



# MODELLO DI DRENAGGIO DELLE ACQUE SUPERFICIALI BASATO SU *COPERNICUS DEM, EU-HYDRO E WFD*

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VISIONI DAL CIELO  
Crescere e imparare con CLMS



PROGRAMME OF THE  
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# Objectives

## ❖ Main objectives:

- Develop a **GIS-based drainage model**
- Ensure **consistency with surface water bodies** defined under the **Water Framework Directive**
- Use a single Digital Elevation Model to **guarantee hydrological continuity**, including cross-border areas

## ❖ Key advantages:

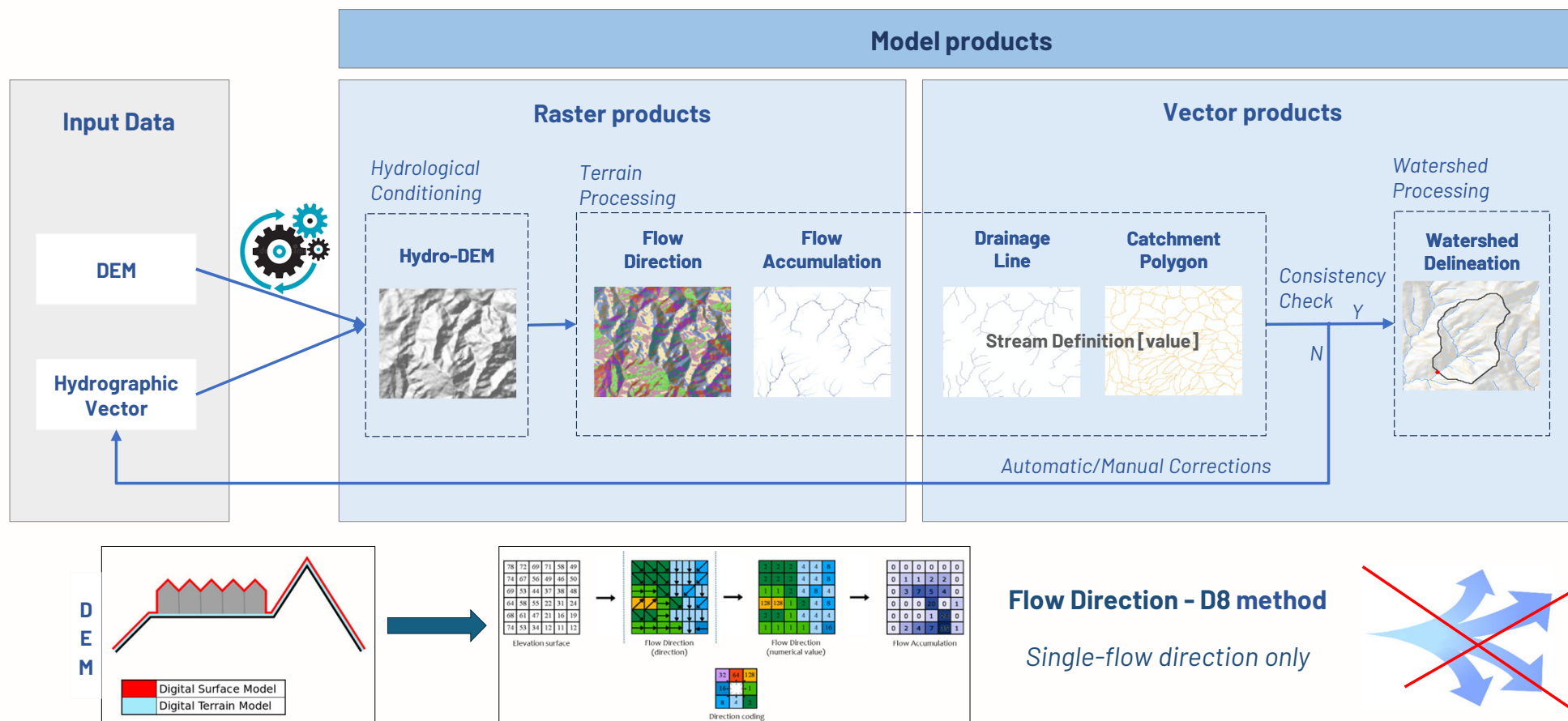
- **Topological consistency** of the hydrographic network
- Creation of a dynamic and interoperable **hydrographic dataset**



