

CLMS NCP: Bio-geophysical parameters

Surface water drainage model at national/transboundary scale:
integration of Copernicus DEM, national hydrographic network from
WFD and EU-Hydro dataset

February 27th 2026

Robertino Tropeano, *ISPRA*
robertino.tropeano@isprambiente.it

Study Objectives

- ❖ Develop a national and transboundary GIS-based drainage model to support the Water Framework Directive (2000/60/EC):
 - Ensure spatial consistency with officially designated WFD surface water bodies at the national level.
 - Adopt a harmonized Digital Elevation Model (DEM) to guarantee cross-border hydrological continuity.
- ❖ Produce a dynamic, interoperable surface hydrography dataset aligned with WFD spatial units.

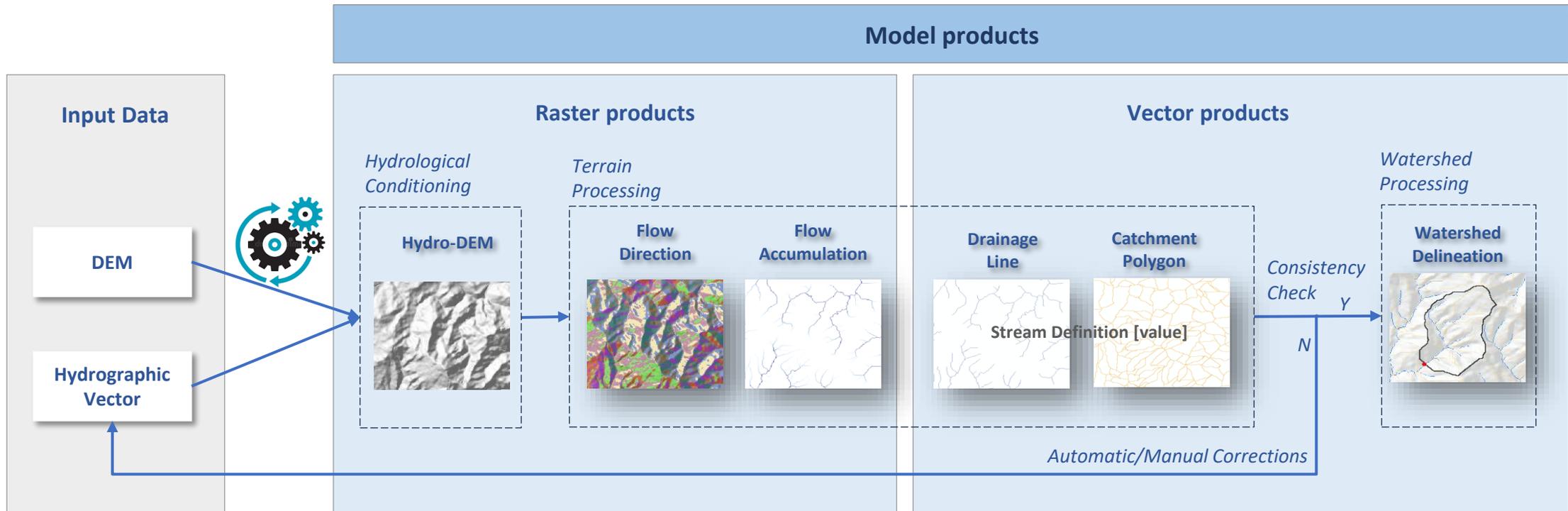
Key Transboundary River Basins:

