All-FORA online Side-Event

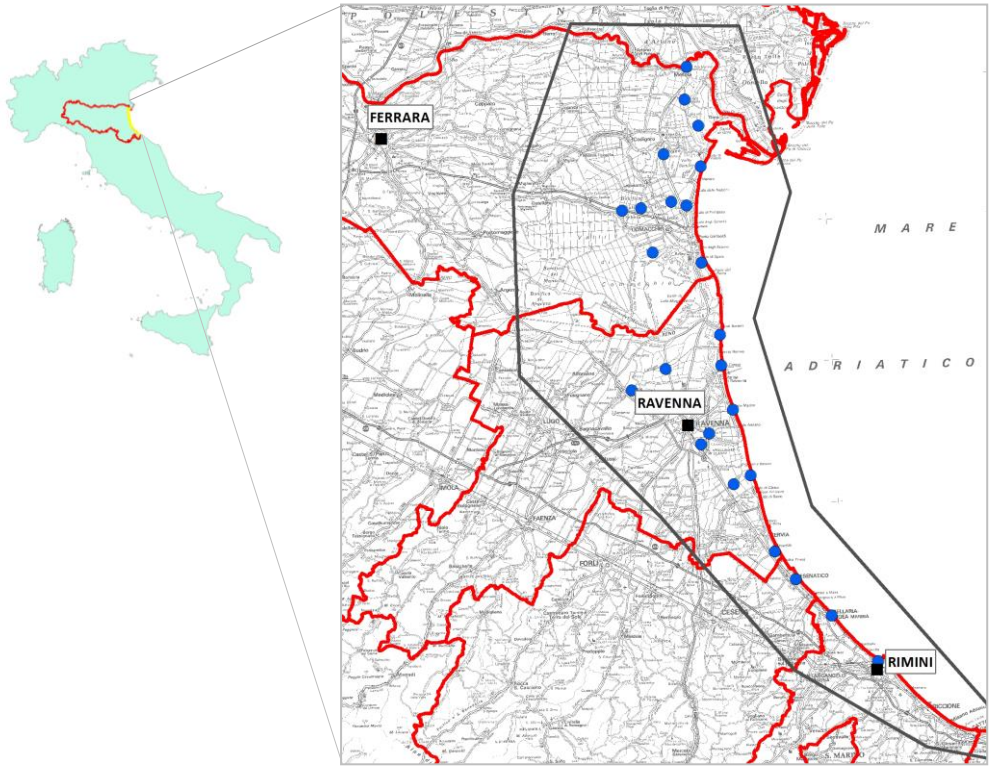
"Saline intrusion: a potential risk for coastal aquifer management in a changing climate"
10 May 2021

Hydrogeological characterization and saltwater intrusion in coastal phreatic aquifer of Emilia – Romagna Region (Italy)

Luciana Bonzi, Lorenzo Calabrese and Paolo Severi

Geological, Seismical and Soil Survey (SGSS) – Emilia- Romagna Region (IT)

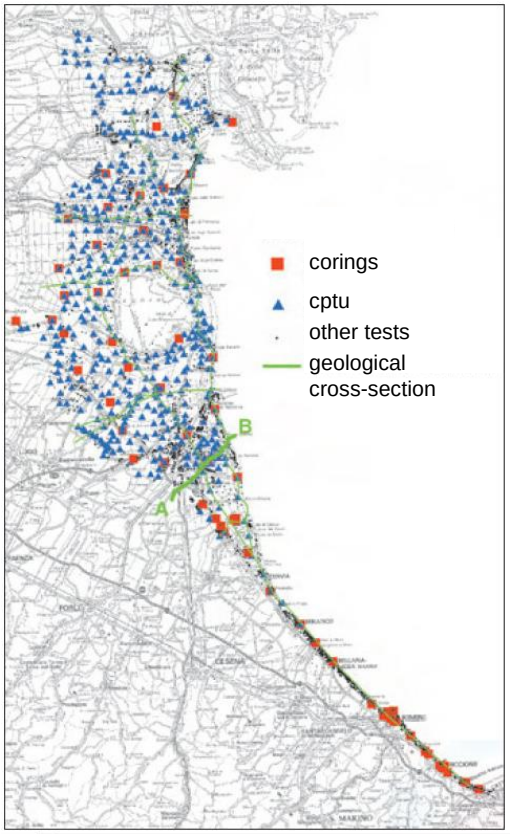
LOCATION & DATA



Coastal lenght: about 130 km
Inland maximum development: about 30 km
Area: about 1300 kmq

Geognostic dataset:

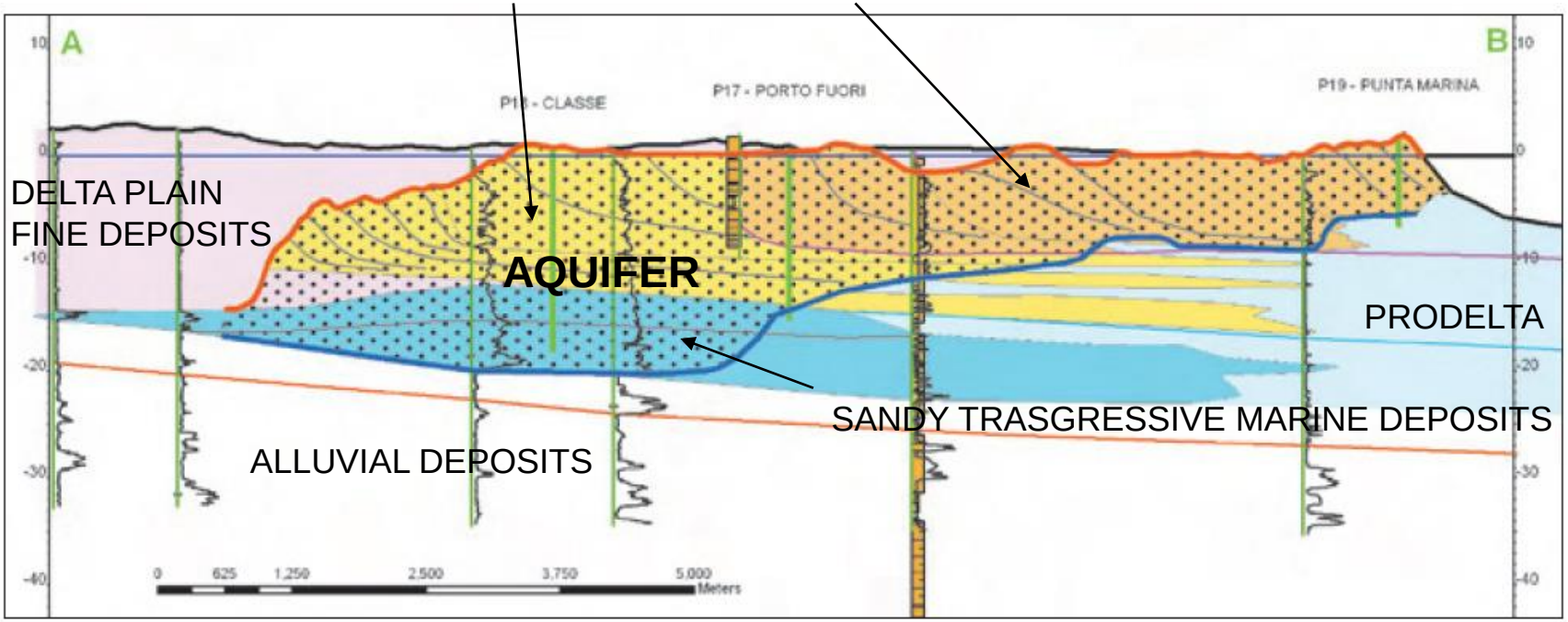
- CPT tests corings
- water-wells
- etc.



- **piezometers:** water level, electric conductivity and temperature monitoring on a regional net