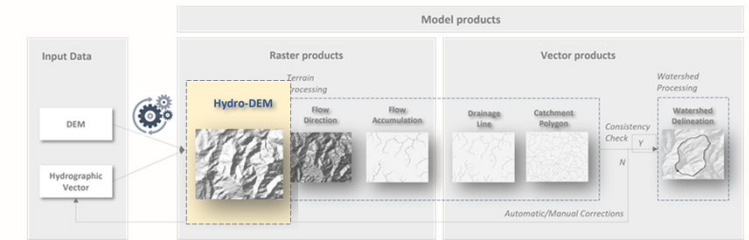
**Study Area: ~370,000 km<sup>2</sup>**

*Including major transboundary rivers (e.g. Ticino and Isonzo)*

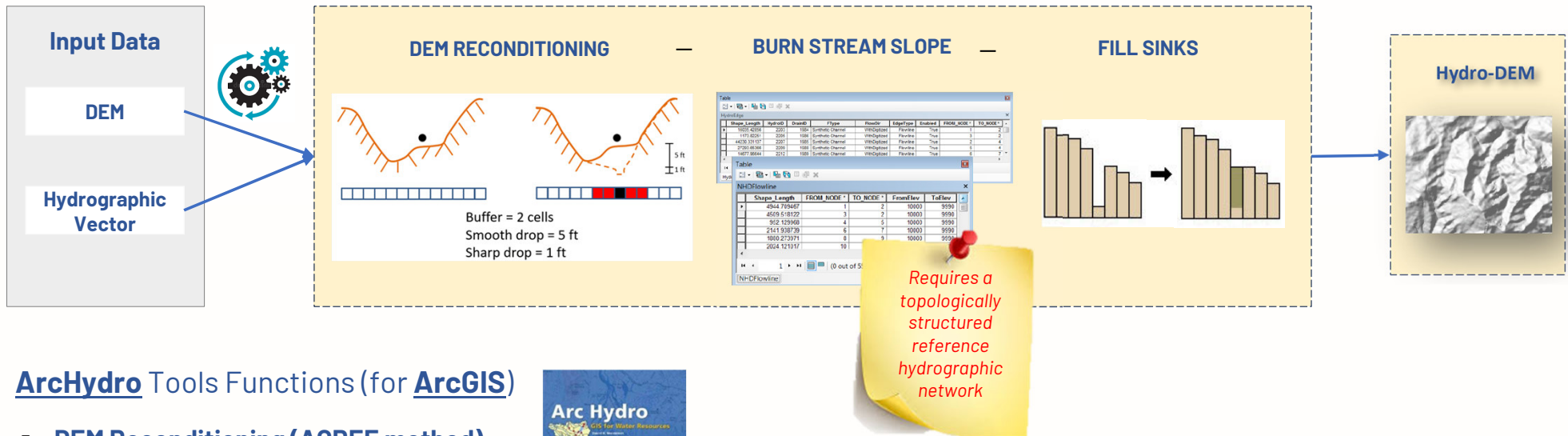
# Model Structure and Workflow



# Hydrological Conditioning of the DEM

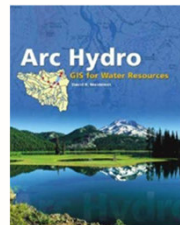


## Hydrological Conditioning



## 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**



Archived

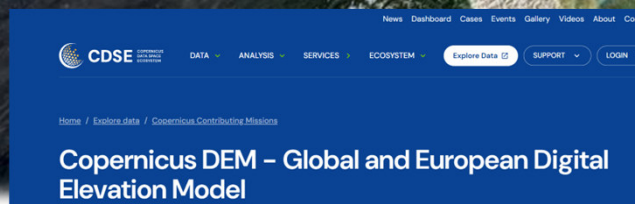
[EEA/Datahub](#)