- Ticino
- Isonzo/Soča

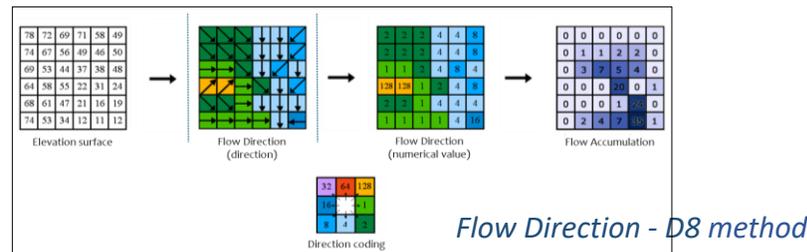


Study Area: ~370,000 km²

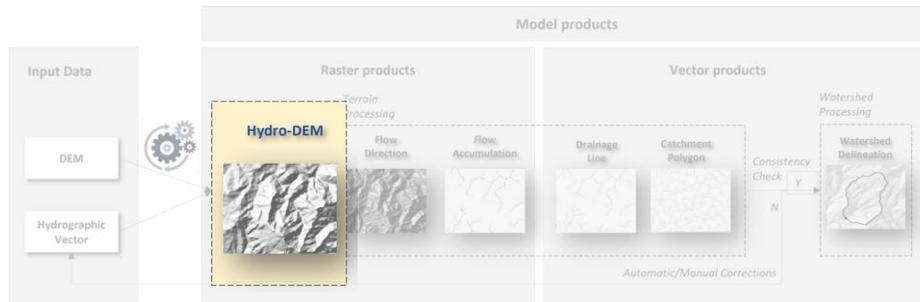
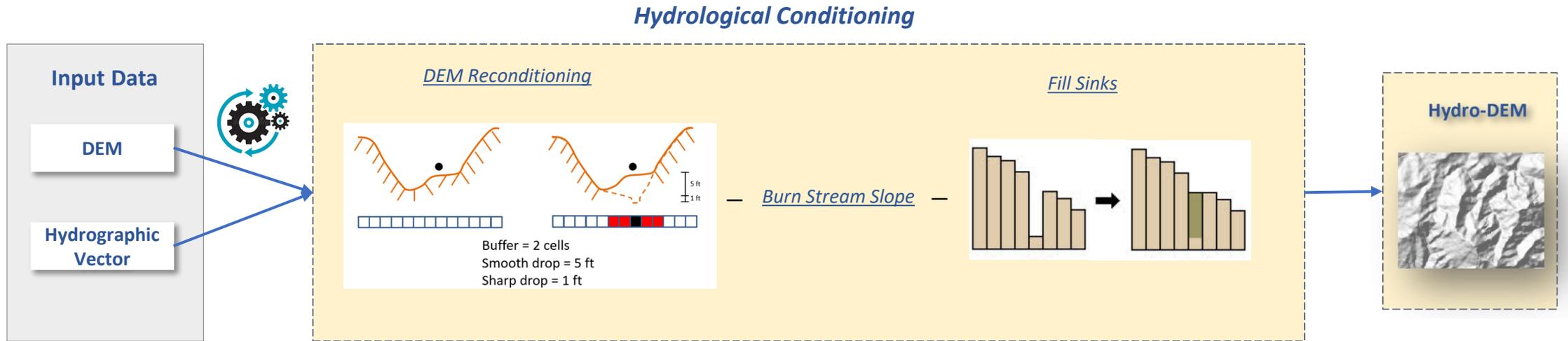
Model Structure and Workflow



(Developed by ISPRA)

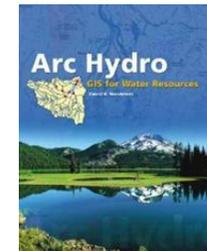


Hydrological Conditioning of the DEM: *Applied Methods*



ArcHydro Tools Functions (for ArcGIS)

