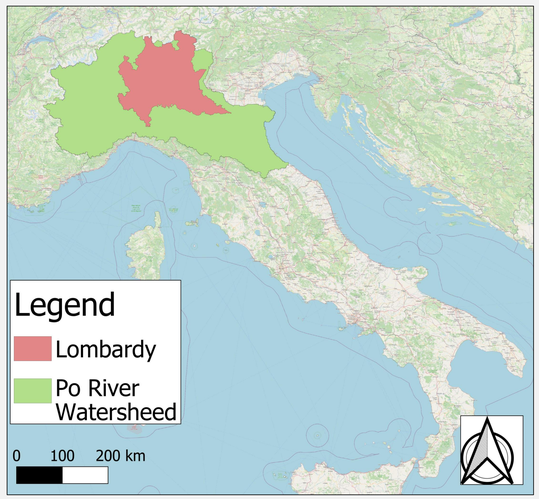
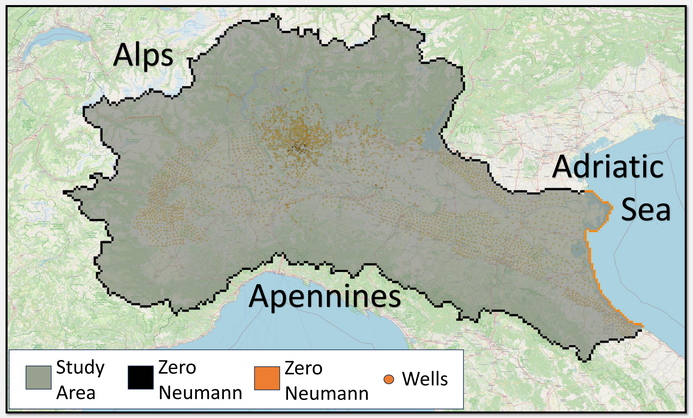
Coarse-grained materials control groundwater flow in the largest watershed in Italy



Water Alliance
Acque di Lombardia

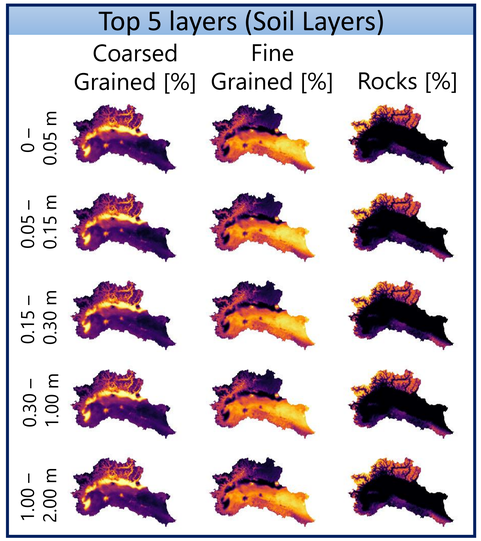
Po River basin (4 regions):
- 16 millions inhabitants
- 40% of Italian GDP
- 87 000km^2

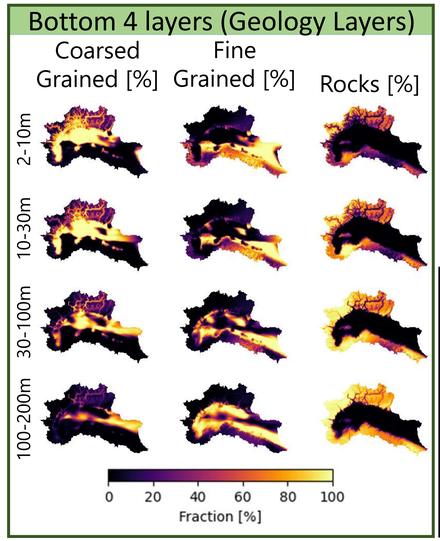
- Software: ParFlow
- 530km x 330 km
- dx = dy = 2km
- Thickness 225m
- 9 layers (var dz)
- PME = 750 mm/y
- > 4000 wells
- Forcing data available until 2022