Terra  
Image by NASA

## Copernicus DEM

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

derived from **TanDEM-X**



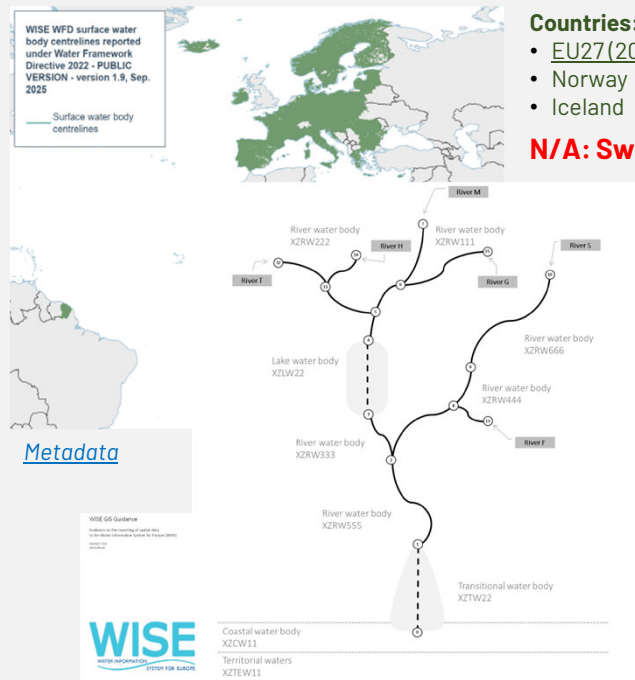
[CDSE/COP-DEM](#)

TanDEM-X - TerraSAR-X  
Image by DLR

# Hydrographic Vector Datasets Evaluated for the Model

## Primary Dataset (pan-European Dataset)

### WISE-WFD Surface Water Body Centreline (EEA)



#### Countries:

- EU27 (2020)
- Norway
- Iceland

N/A: Switzerland

#### Metadata

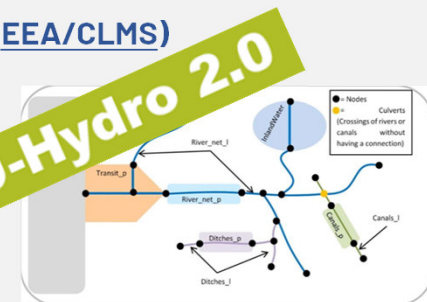
Representation of the hydrographic network –  
**SWBC**  
([WISE GIS Guidance](#))

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

### EU-Hydro v1.3 (EEA/CLMS)



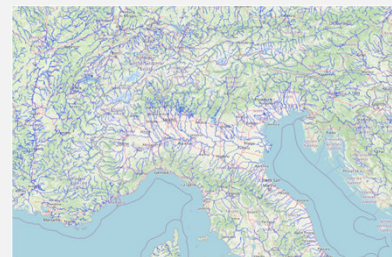
[EU-Hydro River Network Database - CLMS/EEA](#)



Topological relationship  
([River Net User Guide 1.3](#))

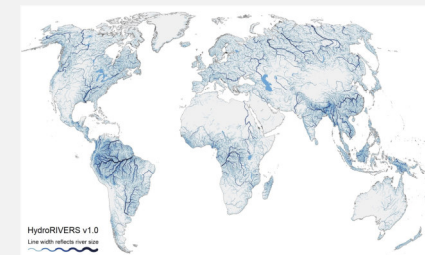
## Ancillary Datasets (Global Dataset)

### 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

- National Area

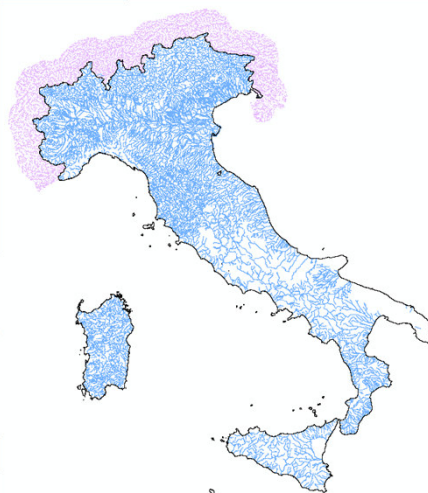
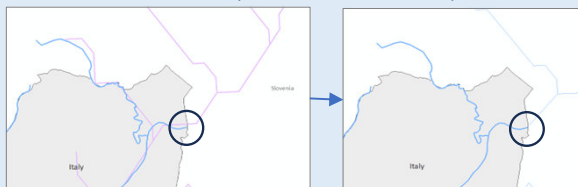
- **WISE-WFD 2016 Surface Water Body Centreline**  
(2nd River Basin Management Plan)

