HYDROCHEMICAL AND ISOTOPIC STUDY OF MAGGIORE VALLEY DEEP AQUIFERS (NW ITALY): EVALUATION OF THE INTERACTIONS WITH THE PO RIVER

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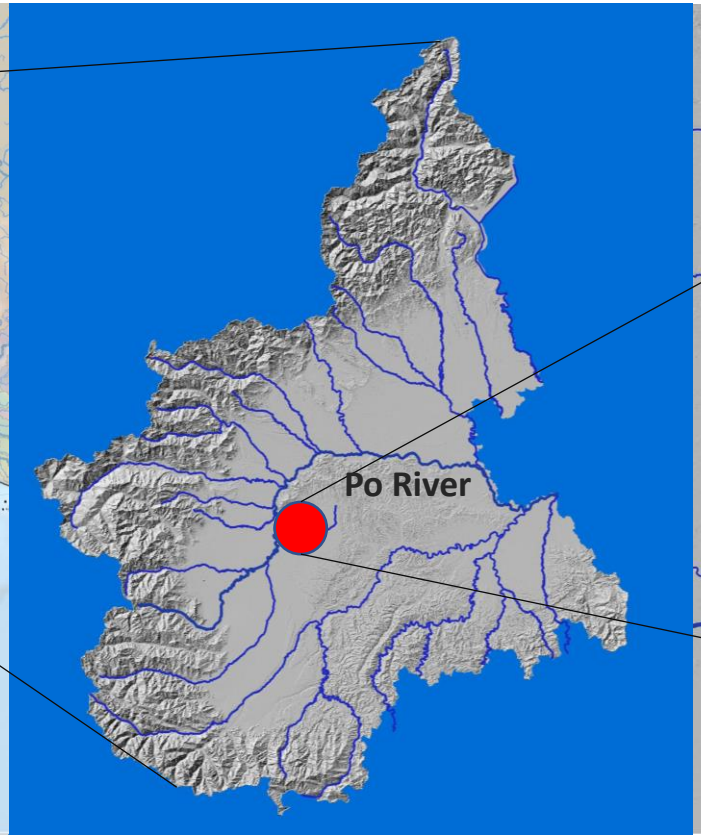
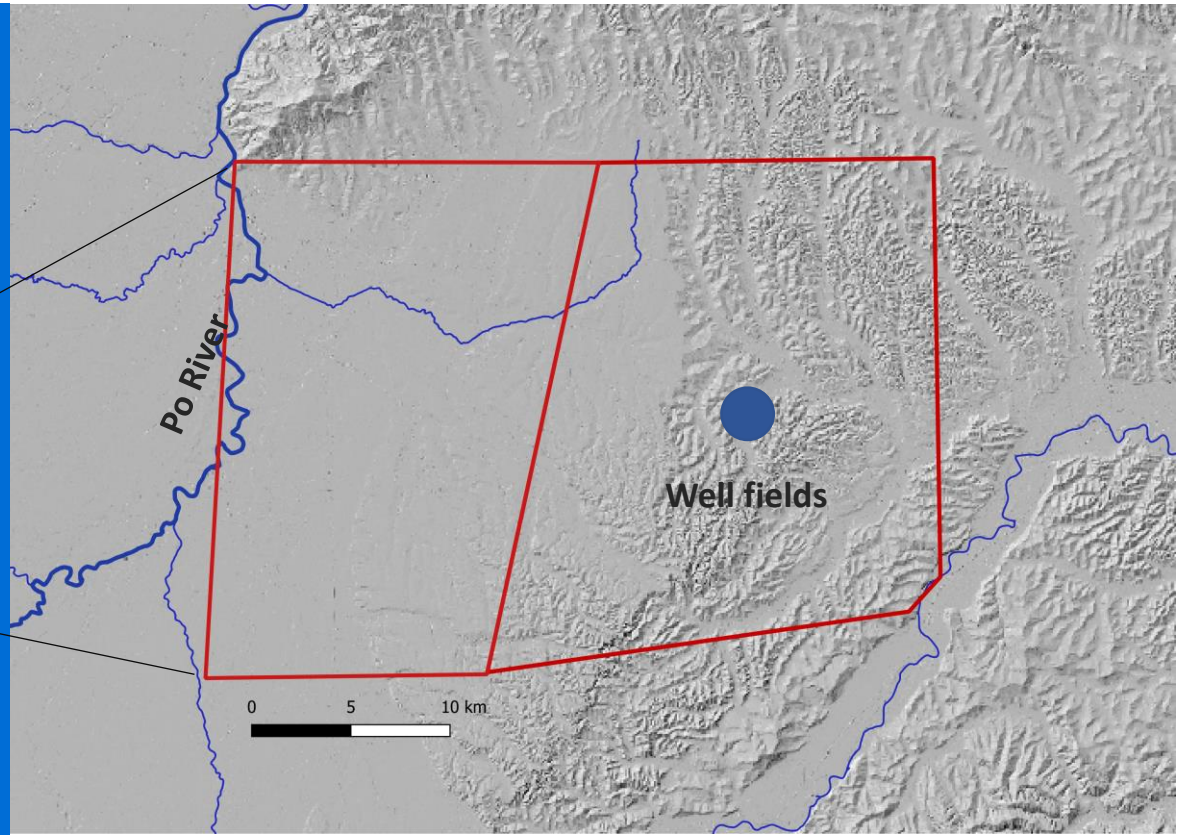
Study area

Italy



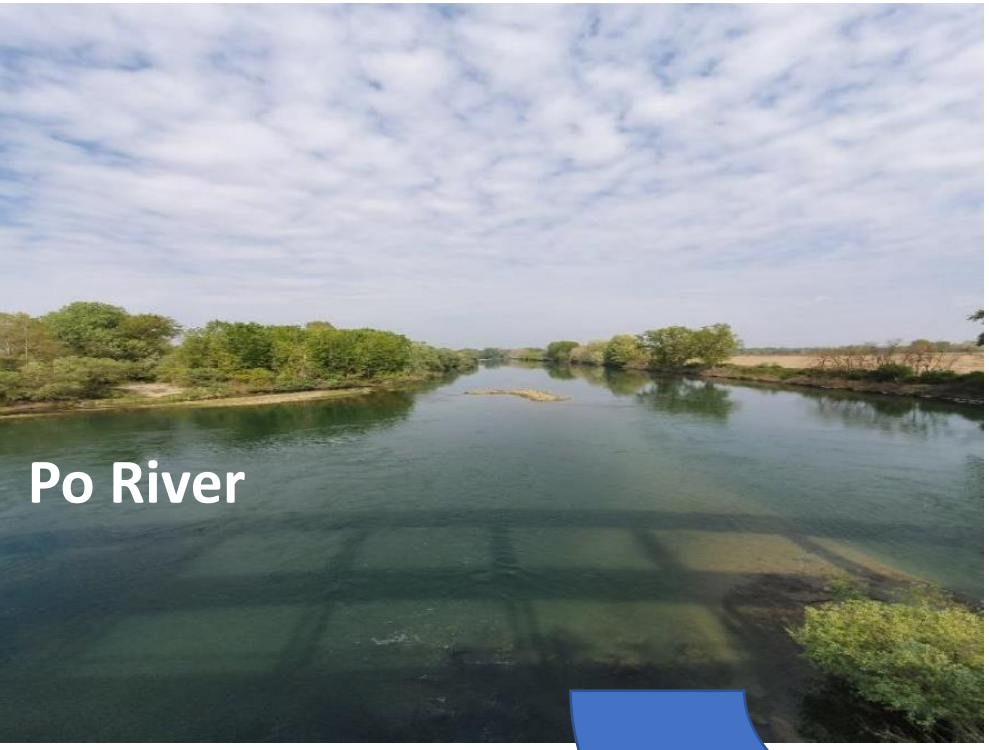
Piedmont Region



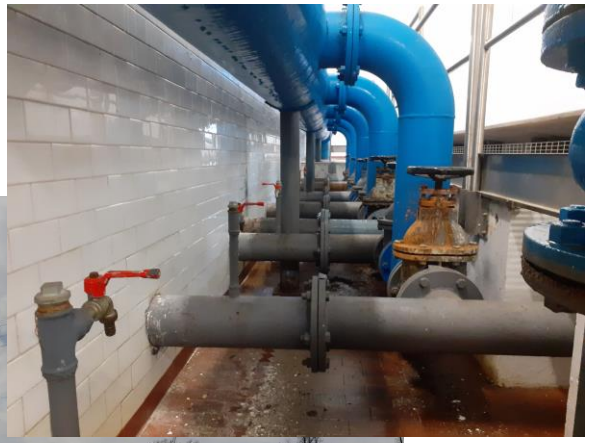
Study area

Introduction

Does an interaction between the Po River and the unconfined and confined aquifers?



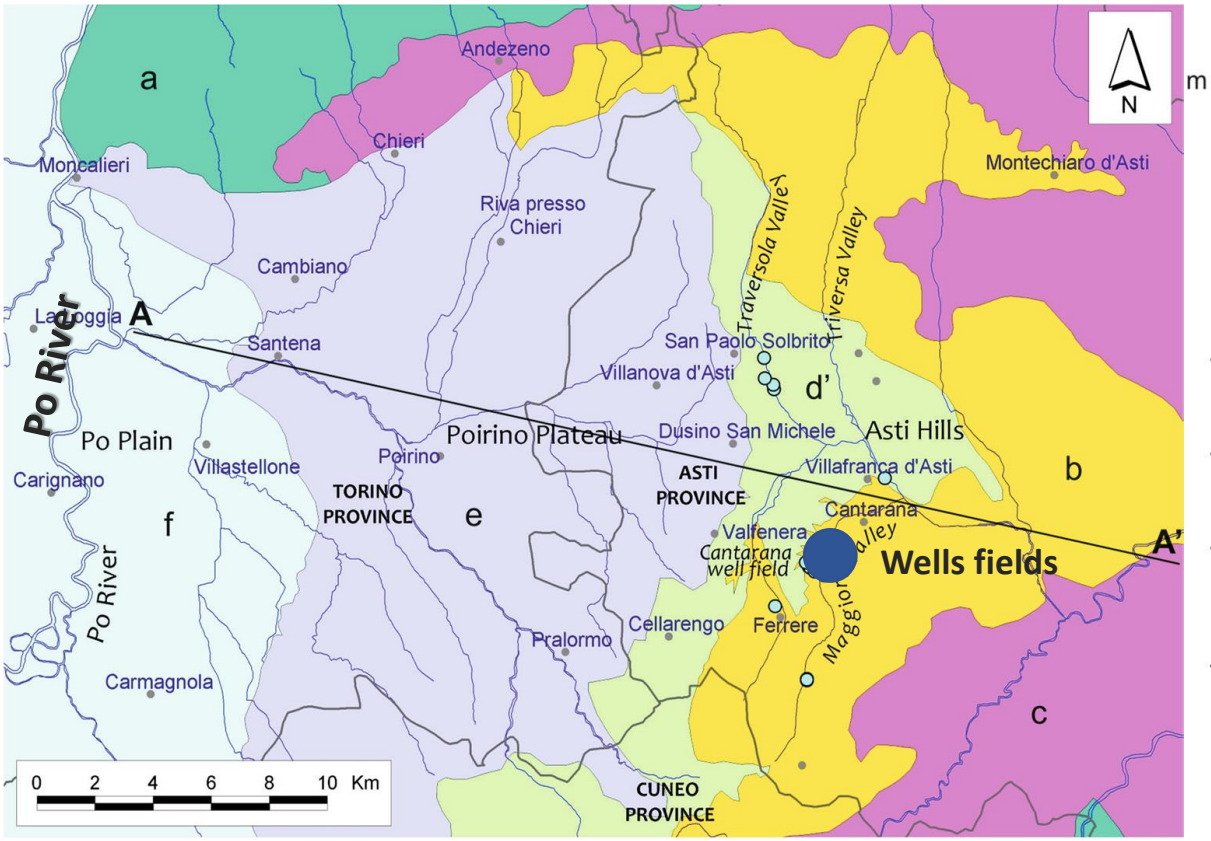
?