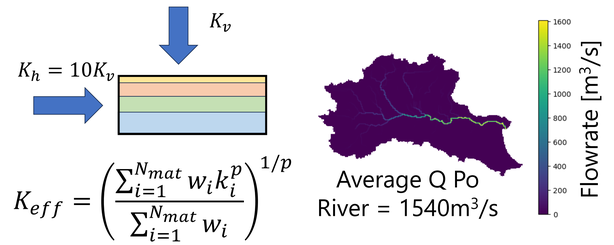


Methodology

Reconstruction of geomaterials based on integration of **ML-based prediction** and globally available datasets of geomaterials (**SoilGrids**)





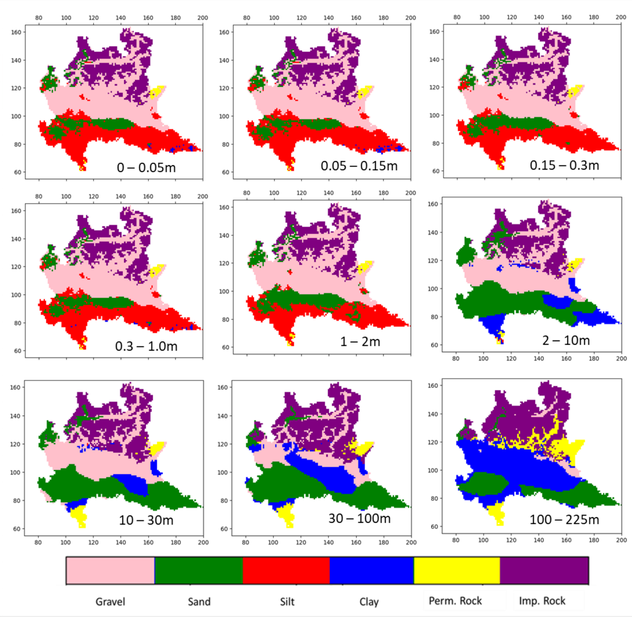


Conduct a **Local Sensitivity Analysis**

Quantities of Interest	Model Parameters θ
Subsurface Storage	Sat. K x 6
Surface Storage	Porosity x 6
WTD Lombardy	α Van Genuchten x6
WTD Lombardy valley	Specific Storativity
Flowrate at exit of Lombardy	Manning x 2

Key Results

	SubS	SurS	WTD lom	WTD val	Q
			m	m	
K1	-1%	-4%	3.22	2.42	-5%
K2	-3%	-33%	3.75	6.76	24%
K3	0%	0%	0.00	0.00	0%
K4	-3%	1%	2.44	5.71	7%
K5	0%	0%	0.00	0.05	0%
K6	0%	0%	0.00	0.00	0%
por1	1%	0%	0.00	0.00	0%
por2	4%	0%	0.00	0.00	0%
por3	0%	0%	0.00	0.00	0%
por4	12%	0%	0.00	0.00	0%
por5	2%	0%	0.00	0.00	0%
por6	0%	0%	0.00	0.00	0%
a1	0%	0%	-0.04	0.00	0%
a2	0%	0%	-0.02	0.00	0%
a3	0%	0%	0.00	0.00	0%
a4	0%	0%	-0.02	0.00	0%
a5	0%	0%	-0.08	0.00	0%
a6	0%	0%	-0.01	0.00	0%
Ss	6%	0%	0.00	0.00	0%
Mann1	0%	9%	-0.01	-0.01	0%
Mann2	0%	16%	-0.03	-0.03	3%



Current Work

- Construction of surrogate models via traditional methods like Polynomial Chaos Expansion and **convolutional neural networks**.
- Evaluation of **pumping scenarios** that reflect different degrees of anthropic impact on the aquifers of the study area.

Project Site

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