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

- Transboundary Area

- **HydroRIVERS v1.0**

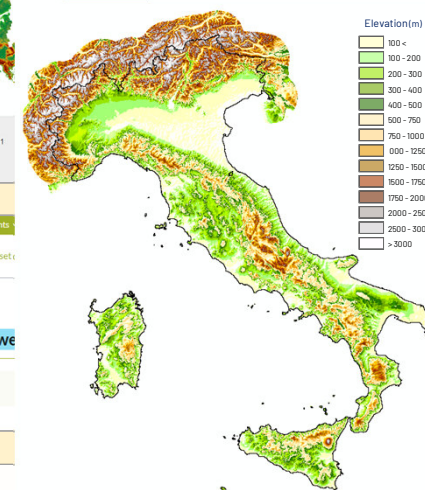
Data Integration  
(network connections)



Integration of **WISE-WFD 2016 SWBC** and **HydroRIVERS v1.0** – study area (Processing by ISPRA)

### Digital Elevation Model (DEM)

#### EU-DEM v1.1



EU-DEM\_v1.1 tile mosaic clipped to the study area  
(Processing by ISPRA)

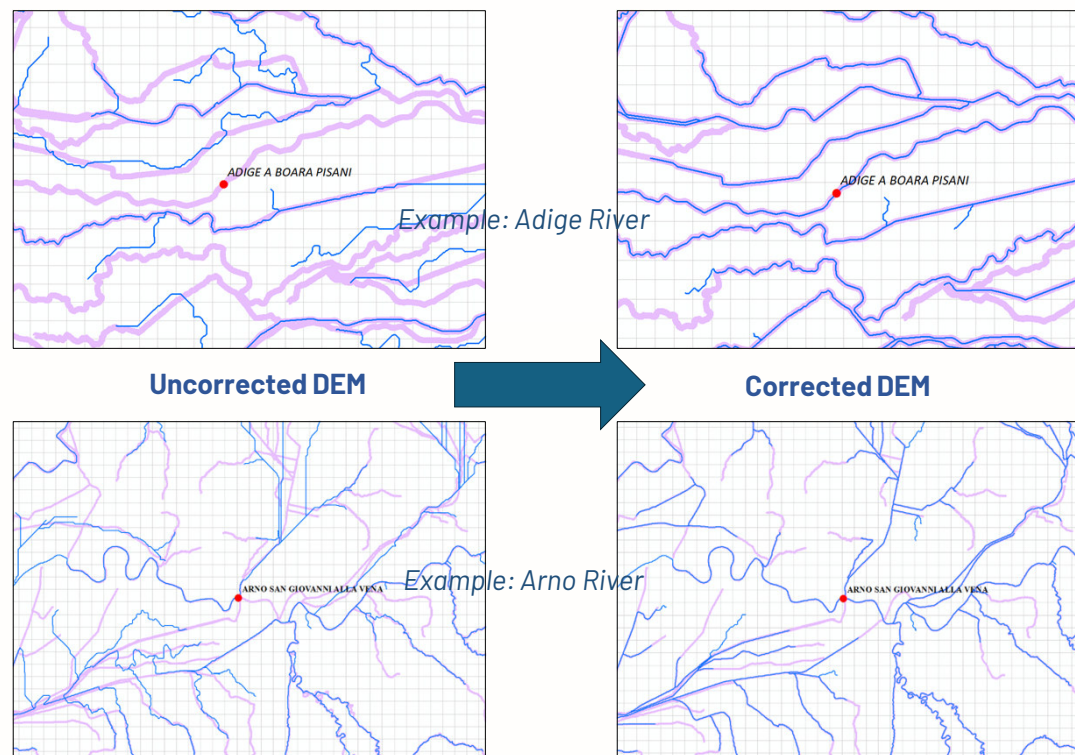
# Prototype Model at National and Transboundary Scale

## Preliminary Results - Drainage Line and Catchment Polygon

Figure 1: **Model output** (Stream Definition: 10 km<sup>2</sup>)