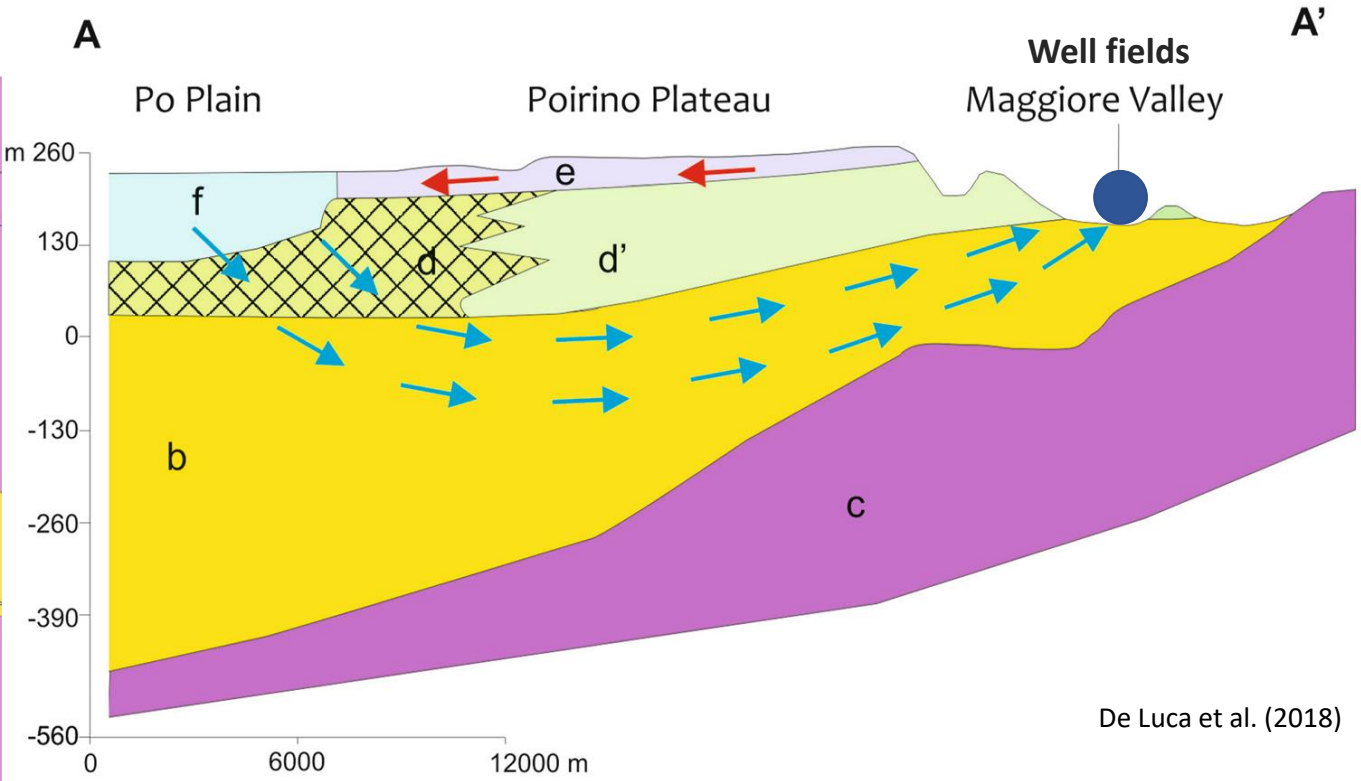


Due to the lack of other relevant sources of drinking water in this part of Piedmont region, this well field represents a drinking water reserve of regional importance.

Study area

Geological-Hydrogeological framework





De Luca et al. (2018)

DESCRIPTION

groundwater flow direction

water well

e f Middle Pleistocene - Holocene alluvial complex (e = Porino Plateau deposits; f = Po Plain deposits)

d d' Middle Pliocene - Lower Pleistocene villafranchian transitional complex (d= gravel and sand; d' = silt and clay)

b c Pliocene marine complex (b = Asti Sands; c = Lugagnano Clay)

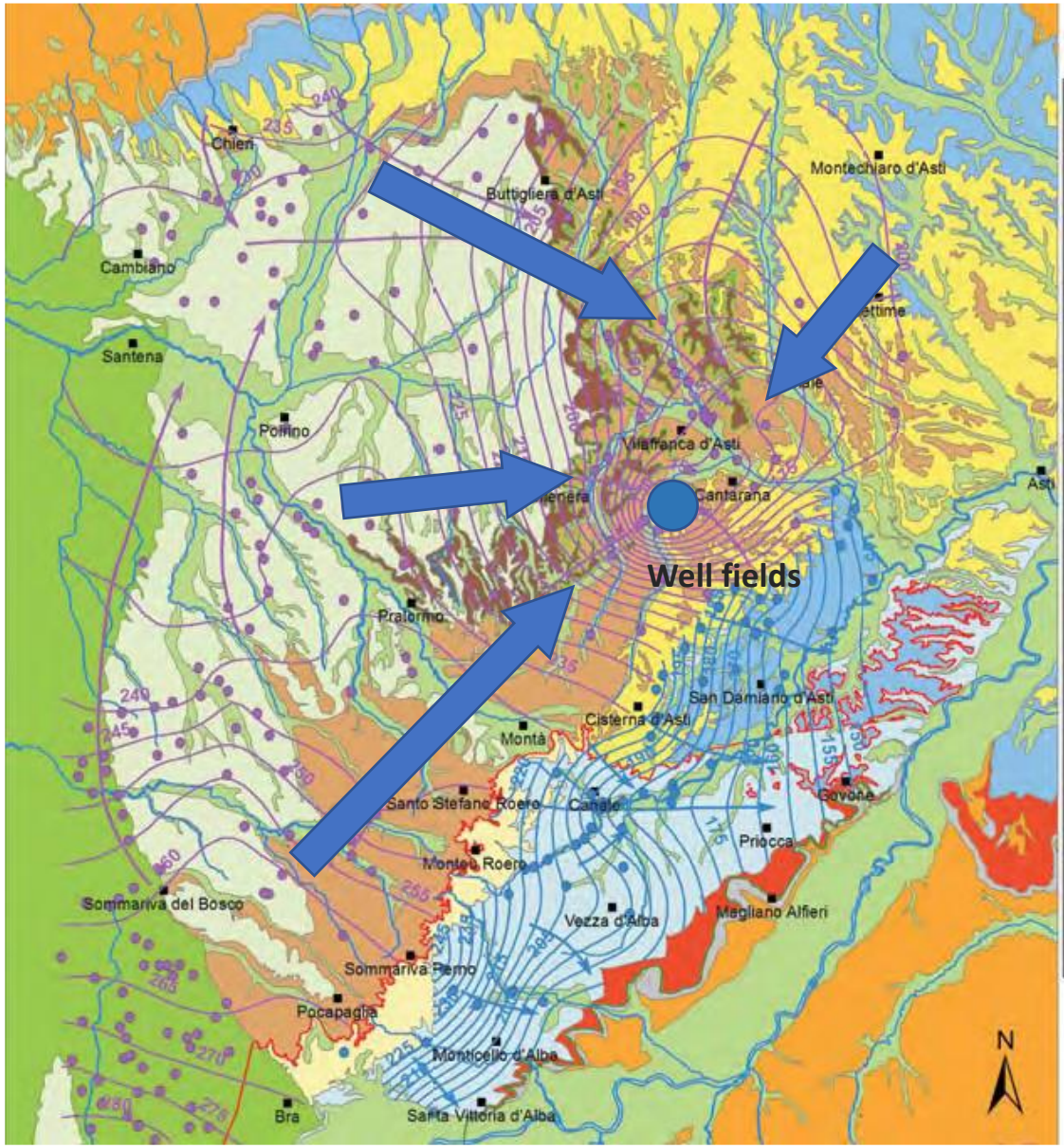
a Pre-Pliocene marine complex

Study area

Geological-Hydrogeological framework

Deep flow converging to the well field area due to the withdrawal.

Excessive withdrawal has created a piezometric level decrease of 60 m in a century



Vigna et al. (2010)

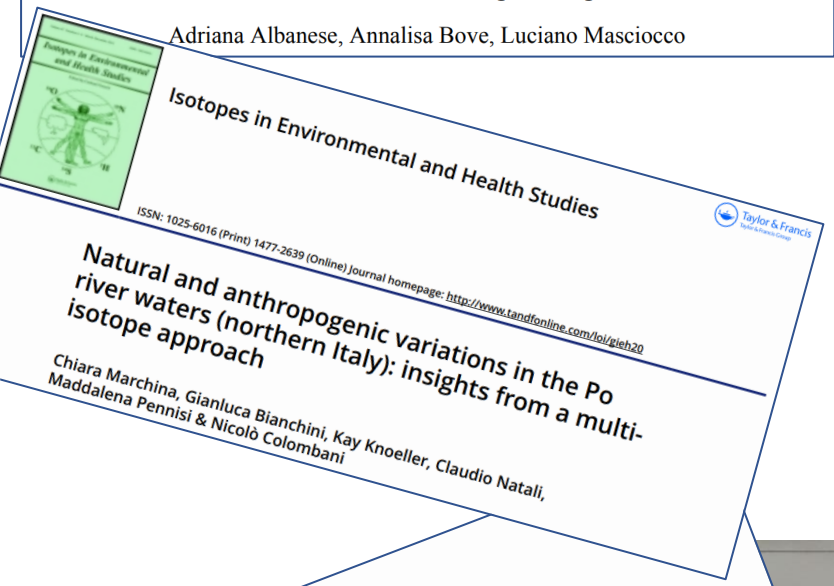
Previous studies

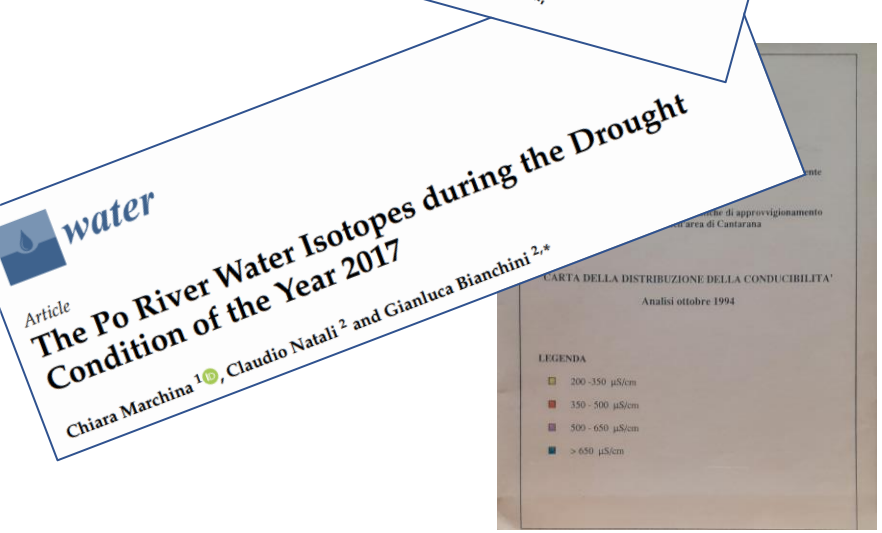
Chemical studies

Giornale di Geologia Applicata 2008, 8 (1) 41-48 - doi: 10.1474/GGA.2008-08.1-04.0199