- **DEM Reconditioning (AGREE method)**
- **Burn Stream Slope**
- **Fill Sinks**



Raster Elevation Datasets Evaluated for the Model

- **EU-DEM v1.1 (25 m)**

derived from SRTM (Shuttle) and ASTER (Terra) GDEMs



EU-DEM is not maintained anymore by the CLMS

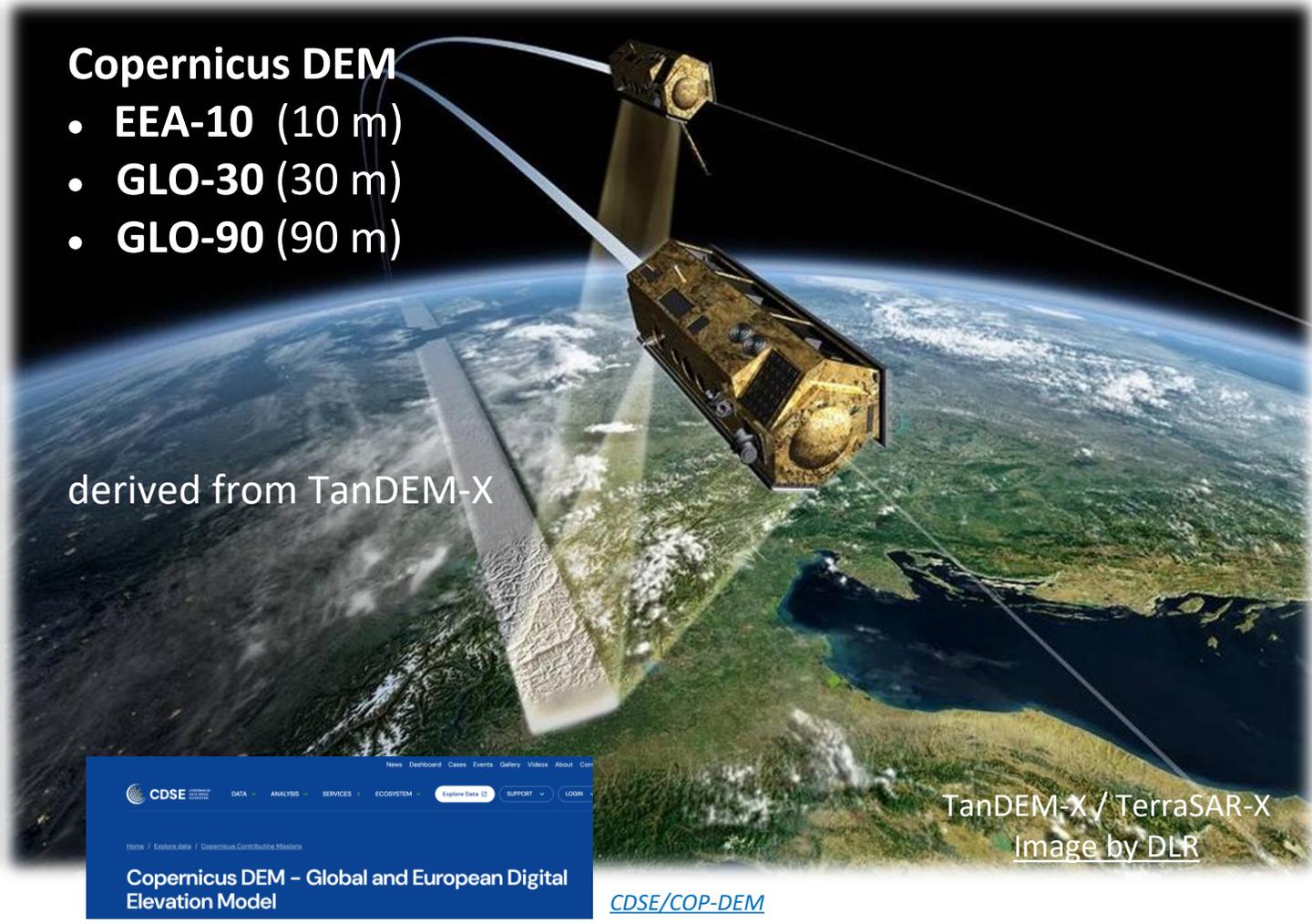


Terra
Image by NASA

[EEA/Datahub](#)

- **Copernicus DEM**
- EEA-10 (10 m)
- GLO-30 (30 m)
- GLO-90 (90 m)

derived from TanDEM-X



TanDEM-X / TerraSAR-X
Image by DLR



[CDSE/COP-DEM](#)