GEOLOGICAL MODEL

OLOCENE SUCCESSION

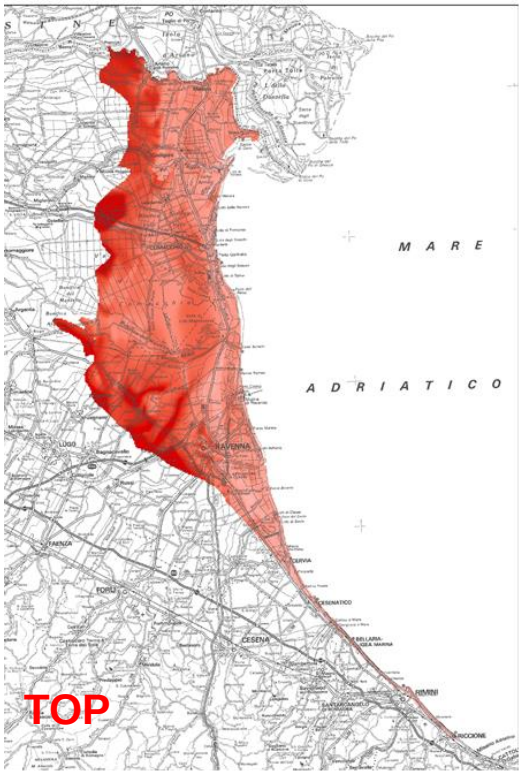


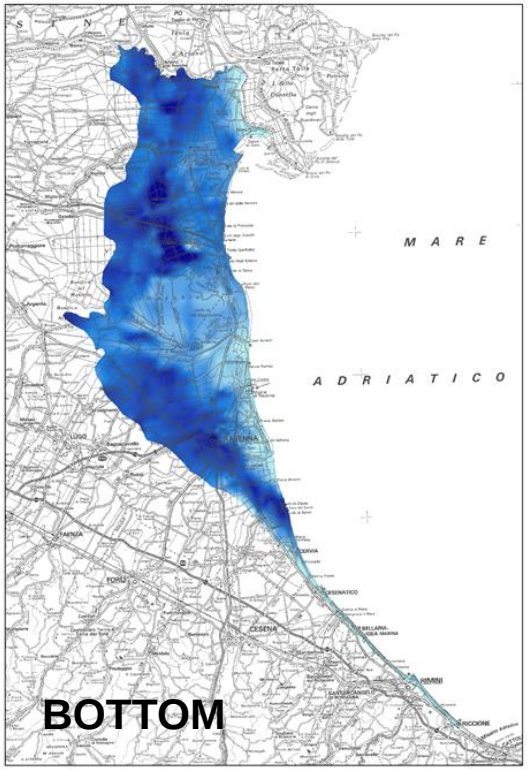
Coastal Phreatic Aquifer

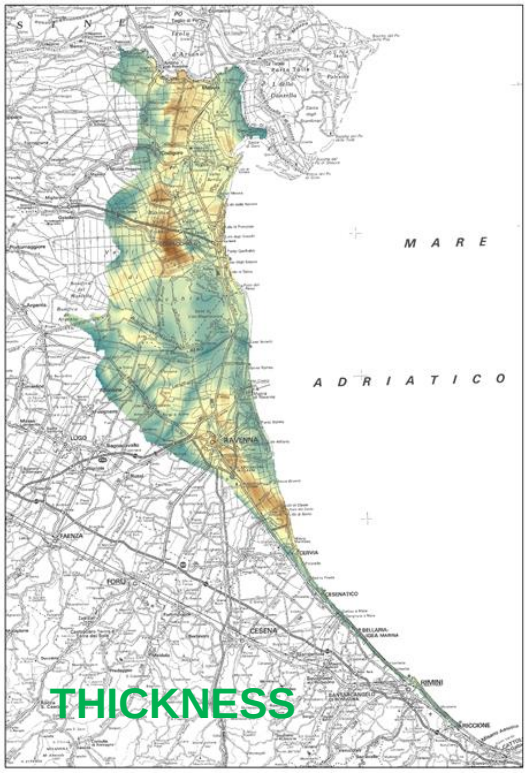
REGIONAL SCALE

THEMATIC MAPS

- Area: 1300 km^2
- Volume: 16 km^3
- Maximum thickness: 31m







Reconstruction of the aquifer limits and characteristic (top and bottom surfaces; thickness)

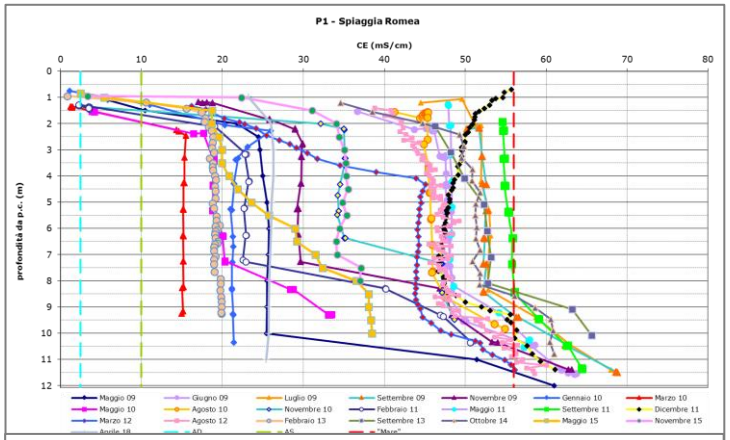
Coastal Phreatic Aquifer

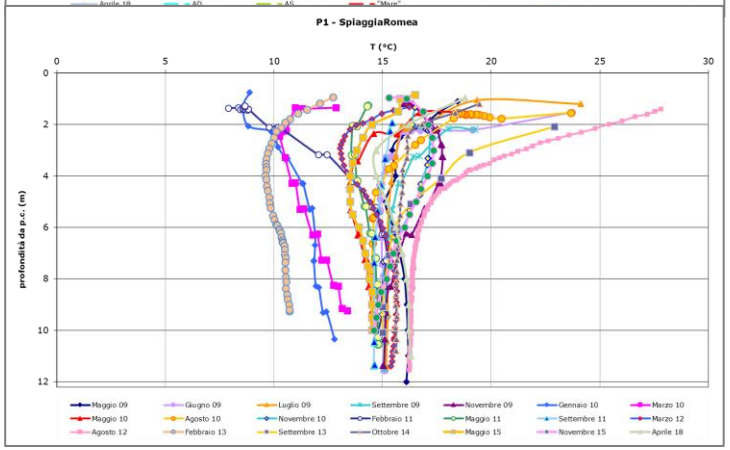
REGIONAL SCALE

MONITORING

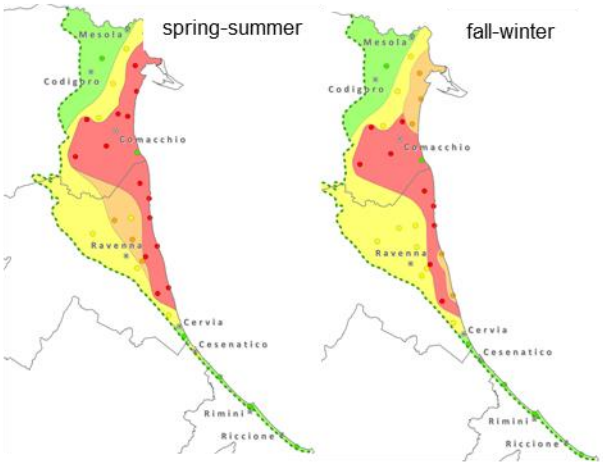
from 2009 to nowadays, seasonal mesurements with probe