Differenziazione idrogeochimica e isotopica dei circuiti idrici sotterranei nel settore sud-occidentale della pianura piemontese

Adriana Albanese, Annalisa Bove, Luciano Masciocco





Other studies

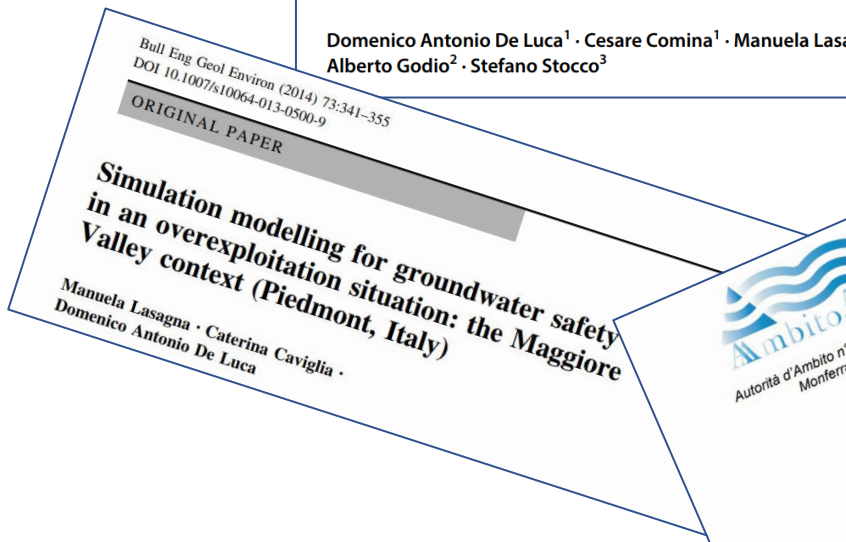
Environmental Earth Sciences (2018) 77:19
https://doi.org/10.1007/s12665-017-7218-0

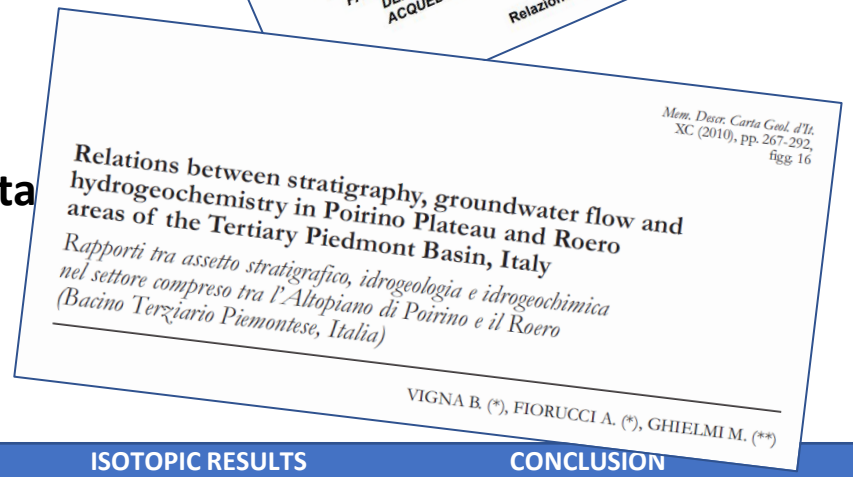
ORIGINAL ARTICLE

CrossMark

Effectiveness of geophysical surveys for water wells relocation in overexploited aquifers (the example of Maggiore and Traversola Valleys, Northwestern Italy)

Domenico Antonio De Luca[1] · Cesare Comina[1] · Manuela Lasagna[1] · Enrico Destefanis[1] · Luciano Masciocco[1] · Alberto Godio[2] · Stefano Stocco[3]





Unpublished groundwater isotopic data

Franchino 2014

Sangiovanni 2016

Data

Sampling March 2021 and June 2021

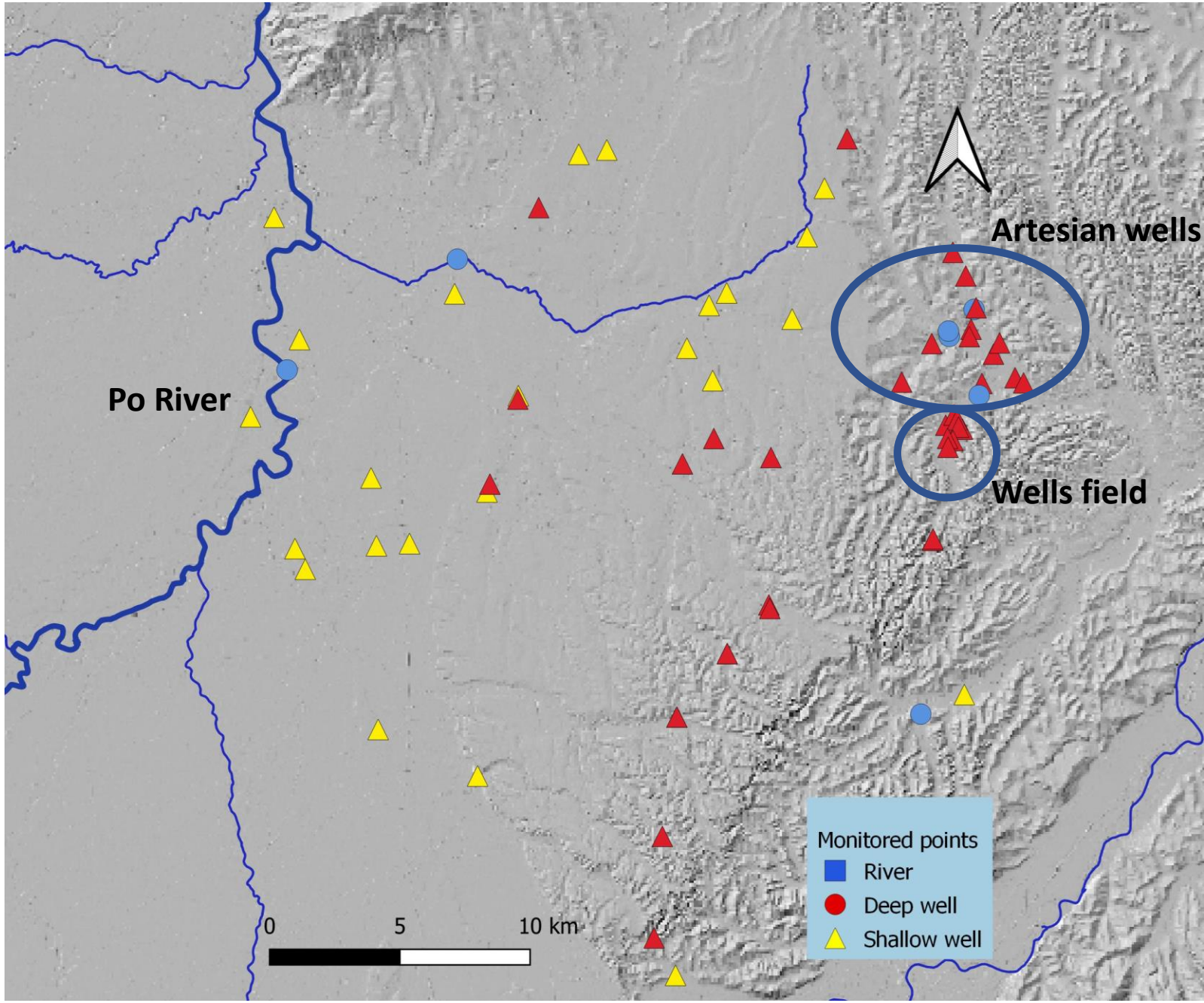
128 chemical analyzes

Chemical monitored points

Shallows wells

Deep wells

Rivers



Data

Sampling March 2021 and June 2021

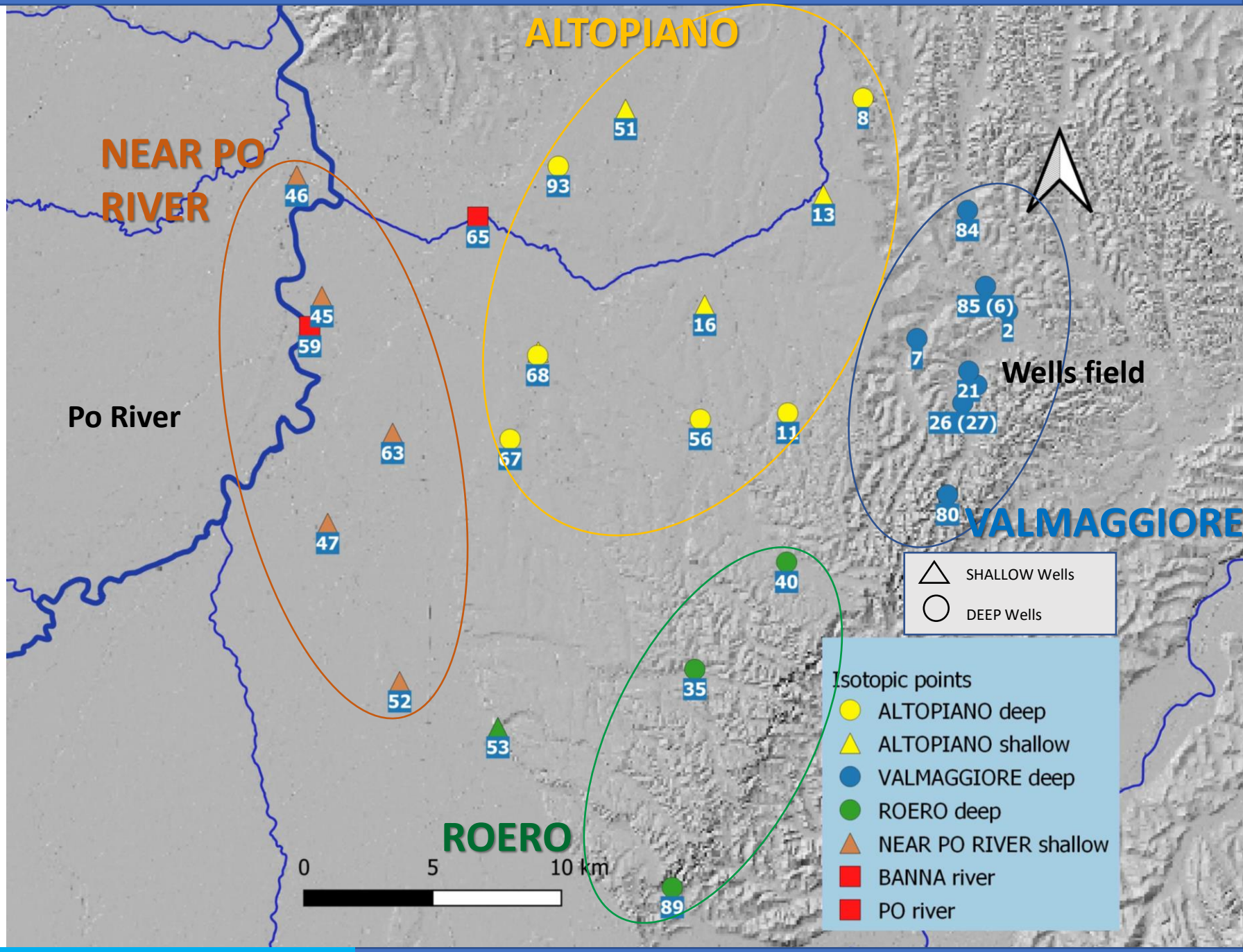
50 isotopic analyzes ($\delta^{18}O/\delta^{2}H$)