Hydrographic Vector Datasets Evaluated for the Model

Primary Dataset

WISE-WFD Surface Water Body Centreline (EEA)

WISE WFD surface water body centrelines reported under Water Framework Directive 2000 - PUBLIC VERSION - version 1.9, Sep. 2025

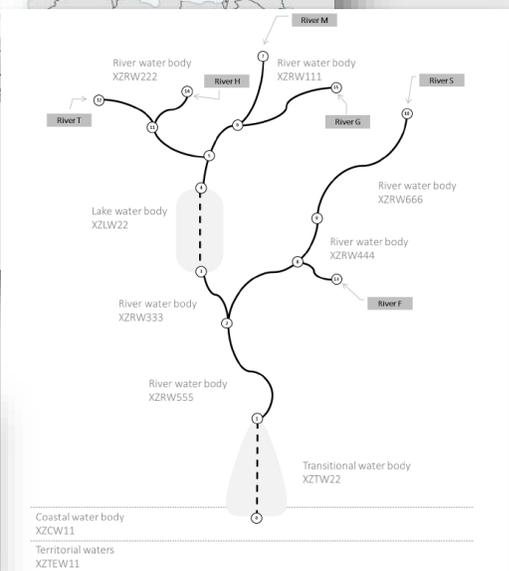


Countries:

- EU27 (2020)
- Norway
- Iceland

N/A: Switzerland

Surface water body centrelines



River water body XZRW222, River H, River water body XZRW111, River S, River G, River water body XZRW666, Lake water body XZLW22, River water body XZRW444, River F, River water body XZRW333, River water body XZRW555, Transitional water body XZTW22, Coastal water body XZCW11, Territorial waters XZTEW11

Metadata

WISE GIS Guidance
Guidance on the mapping of water bodies, water bodies information system for Europe
2025

WISE
WATER INFORMATION SYSTEM FOR EUROPE

Representation of the hydrographic network – SWBC
([WISE GIS Guidance](#))

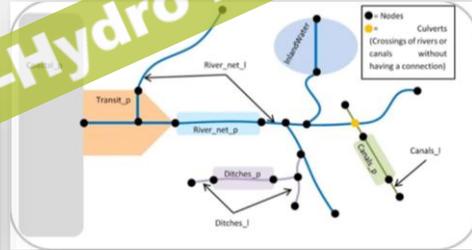
Priority Dataset to Fill Gaps in the Primary Dataset (pan-European Dataset)

EU-Hydro v1.3 (EEA/CLMS)

EU-Hydro River Network Database 2006-2012 (vector), Europe



The new EU-Hydro 2.0



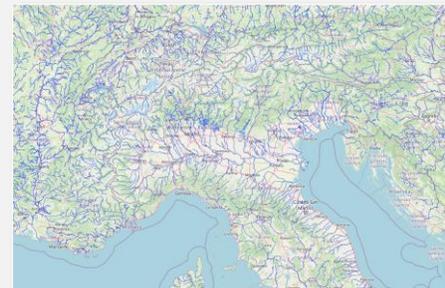
Nodes
• Nodes
• Culverts (Crossings of rivers or canals without having a connection)

Transit_p, River_net_p, River_net_j, Ditches_p, Ditches_j, Canal_p, Canal_j

[EU-Hydro River Network Database - CLMS/EEA](#) Topological relationship ([River Net User Guide 1.3](#))

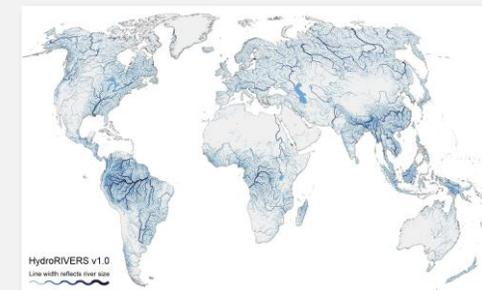
Ancillary Datasets (Global Dataset)

Waterways – OpenStreetMap (OSM)



