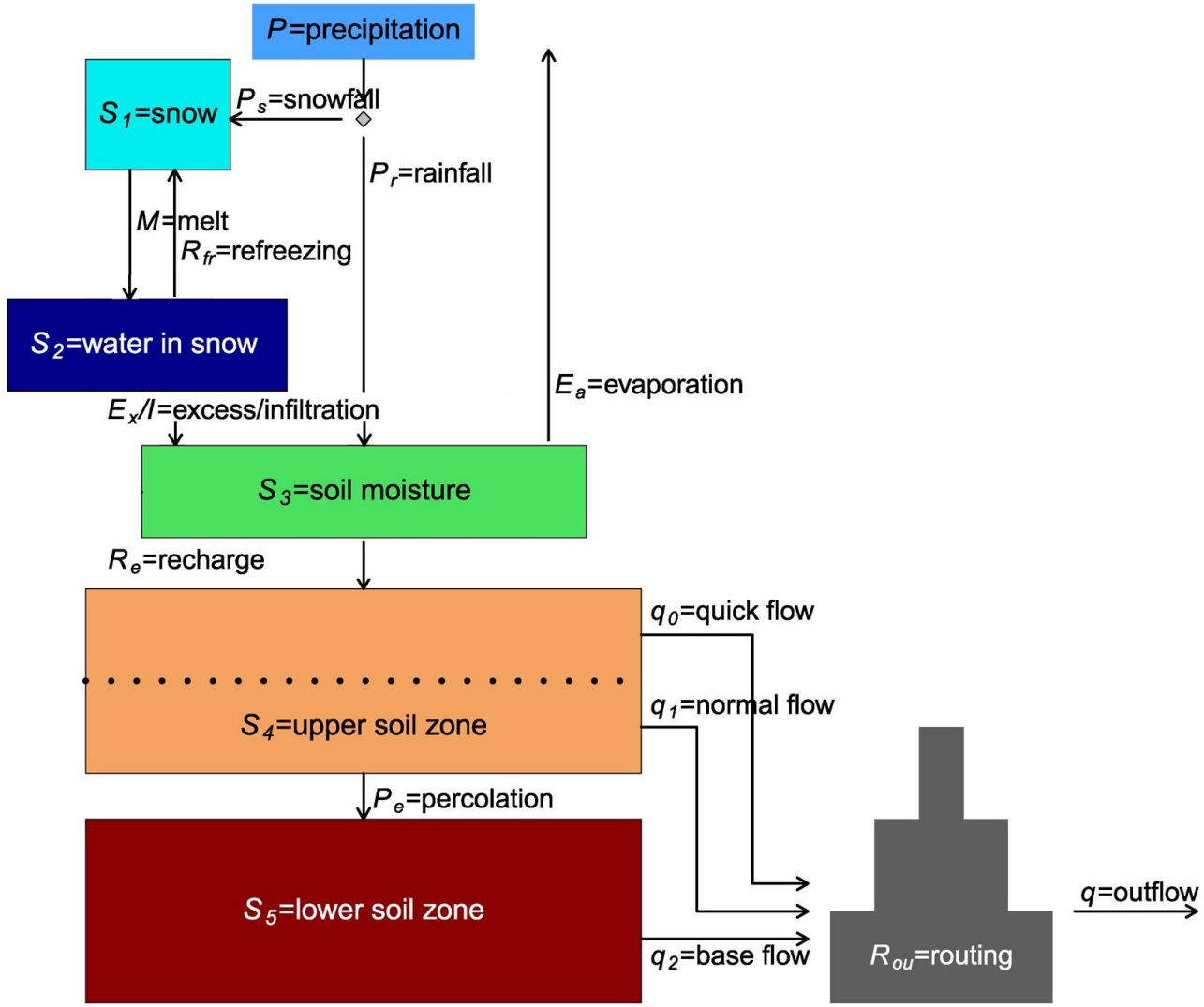
- Soil water balance
- Groundwater and subsurface flow
- Routing of surface runoff to the nearest river channel
- Routing of channel flow