Isotopic monitored points

Shallows wells

Deep wells

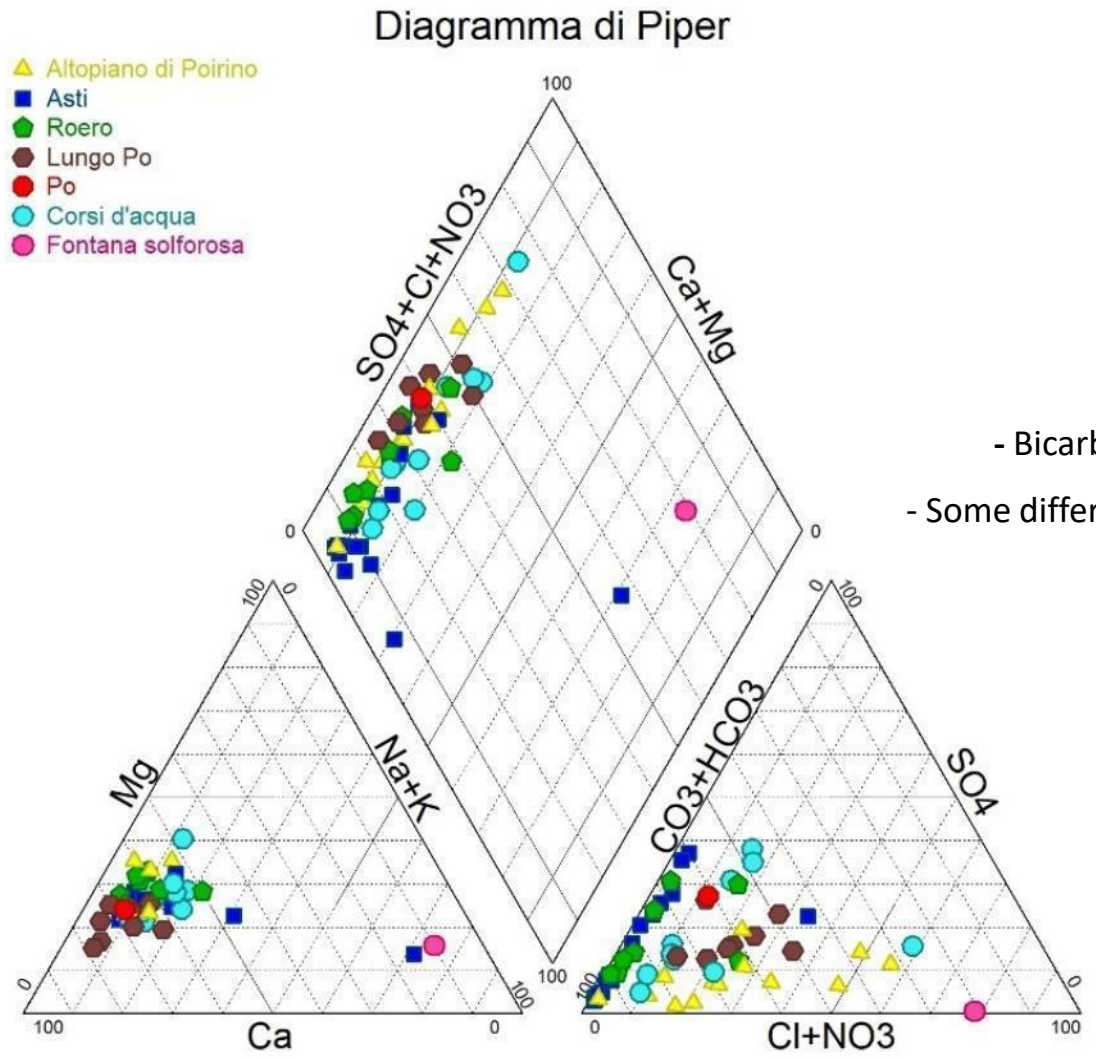
Rivers



Chemical results

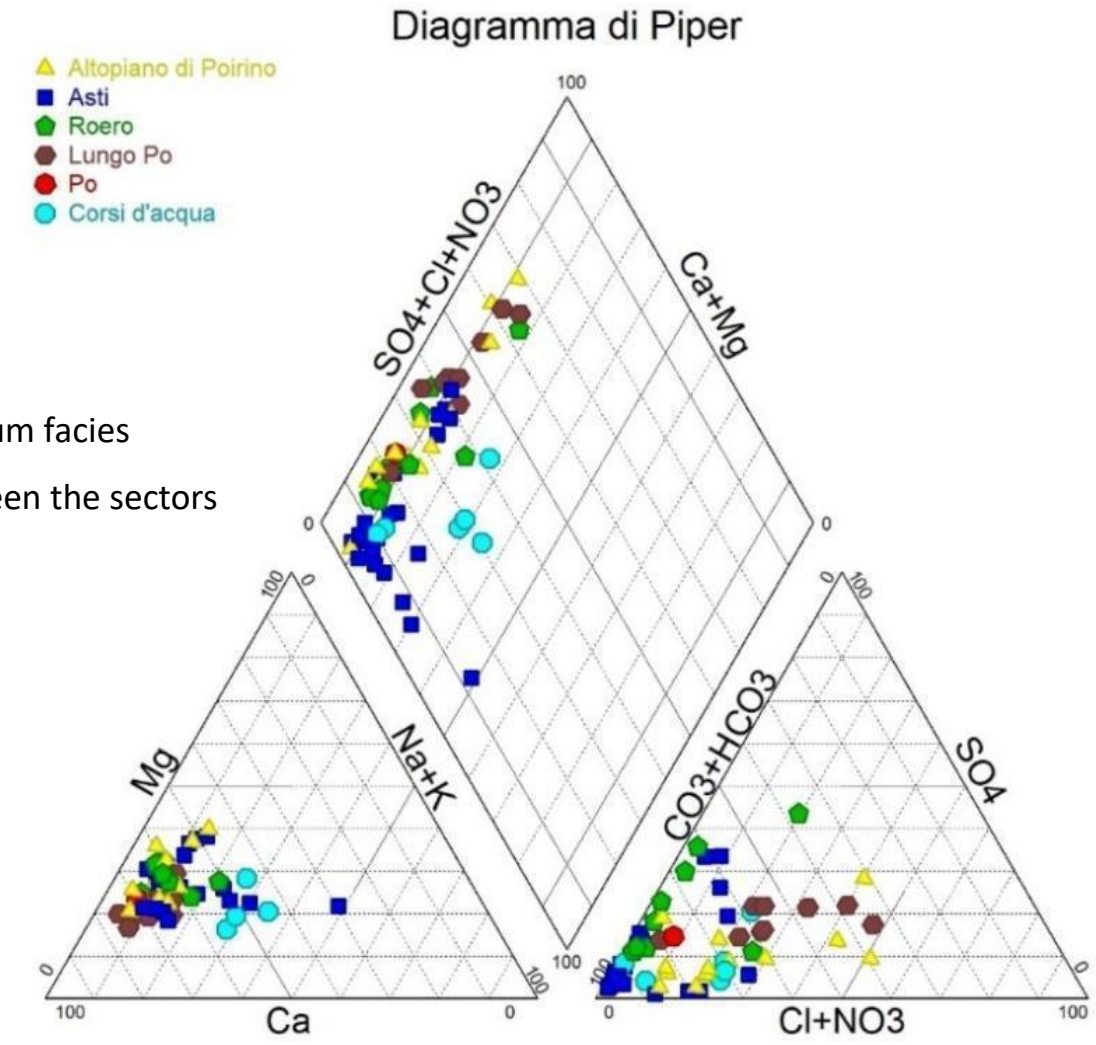
Piper

I campaign (March 2021)



- Bicarbonate-calcium facies
- Some differences between the sectors

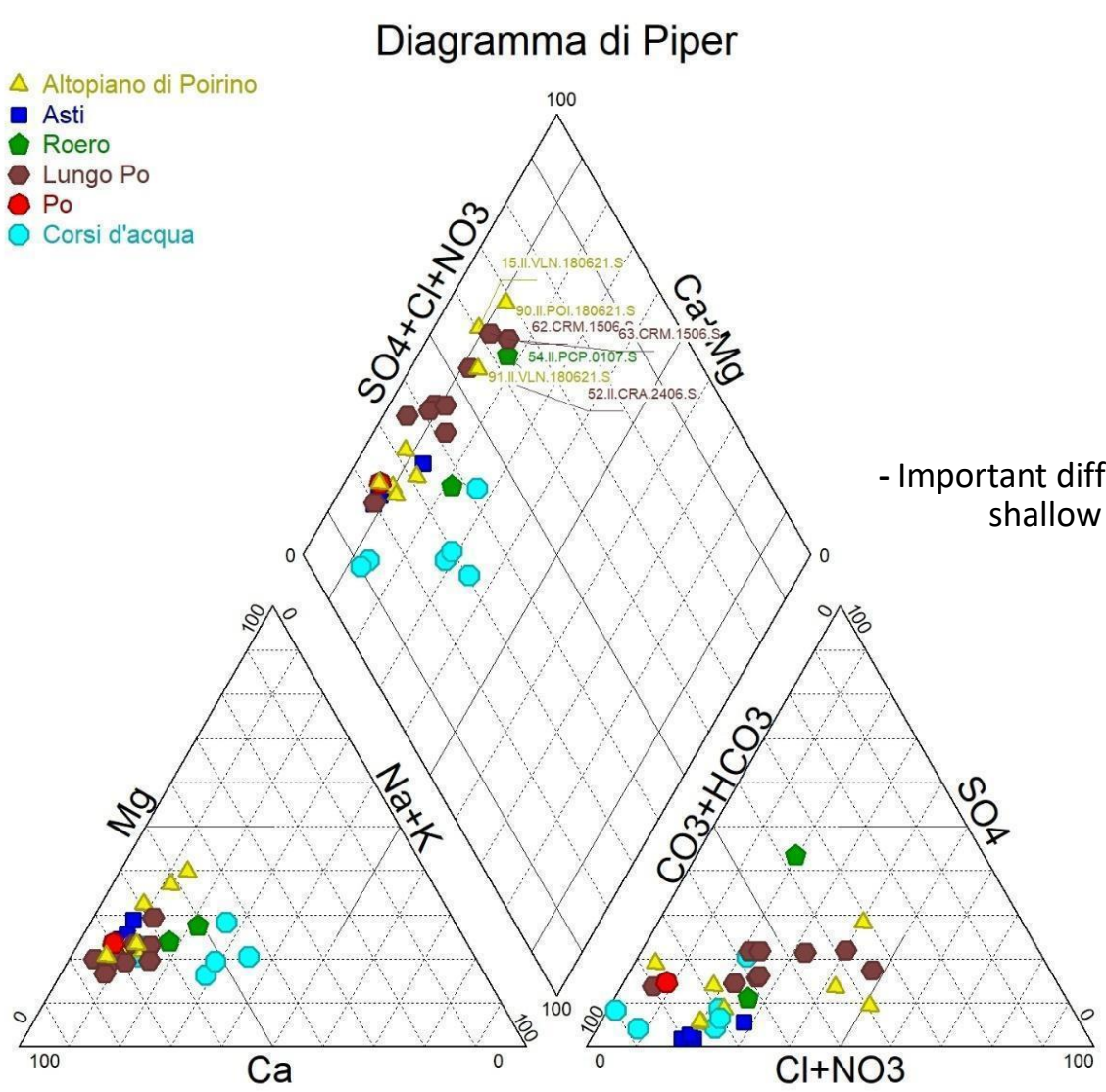
II campaign (June 2021)