Transboundary Study Area Dataset Coverage
(Processed by ISPRA using Overpass-Turbo / OSM)

HydroRIVERS v1.0 (HidroSHEDS)



[HydroSHEDS website](#)

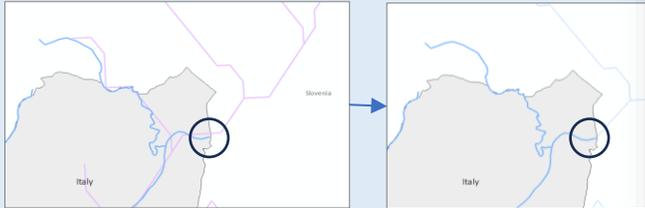
Prototype Model at National and Transboundary Scale

Input Data

Hydrographic Network

- WISE-WFD 2016 Surface Water Body Centreline**
(2nd River Basin Management Plan)
National study area input

- HydroRIVERS v1.0**
Transboundary study area input



Manual correction for dataset integration
(network connections)

[WISE-WFD 2016 SWBC v1.9 – Dataset download \(EEA\)](#)

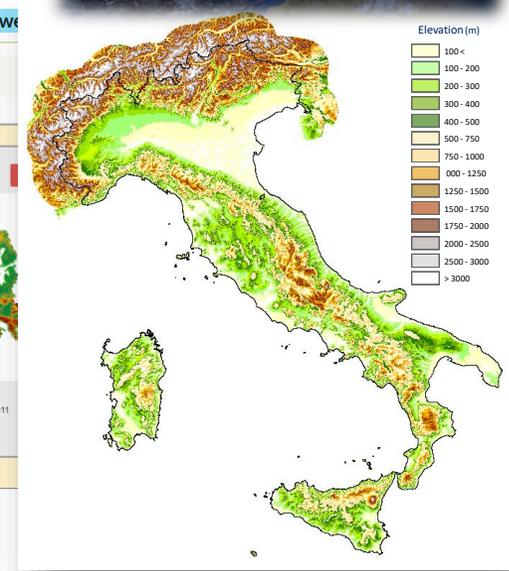
[HydroRIVERS v1.0 – Dataset download \(HydroSHEDS\)](#)



Integration of WISE-WFD_2016_SWBC and HydroRIVERS_v1.0
– study area (Processing by ISPRA)

DEM

EU-DEM v1.1



EU-DEM_v1.1 tile mosaic clipped to the study area
(Processing by ISPRA)

Prototype Model at National and Transboundary Scale

Preliminary Results - Drainage Line and Catchment Polygon



Figure 1 - Model output (Stream Definition: 10 km²)

Figure 2: Model vs. Reference Hydrographic Network
Example: Adige River (at Boara Pisani)

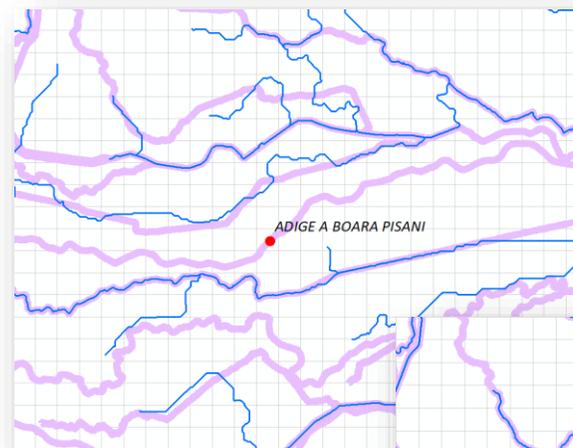


Figure 2.1 - Uncorrected DEM

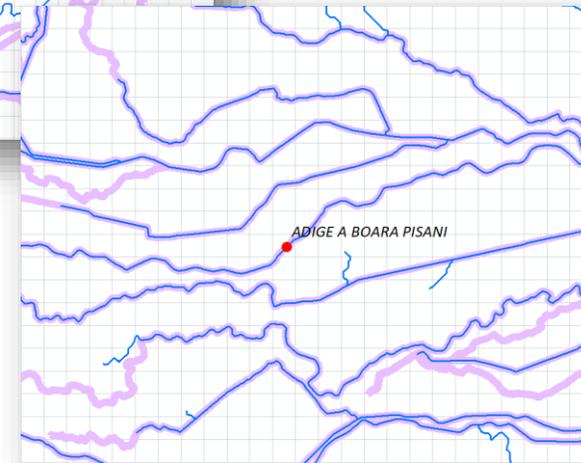


Figure 2.2 - Corrected DEM

(Developed by ISPRA)