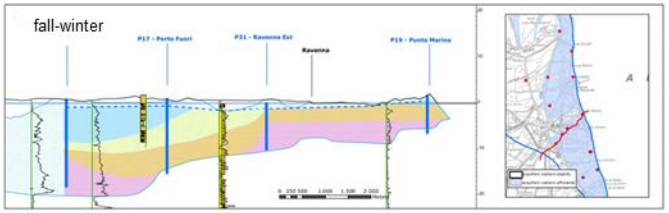
ELECTRICAL CONDUCTIVITY & TEMPERATURE

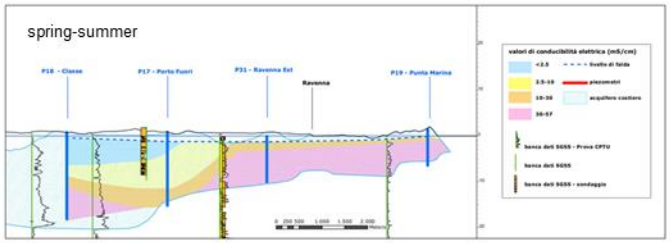




Seasonal variability







GEOERA –TACTIC PROJECT

(Tools for Assessment of ClimaTe change ImpacT on groundwater and adaptation Strategies)

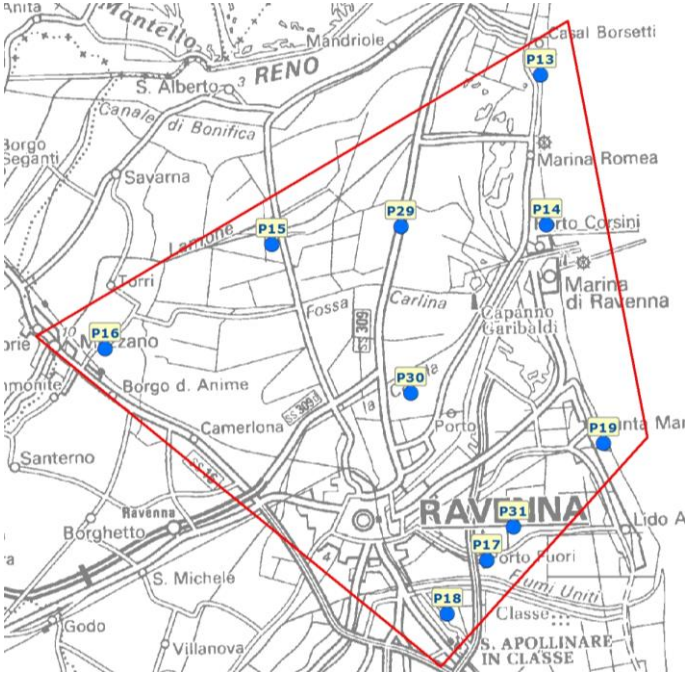
TACTIC GROUNDWATER

Detailed geolithological 3D reconstruction

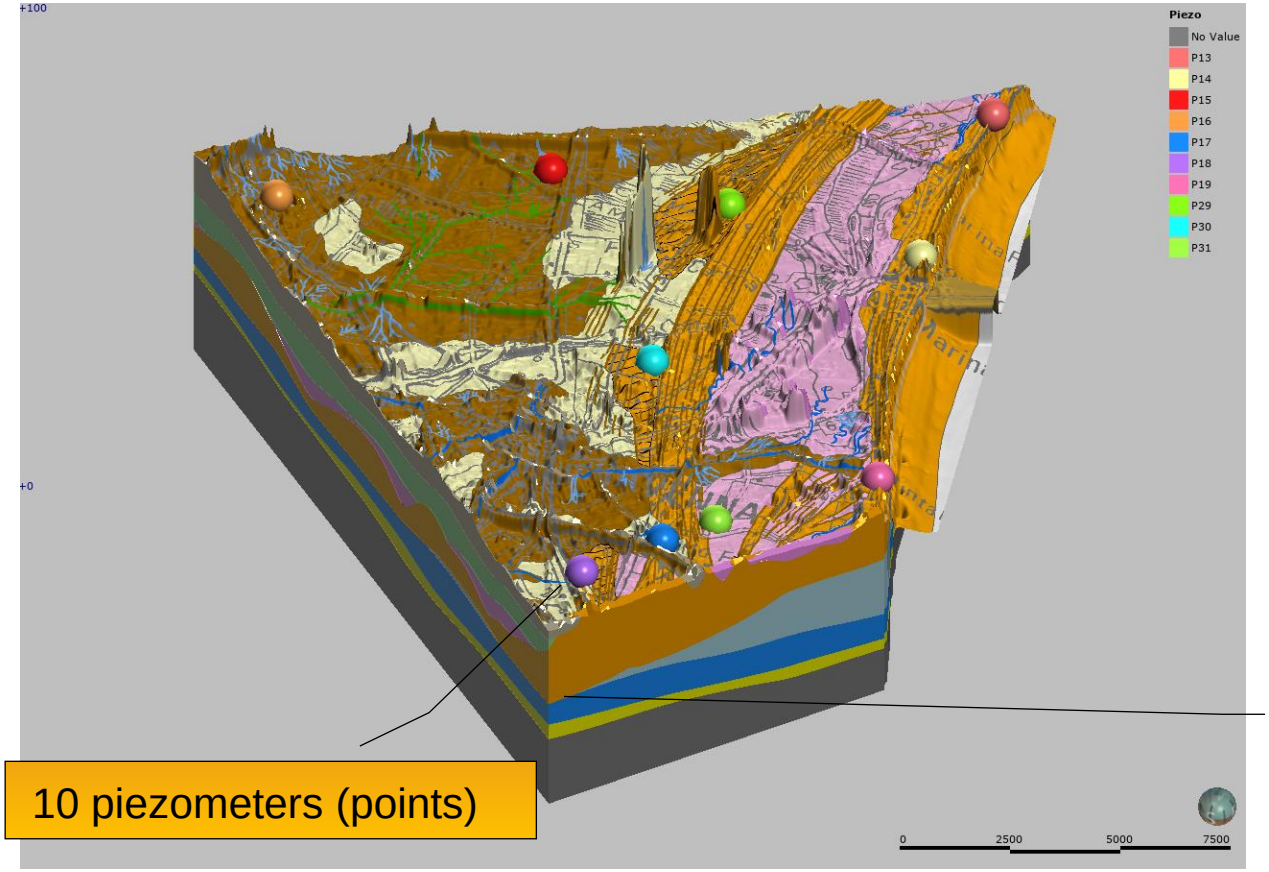
Hydrogeological parameters from CPT

EC & T 3D maps

Study area: Ravenna coastal plain



3D GEOLOGIAL MODEL



10 piezometers (points)

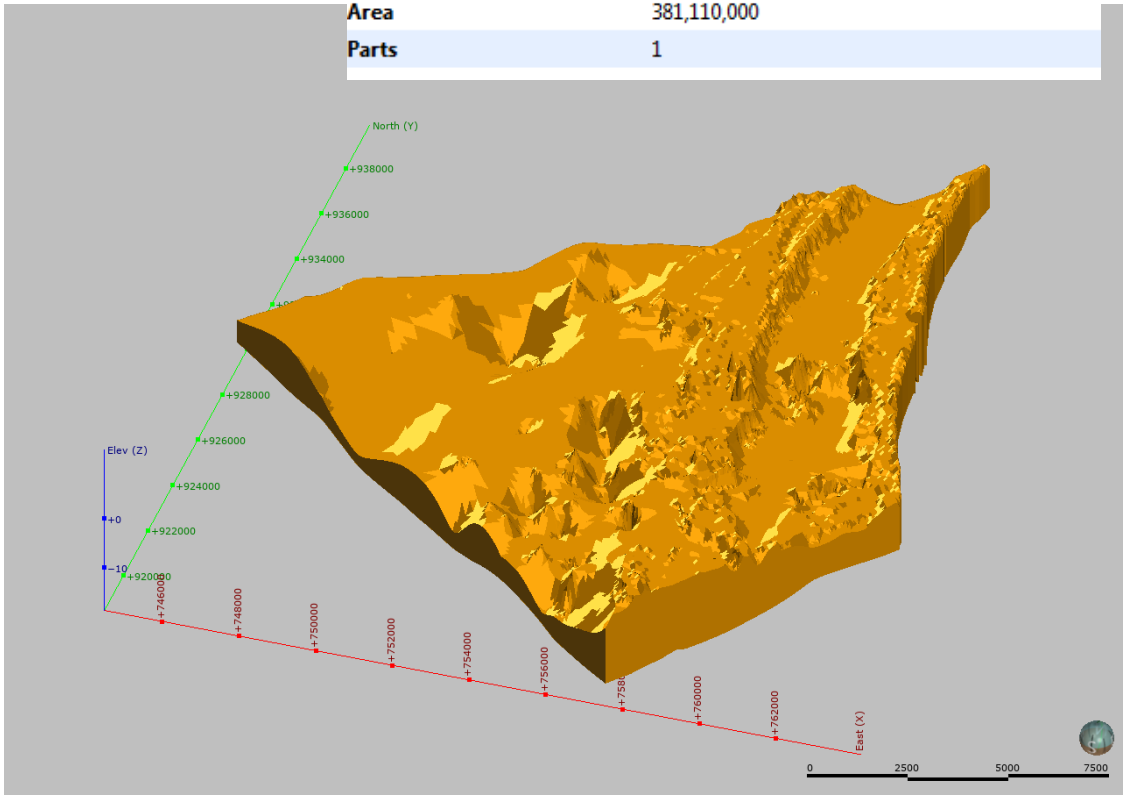
The Holocene succession of the study area is subdived into **5 units** corrensponding to the main depositional environments (marine shallow water/deltaic to alluvial systems)

The **orange and blue units** include delta-front, strand plain sands and transgressive marine deposits
and constitute the Coastal Phreatic Aquifer

3D AQUIFER MODEL

GM_interpretation_MESH_TACTIC: strand plain and delta front

Location	753893.6564, 926783.1746, -2.4614
Face dip	0.319326
Volume	1,820,100,000
Area	381,110,000
Parts	1



Characterization

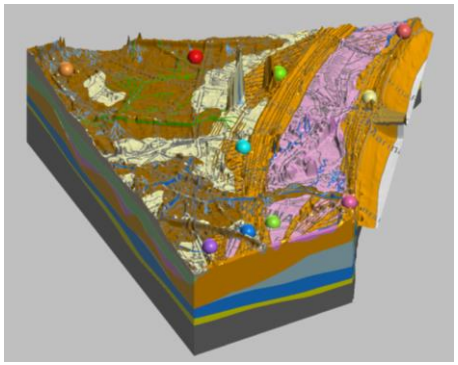
- shape
- area
- volume
- depth of upper and lower limits
- thickness