Chemical results

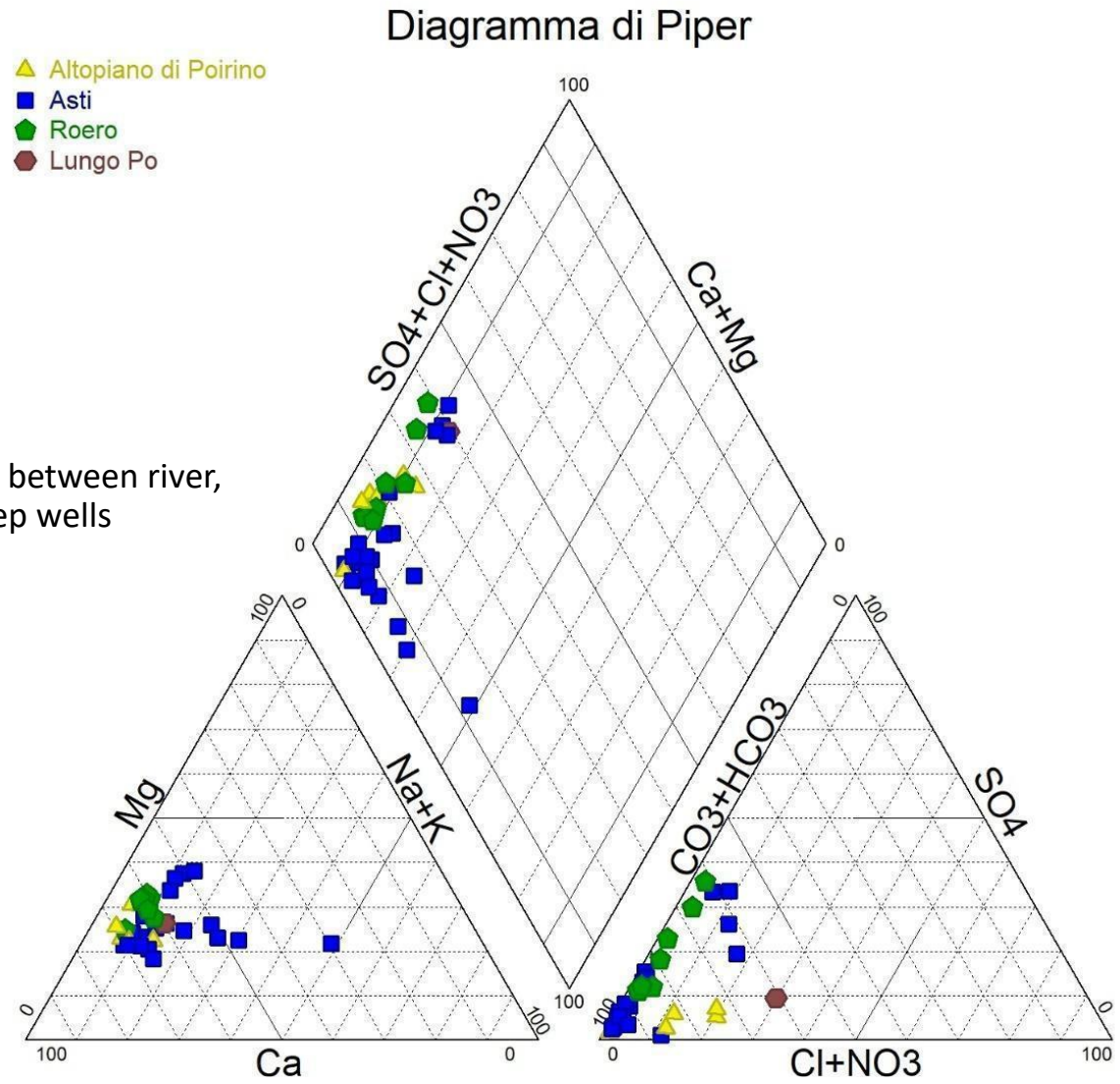
Piper

Shallow wells - River



- Important differences between river, shallow and deep wells

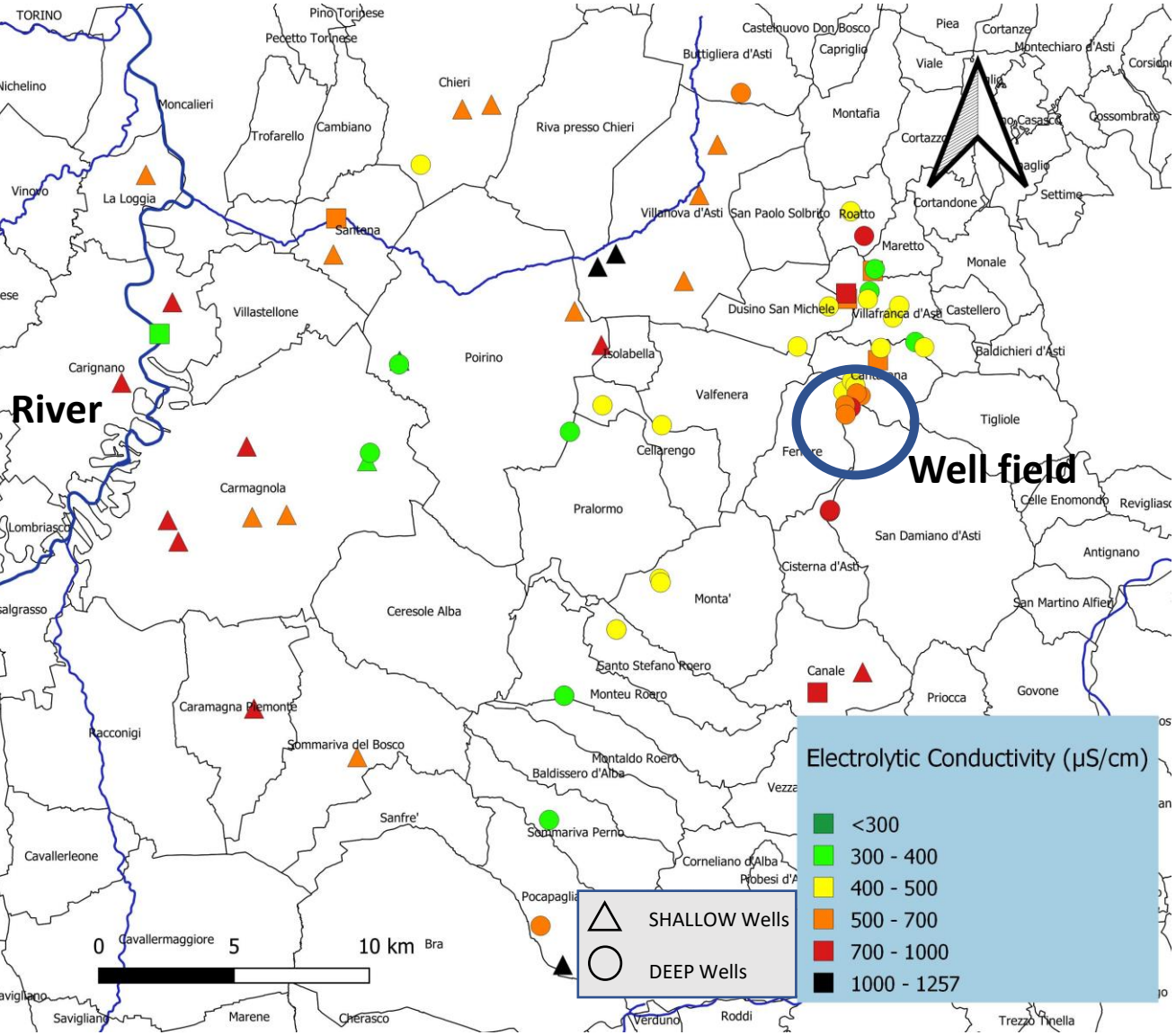
Deep wells



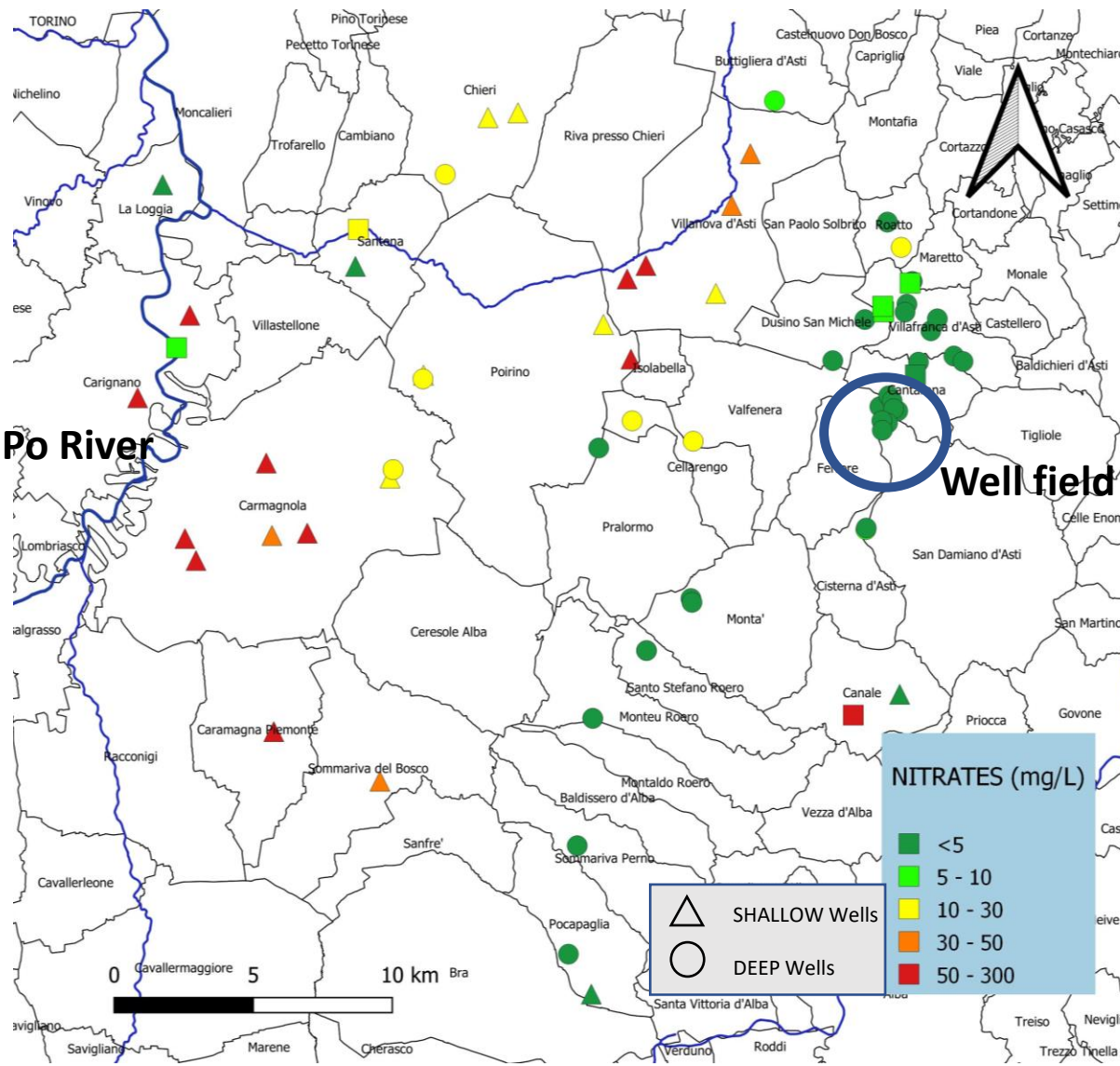