Prototype Model at National and Transboundary Scale

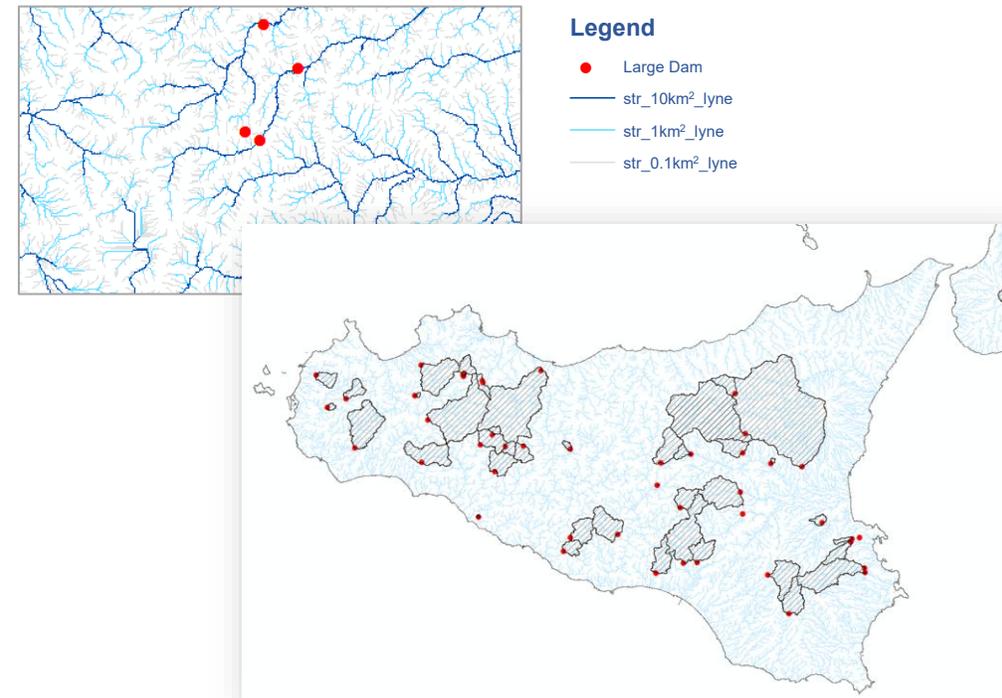
Preliminary Results - Watershed Delineation Example

Figure 1: Delineation of Closed Watersheds at a Subset of Historical Hydrometric Monitoring Stations



Figure 2: Delineation of Watersheds for Large Dams (Italian Law) – Sicily

Stream Definition: 0.1, 1 and 10 km²



(Developed by ISPRA)

Updated Model: *Input Data*

Hydrographic Network

Primary Dataset

- WISE-WFD 2022 Surface Water Body Centreline
(3rd River Basin Management Plan)

[WISE-WFD 2022 SWBC v1.9 – Dataset download \(EEA\)](#)

Priority Dataset

- EU-Hydro v1.3/v2.0

[EU-Hydro v1.3 – Dataset download \(CLMS/EEA\)](#)