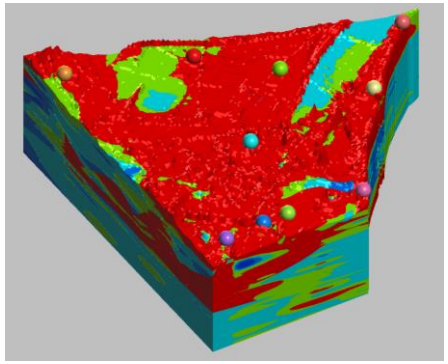
Benefits

- continuous values
- slices
- more details and upgrade
- file export
- visualization

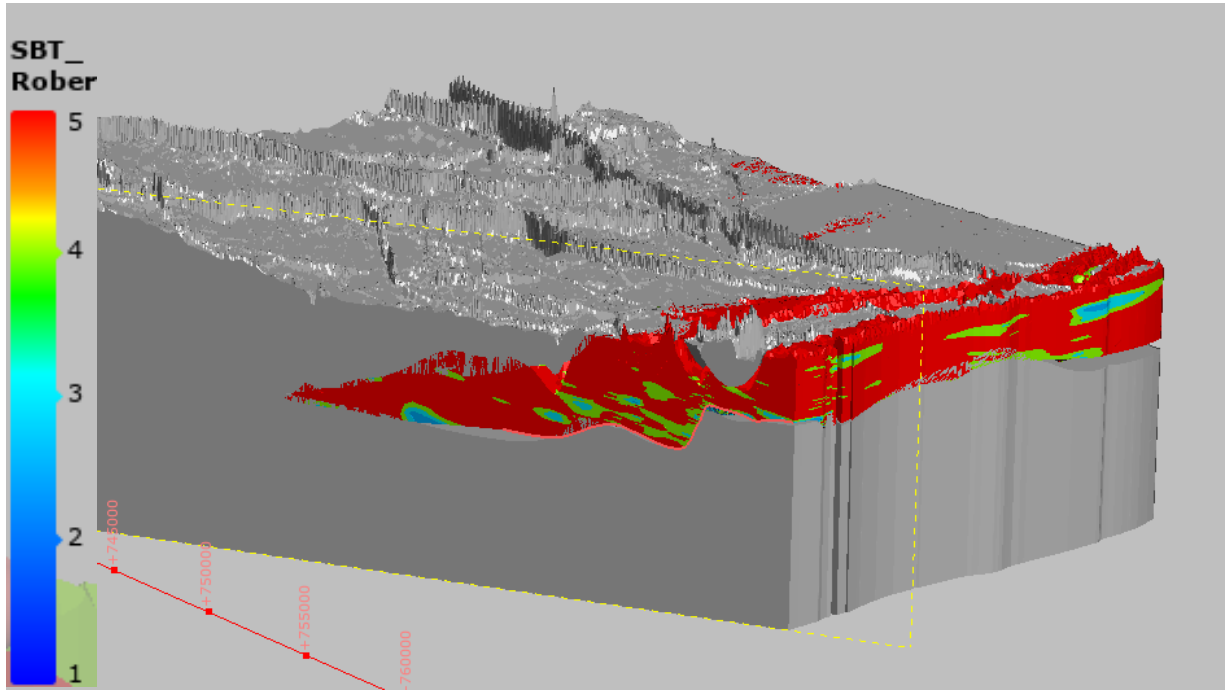
PHYSICAL & GEOTECHNICAL PARAMETERIZATION

3D geological model