SOIL WATER BALANCE

Snow routine

- Air temperature (near surface)
- Snow depth
- Snow water equivalent
- Snow cover

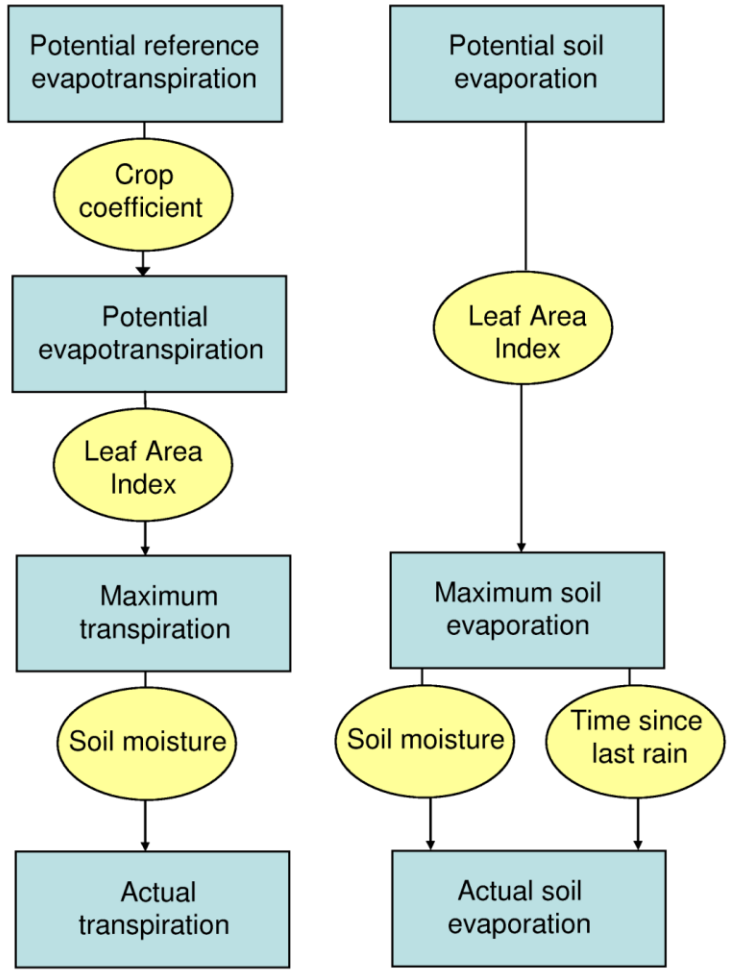


SIMULATION OF EVAPO(TRANSPI)RATION

Potential reference evapotranspiration and evaporation LISVAP

Penman-Monteith equation or the Hargreaves equation)

- Temperature
  - Maximum, Minimum, Average daily temperature
- Vapour pressure
  - Average daily dew point temperature
  - Actual vapor pressure
  - Instantaneous sea level pressure
- Wind speed
  - Wind speed at 10 m height
- Incoming solar radiation
  - Sunshine duration
  - Cloud cover
- Radiation
  - Incoming solar radiation
  - Net long wave radiation



Proposed variable requirements

ATMOSPHERE/ NEAR SURFACE

Category	Key variable	Horizontal resolution [km]	Observing cycle [h]	Latency [h]	Available technologies
Atmosphere/ Near surface	Accumulated Precipitation	25-30[2]	1	1	Surface stations (automatic rain gauges), Weather Radars
	Air temperature (near surface)	50-60[2]	1	1	Surface stations (AWS)
	Dew Point Temperature	50-60[2]	1	1	Surface stations (AWS)
	Air specific humidity (near surface)	50-60[2]	1	1	Surface stations (AWS)
	Wind speed (near surface)	150[2]	1	1	Surface stations (AWS)
	Downward short-wave irradiance at Earth surface	150[2]	1	24	Surface stations (pyranometer)
	Upward long-wave irradiance at Earth surface	150[2]	1	24	Surface stations (pyrgeometer)