Ancillary Dataset

- Waterways - OpenStreetMap
- HydroRIVERS v1.0

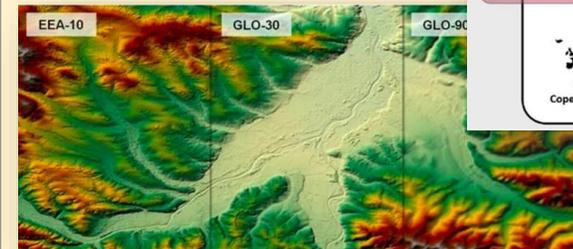
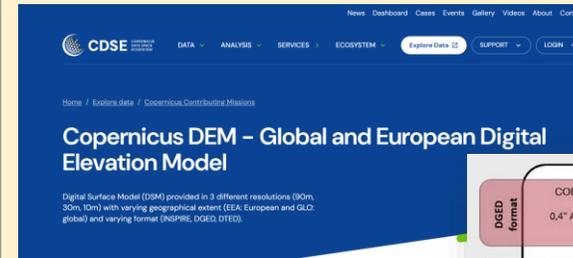
[Open Street Map website](#)

[HydroRIVERS v1.0 – Dataset download](#)



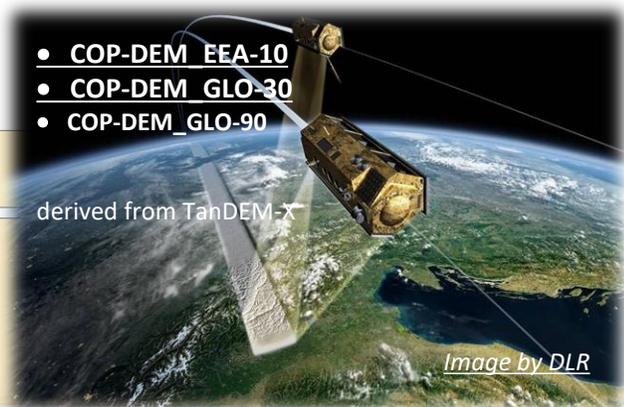
Integration Example (Selected Area):
WISE-WFD 2022 SWBC – EU-Hydro v1.3

Copernicus DEM



Format	Resolution	Geographical Extent
DGED format	0,4" Arc seconds	EEA-10 Copernicus DEM
DGED format	1,0" Arc seconds	GLO-30 Copernicus DEM
DGED format	3,0" Arc seconds	GLO-90 Copernicus DEM
INSPIRE format	0,3" Arc seconds	EEA-10 Copernicus DEM
DTED format	1,0" Arc seconds	GLO-30 Copernicus DEM
DTED format	3,0" Arc seconds	GLO-90 Copernicus DEM

[CDSE/COP-DEM](#)



- COP-DEM_EEA-10
- COP-DEM_GLO-30
- COP-DEM_GLO-90

derived from TanDEM-X

Copernicus DEM Access:

- GLO-30 / GLO-90: open to all registered users
- EEA-10: **restricted access**
Eligible users: Copernicus Services, EU Institutional Users, EU Research Projects, National Public Authorities, Copernicus Operators