Chemical results

Areal distribution

Electrolytic conductivity



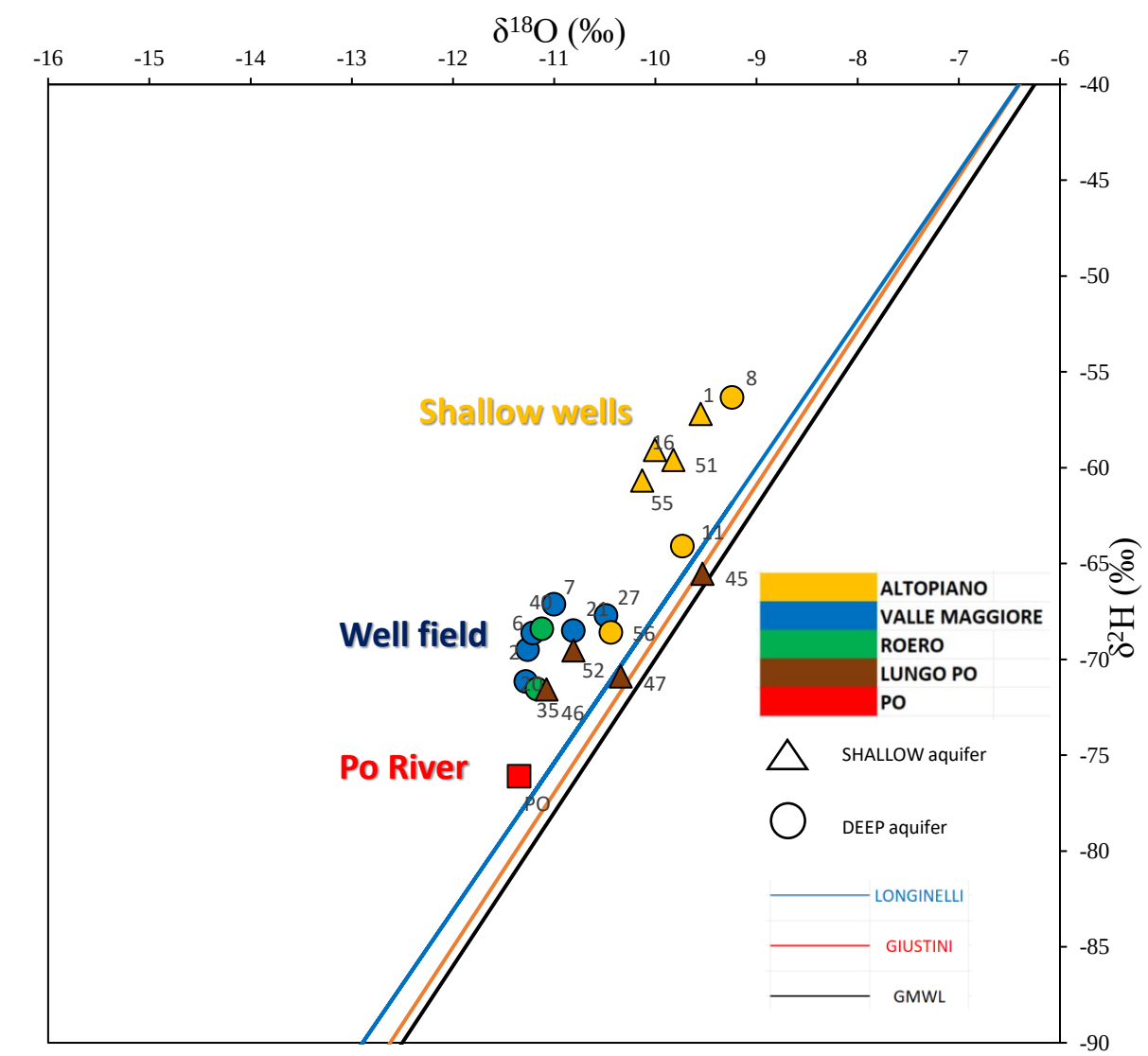
NO_3^-



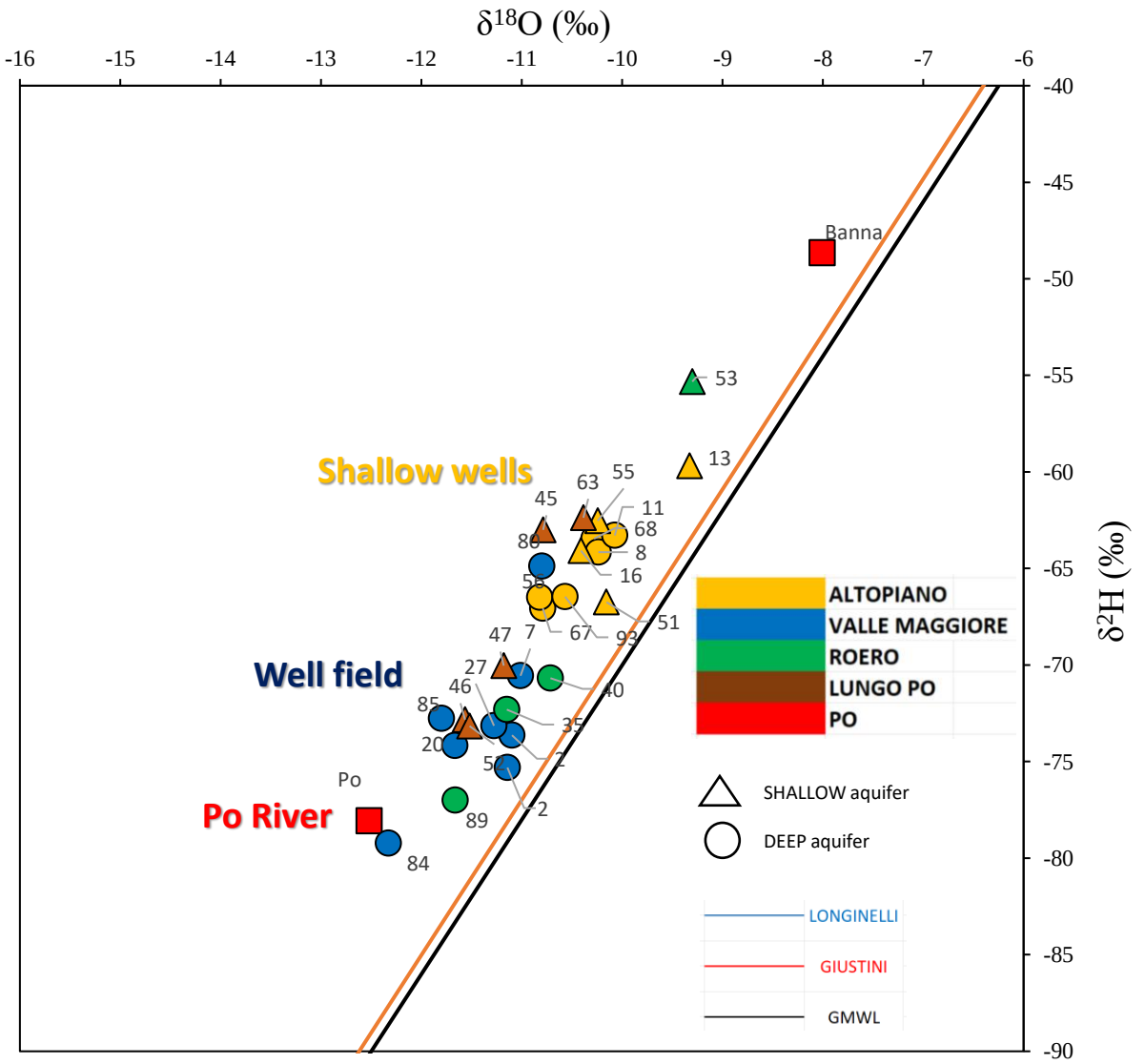
Isotopic results

$\delta^{18}O/\delta^{2}H$

I campaign (March 2021)



II campaign (June 2021)