TERRESTRIAL/ LAND SURFACE

Category	Key variable	Horizontal resolution [km]	Observing cycle [h]	Latency [h]	Available technologies
Terrestrial/ Land surface	Snow depth	45-55[3]	1	1	Surface stations (Automatic rain gauges, snow depth gauges);
	Snow water equivalent	45-55[3]	24	24	Surface stations (snow scales, snow pillow, snow surveys, Gamma ray stations)
	Evapotranspiration	150-200[2]	1	1	Surface stations (evaporation pan, lysimeter, eddy covariance)
	Soil moisture at surface	150-200[2]	1	1	Surface stations (soil probes, cosmic-ray soil moisture method) Possibly groundwater stations
	Water level	N/A[4]	1	1	Automatic hydrological stations
	Discharge	N/A[4]	1	1	Automatic hydrological stations Derived from rating curves
	Lake/ Reservoir level	N/A[5]	1	1	Automatic hydrological stations

ATMOSPHERE/ UPPER-AIR

Category	Key variable	Horizontal resolution [km]	Observing cycle [h]	Latency [h]	Available technologies
Atmosphere/ Upper-air	Atmospheric temperature	10[1]	3	2	Radiosonde, Aircraft-Based Observations (ABO), Uncrewed aerial systems (UAS), Mircowave Radiometers, Differential Absorption Lidar, Raman Lidar
	Specific humidity	20[1]	6	2	Radiosonde, Aircraft-Based Observations (ABO), Uncrewed aerial systems (UAS), Microwave Radiometers (MWR), Ground-based GNSS, Differential Absorption Lidar, Raman Lidar
	Wind (horizontal and vertical)	10[1]	12	2	Radiosonde, Aircraft-Based Observations (ABO), Uncrewed aerial systems (UAS), Weather Radars, Sodar Wind Profilers, Radar Wind Profilers, Doppler Wind Lidars
	Cloud cover	10[1]	3	2	Surface stations (ceilometer)
Atmosphere/ Near surface	Cloud to Ground lightning density	15[1]	15 min	15 min	Ground-based real-time lightning detection

SUPPLEMENTARY DATA AND VARIABLES

Category	Variable	Horizontal resolution [km]	Observing cycle [h]	Latency [h]	Available sources (example)
Terrestrial/ Land surface	Land surface topography	0.25	-	-	MERIT DEM: Multi-Error-Removed Improved-Terrain DEM
	Channel geometry	N/A	-	-	CaMa-Flood: Global River Hydrodynamics Model
	Land cover	0.1	-	-	Copernicus Global Land Cover Layers: CGLS-LC100
	Vegetation type	2	-	-	CORINE Land Cover 2018 CLC2018
	Leaf Area Index (LAI)	1	10 d	5 d	Copernicus Global Land Service LAI, 10-daily, Version1
	Fraction of vegetated land	0.1	-	-	Copernicus Global Land Cover Layers: CGLS-LC100
	Lake area	0.3	-	-	Copernicus Water Bodies 2020-present (raster 300 m), global, monthly - version 2
	Wetland extent	1	-	-	Global Lakes and Wetlands Database (GLWD) 2004

SUPPLEMENTARY DATA AND VARIABLES

Category	Variable	Horizontal resolution [km]	Observing cycle [h]	Latency [h]	Available sources (example)
Terrestrial/ Land surface	Soil type	0.25	-	-	ISRIC, mean value, (https://soilgrids.org/)
	Soil depth	0.25	-	-	SoilGrids250m 2017-03 - Absolute depth to bedrock
	Snow cover	0.02	1 d	1 d	Copernicus Fractional Snow Cover (raster 20m) 2016-present, Europe, daily
	Water abstraction/use[6]	N/A	-	-	Water demand, water abstraction and water consumption.

THANK YOU FOR YOUR ATTENTION