Pilot Study at the Local Scale: Sicily, Italy

Model Input

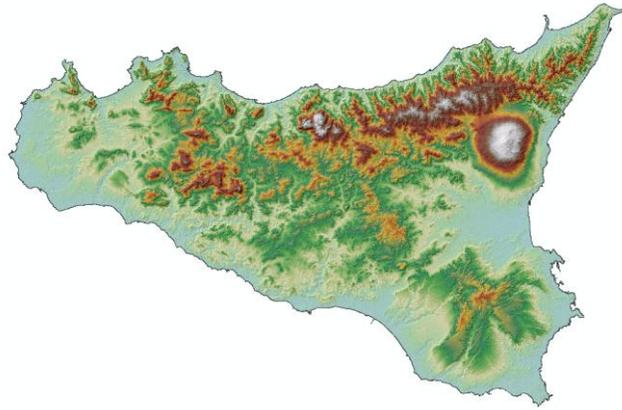


Figure 1: Copernicus DEM – EEA-10-INSP

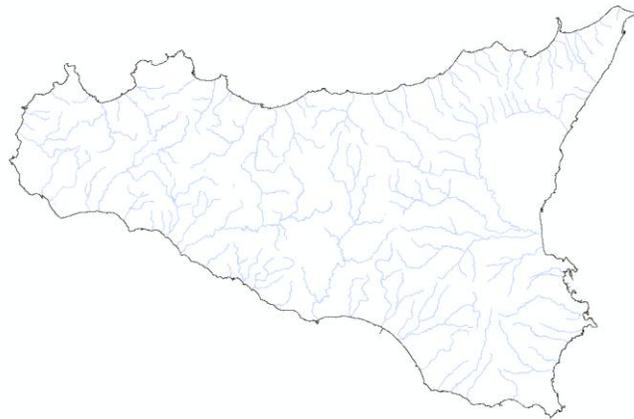


Figure 2: WISE-WFD 2022 Surface Water Body Centreline

Model Output

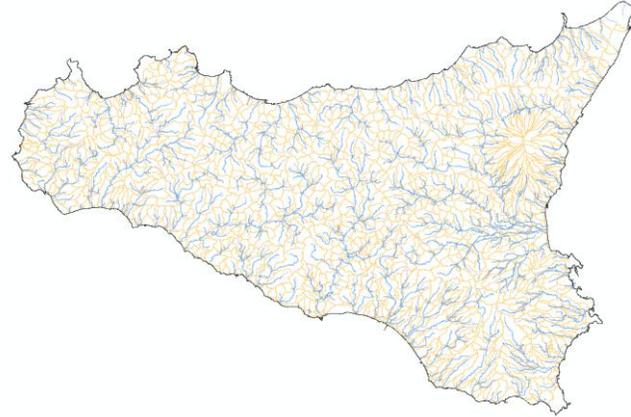


Figure 3: Derived Drainage Network and Catchment Delineation (Stream Definition: 10 km²)

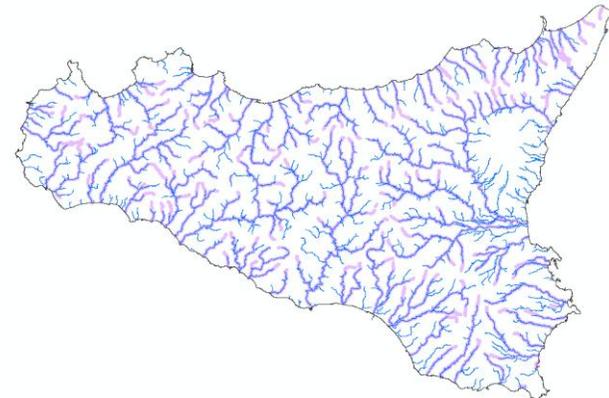
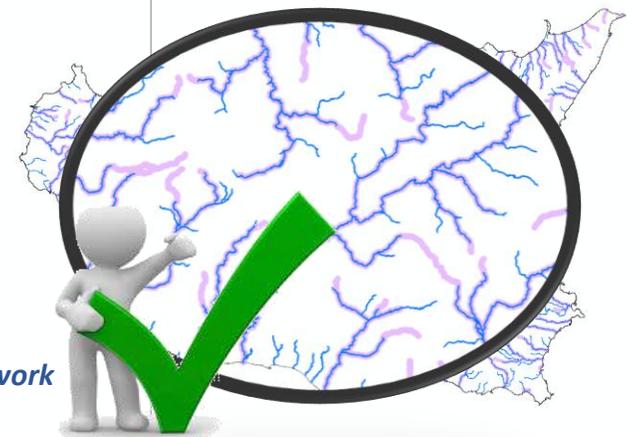


Figure 4: Overlay between *Derived Drainage Network* and *Surface Water Body Centreline*



Sicily (Area: 25,832 km²)



Conclusions

A unified drainage framework ensures consistent river basins delimitation, cross-border comparability and a solid technical basis to support the Water Framework Directive River Basin Management Plans.

Thank you!

Robertino Tropeano, *ISPRA*

robertino.tropeano@isprambiente.it