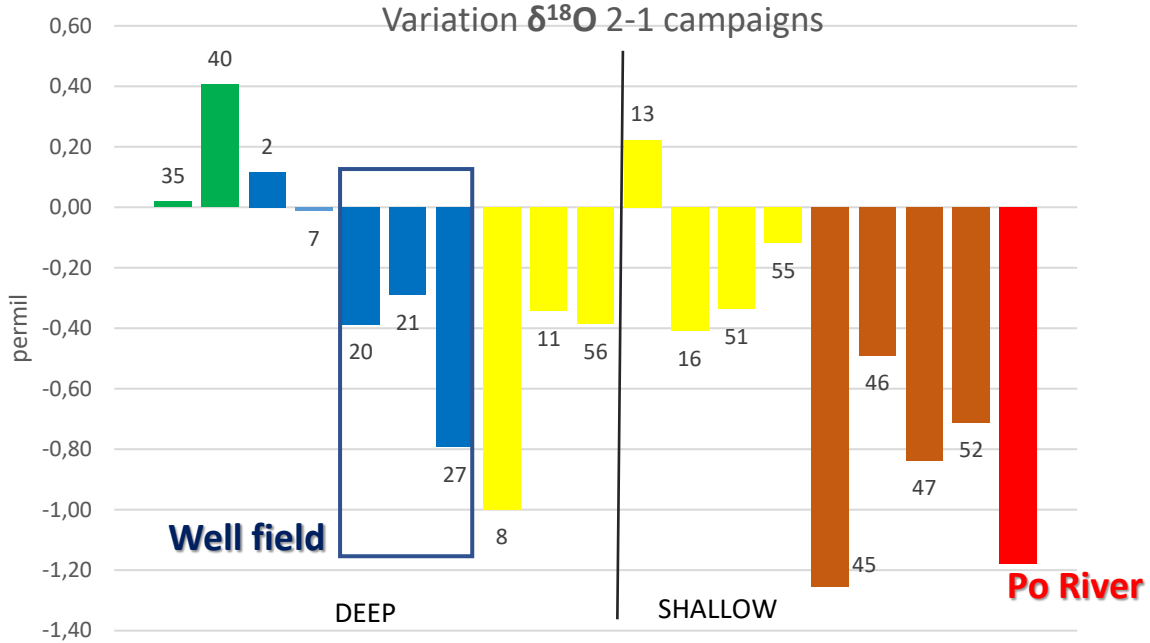


- Important differences between river, shallow and deep wells

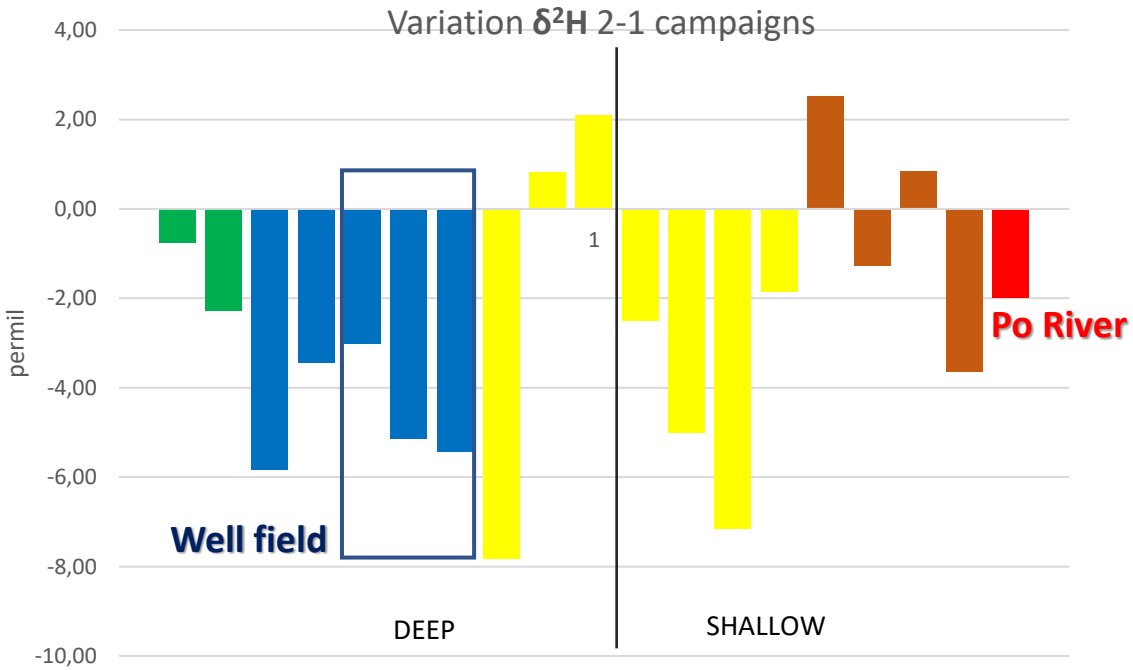
Isotopic results

Time variation

$\delta^{18}O$



$\delta^{2}H$

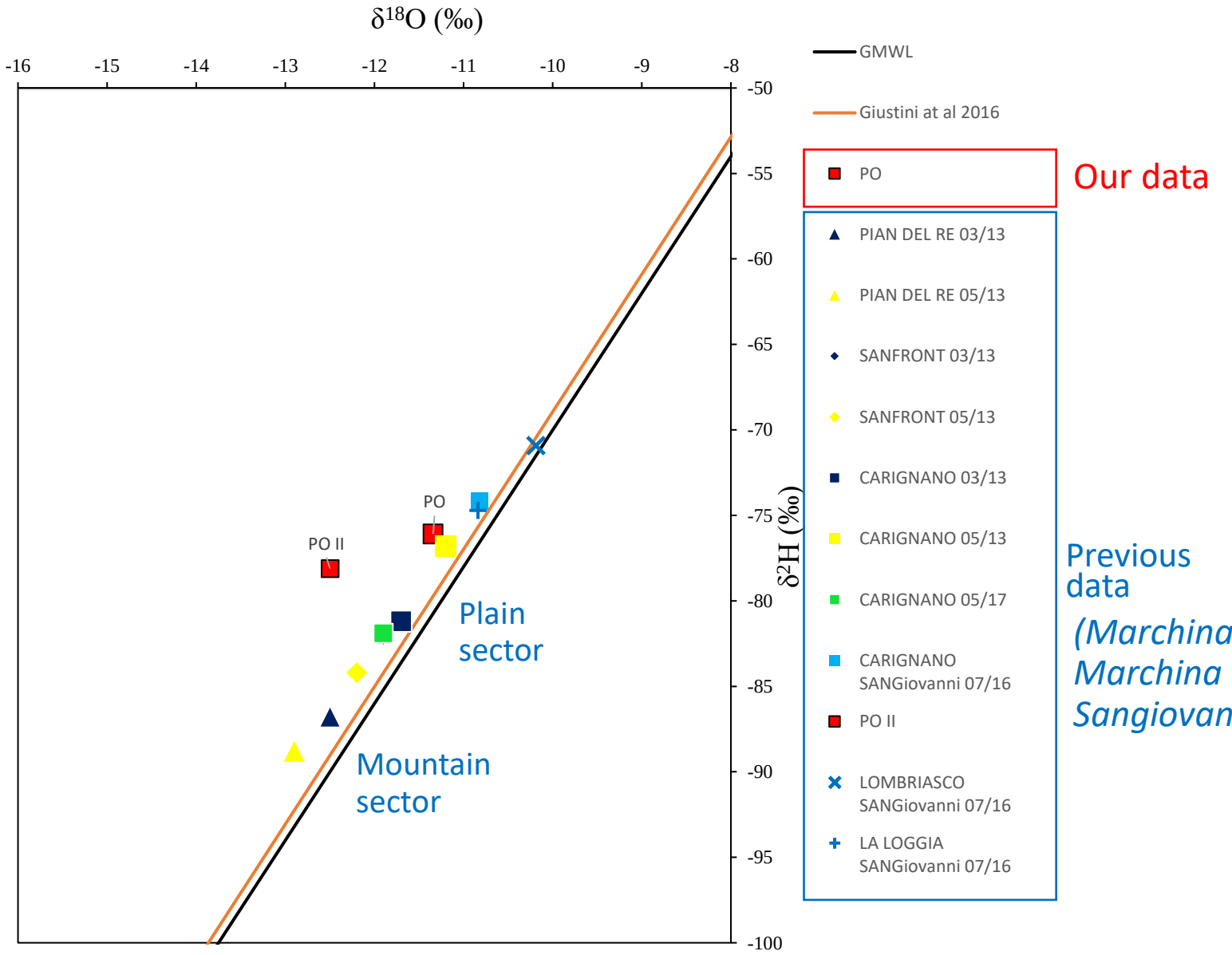


Isotope signal negativization in June compare to March (opposite trend to precipitation)

Po River similar to shallow wells

Isotopic results

Comparison Po River



Our data

Previous data

(Marchina et al. 2016, Marchina et al. 2019, Sangiovanni, 2016)