Figure 2: **Model** vs. **Reference Hydrographic Network**





# Prototype Model at National and Transboundary Scale

## Preliminary Results - Watershed Delineation Example

Figure 1: **Watersheds at historical Hydrometric stations**



Figure 2: **Watersheds at Large Dams (Italian Law) - Sicily**

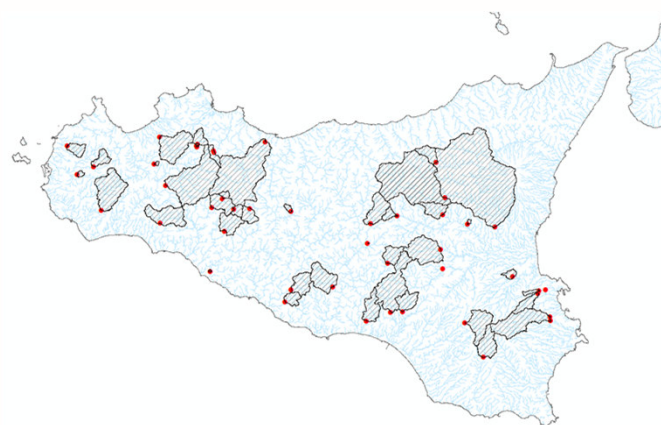
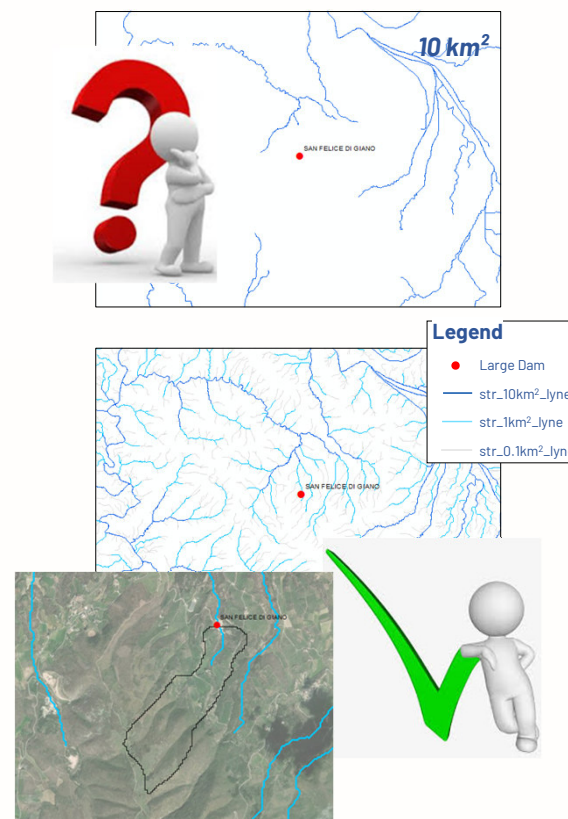


Figure 3: **Stream Definition: 0.1, 1 and 10 km<sup>2</sup>**



# Updated Model – Pilot Study at the Local Scale: Sicily, Italy

## Input

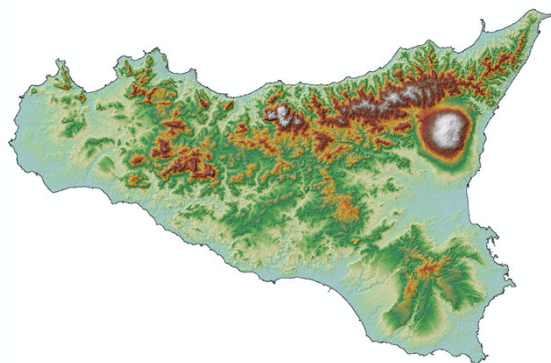


Figure 1: Copernicus DEM – EEA-10-INSP (10 m)



Figure 2: **WISE-WFD 2022** Surface Water Body Centreline

## Output



Figure 3: Derived **Drainage Network** and **Catchment Delineation**  
(Stream Definition: 10 km<sup>2</sup>)

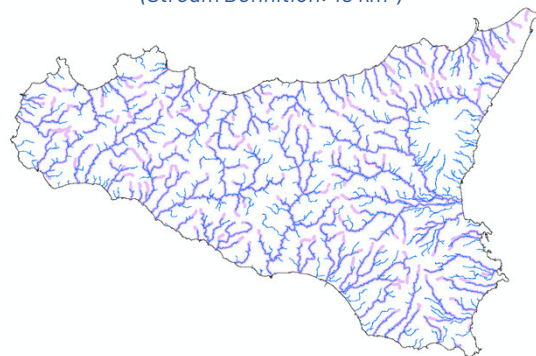


Figure 4: **Derived Drainage Network** vs **SWBC**



Sicily (Area: 25,832 km<sup>2</sup>)



# Conclusions



## Integrated Drainage Framework:

- Ensures river basin delineation **consistent with surface water bodies (WFD)**
- Generates a **consistent and topologically error-free river network** with **multiple levels of detail**
- Supports **cross-border comparability** for shared river basins
- Provides an **up-to-date information base** for sustainable water resources planning and management

**Overall: Contributes to the integration and harmonization of hydrological data, supporting EU water policies.**





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