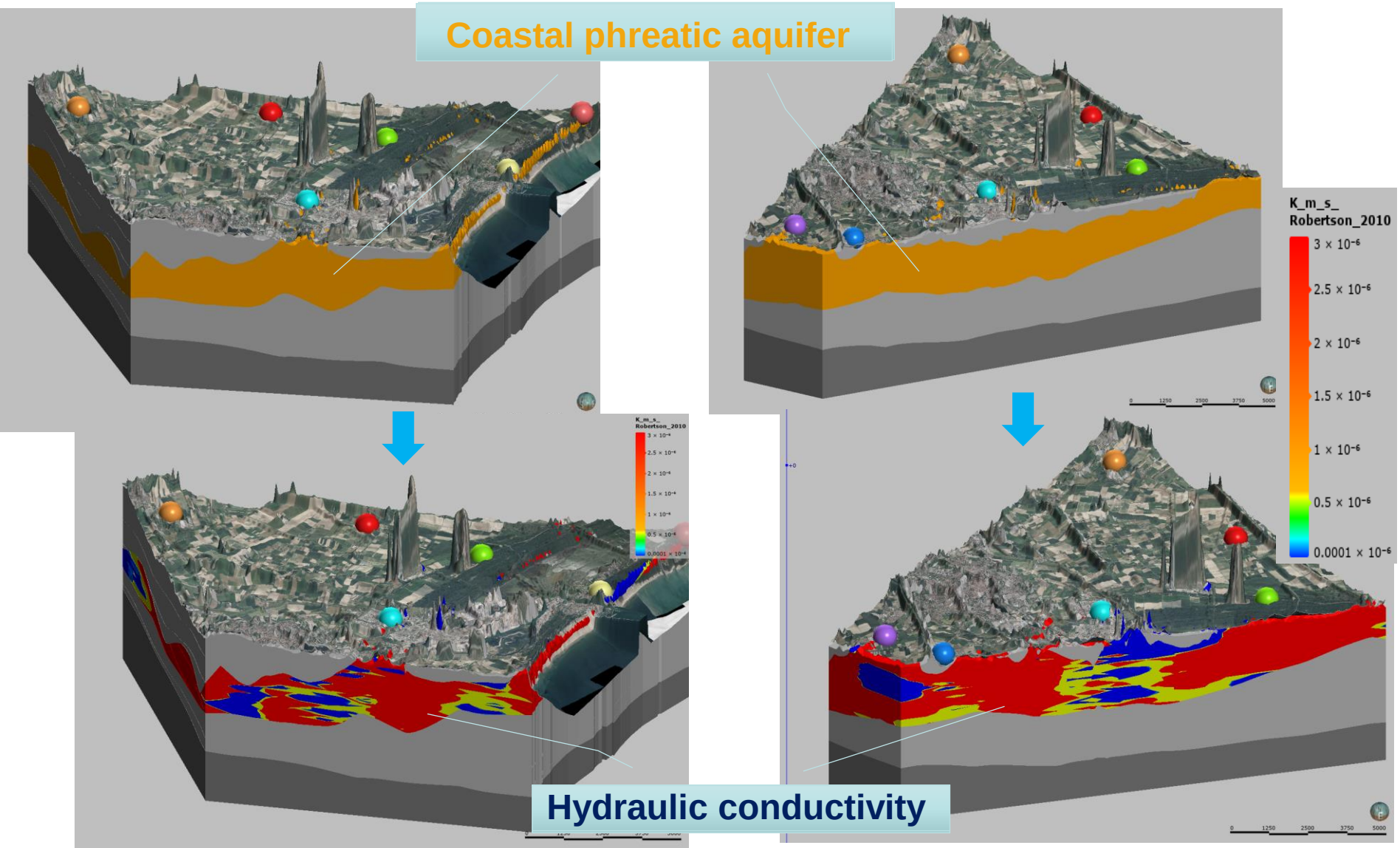
lithological heterogeneity within the aquifer



Soil Behavior Type

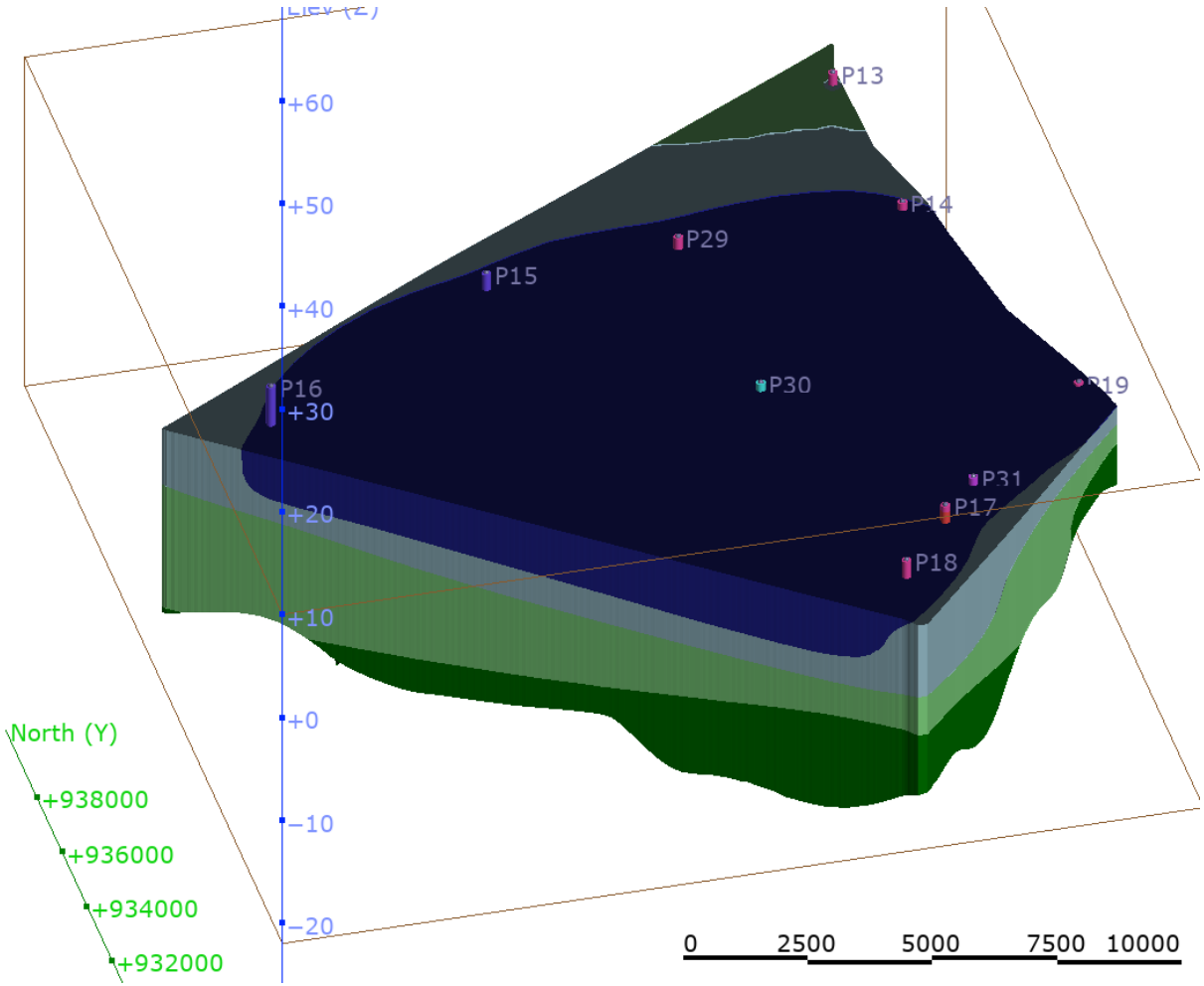
3D parametric model created by interpolating CPT data with geological model constrains