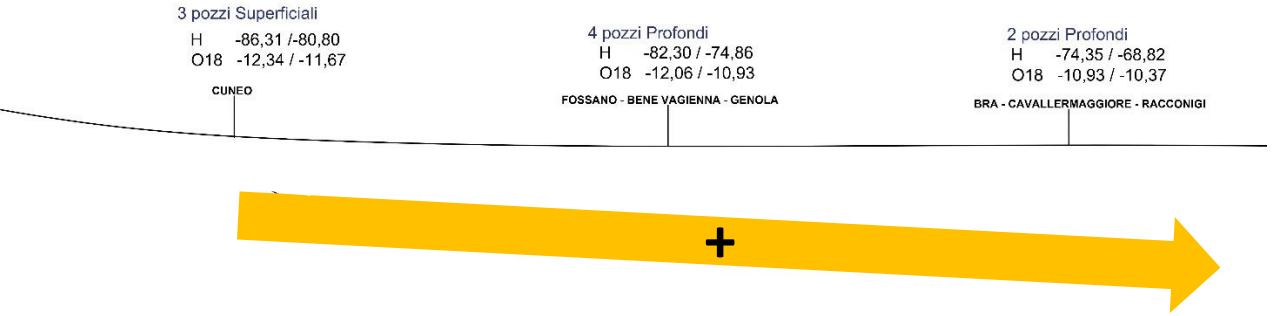
Isotopic results

Comparison Groundwater data

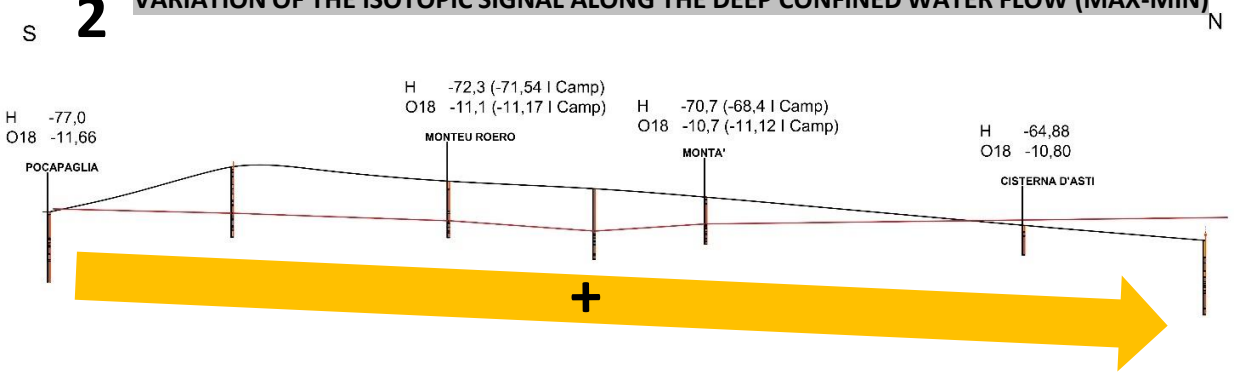
Deep confined aquifers

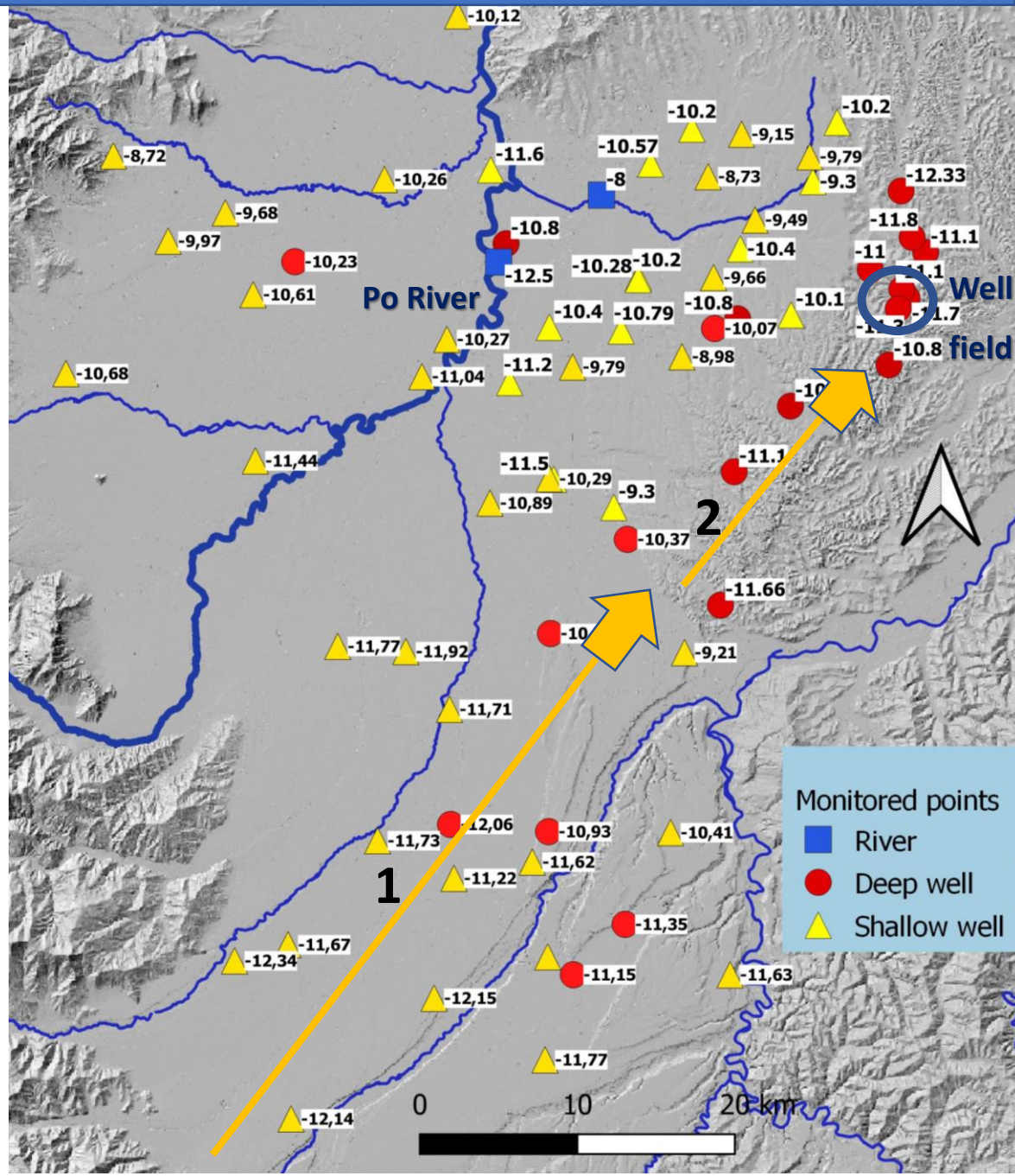
Progressive isotope signal positivization due to the interaction with the more positive shallow unconfined aquifer

1 VARIATION OF THE ISOTOPIC SIGNAL ALONG THE DEEP CONFINED WATER FLOW (MAX-MIN)



2 VARIATION OF THE ISOTOPIC SIGNAL ALONG THE DEEP CONFINED WATER FLOW (MAX-MIN)





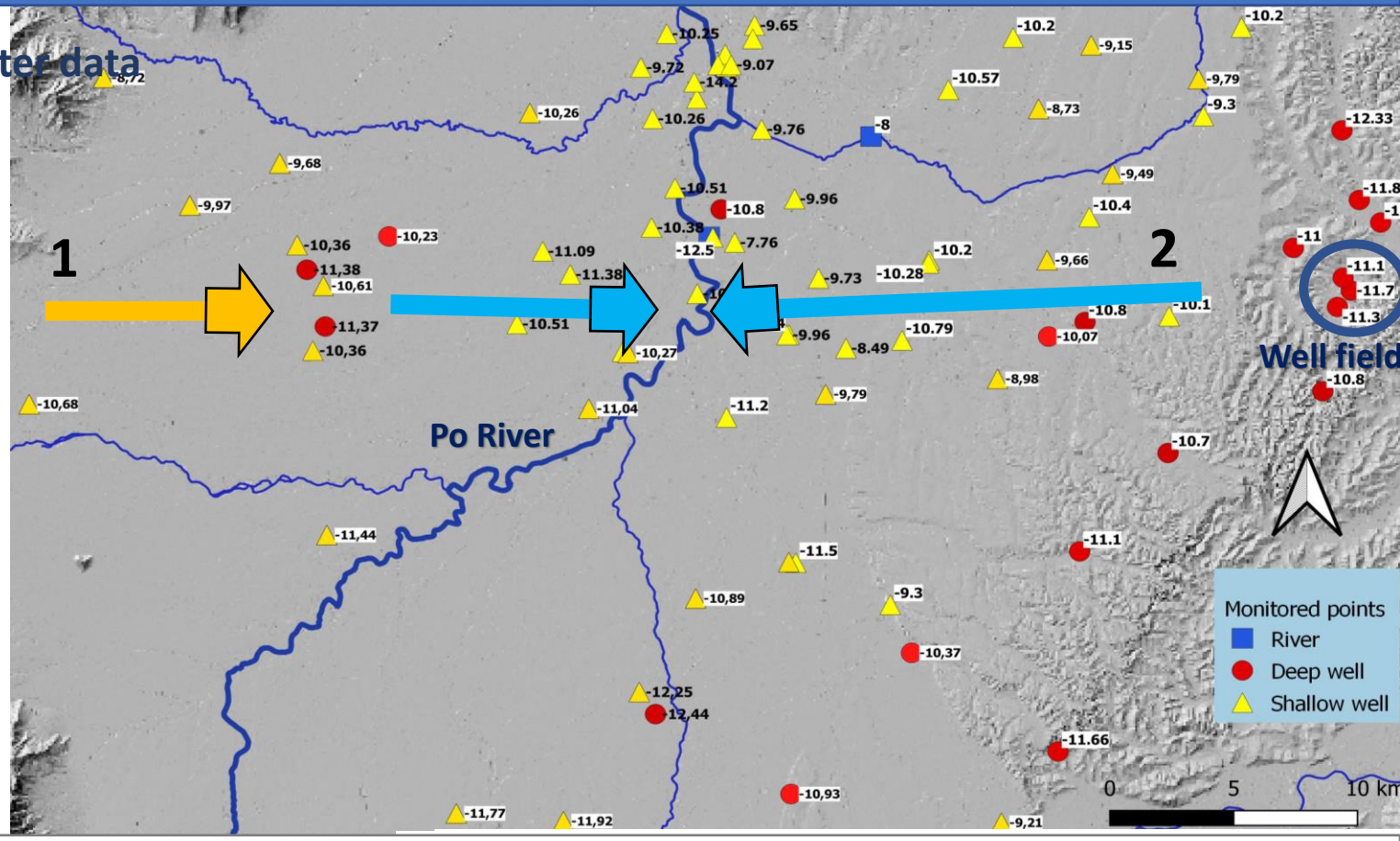
Isotopic results

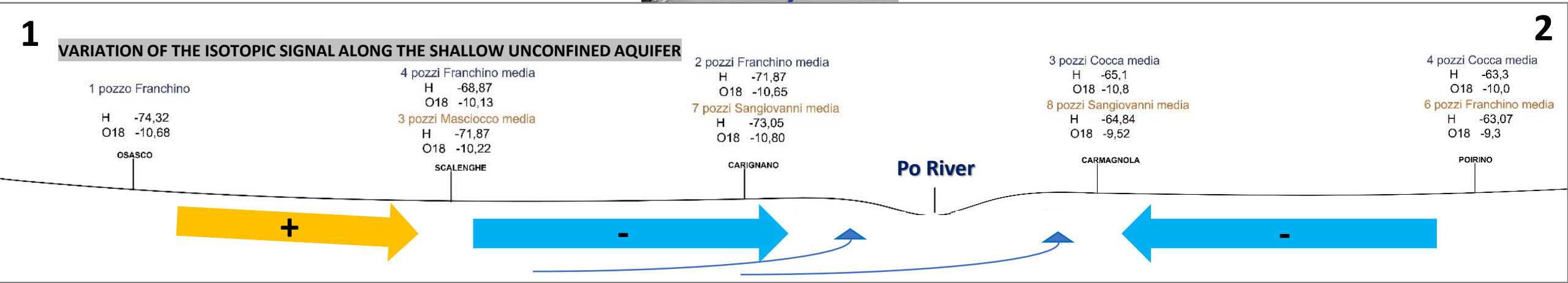
Comparison Groundwater data

Shallow unconfined aquifers

Initial isotope signal positivization, subsequent negativization near to the Po River.

mixing with the deep aquifer groundwater under pressure due to the absence of impermeable levels separation





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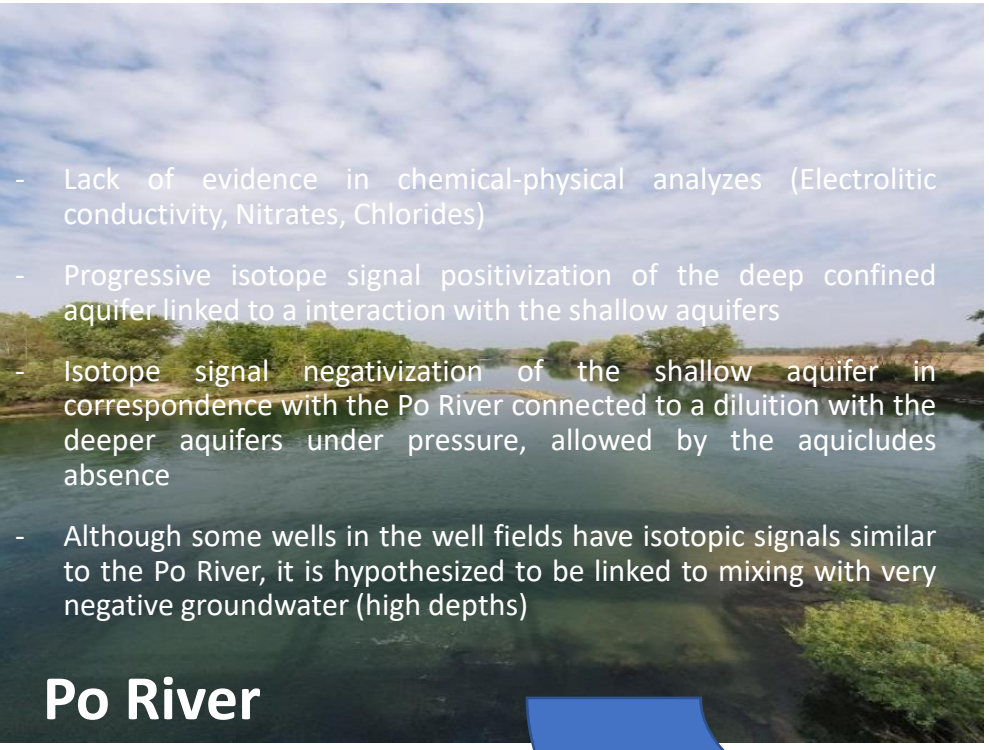
Conclusion

Does an interaction between the Po River and the unconfined and confined aquifers?



- Lack of evidence in chemical-physical analyzes (Electrolitic conductivity, Nitrates, Chlorides)
- Progressive isotope signal positivization of the deep confined aquifer linked to a interaction with the shallow aquifers
- Isotope signal negativization of the shallow aquifer in correspondence with the Po River connected to a diluition with the deeper aquifers under pressure, allowed by the aquicludes absence
- Although some wells in the well fields have isotopic signals similar to the Po River, it is hypothesized to be linked to mixing with very negative groundwater (high depths)

Po River

The interaction between the Po River and deep aquifers is possible due to the reduced difference in the isotopic signal between the two end-members.

The study provides an additional tool for a better groundwater management and protection of a regional importance drinking water reserve.

Wells fields

Thank you for the attention

Guano, Ecuador *2022 May*