HYDROGEOLOGICAL PARAMETERIZATION



INTEGRATION OF PIEZOMETRIC DATA INTO 3D MODELS

Piezometric level, electrical conductivity data and definition of saturated volume (groundwater volume) for each monitoring suveys.



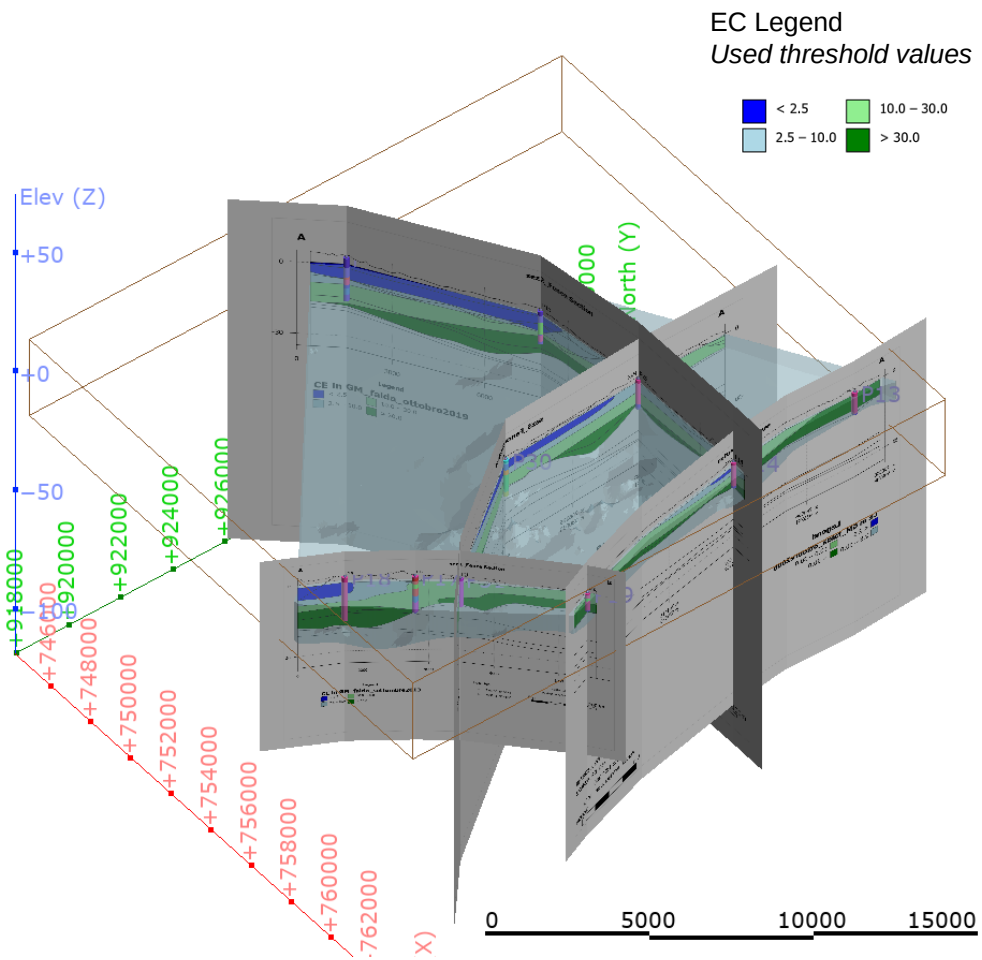
Example of 3D EC model and piezometers
(March 2010 survey)

CE Legend

< 2.5	10.0 – 30.0
2.5 – 10.0	> 30.0

3D MODELS SKILLS

- 3D interpolation of numeric data (EC);
- 3D viewer facilitates navigation around models and dissemination;
- Information extraction as new cross-sections and 2D maps;
- exporting file for further modeling; comparison of the different surveys and definition of characteristic and evolution of fresh water / saltwater interface



geological fence diagram with electrical conductivity (EC) distribution

EC_3D_model

Thanks for your attention!

lorenzo.calabrese@regione.emilia-romagna.it

The models were freely shared online SGSS web pages :

Modellazione 3D — Ambiente (regione.emilia-romagna.it)

https://view.seequent.com/embed/sid0dgia8ba5gnltgy8l/default/wm1o29klqce212x668dc

Geoera-TACTIC web pages:

https://geoera.eu/blog/gip-p-post-3d-geological-model-for-the-tactic-project/

https://geoera.eu/blog/a-brand-new-way-to-visualize-the-geology/