

Location of aquifer

Coastal Pisan Plain, Italy

Reported by

Doveri, M., Giannecchini R., Menichini M.

Type of medium (Karst, porous, fracture)

Porous

Type of aquifer (phreatic or confined)

Mainly confined

Main lithology - (e.g. gravel, sand and clay)

Multilayered system. Three types of hydrogeological units were classified: gravel (the main aquifer, mostly confined), sand and silty sand, clay and silt (mainly impermeable).

Hydrochemistry: fresh or saline

Fresh, locally partially salinized (max 10%)

Saltwater intrusion: lateral from sea or lakes – upconing

Lateral and upconing.

Aquifer geometry: hydraulic characteristics

The gravelly aquifer has hydraulic conductivity (K) ranging from 2.5×10^{-2} to 9.9×10^{-5} m/s

Aquifer parameters: storage - annual water pumping - (in MCMA - millions cubic meters, annually)

Not available.

Depth of aquifer (water level and bottom) - water level 5-30 m - aquifer depth - 50-200 m

Piezometric level below the sea level in most of the area during the monitoring period (Oct 2012-Feb 2014)

Major chemistry (anions - ?; Cations - ?)

Prevalently Ca/HCO_3 - SO_4 water circulation, locally evolving towards Na/Cl composition as a consequence of seawater mixing.

Major salinity sources

Mixing processes between freshwater and seawater occurring both directly from the sea and from the Arno river (Doveri et alii, 2010; Butteri et alii, 2010).

Population

90.000 people and tourist attitude

Aquifer status: special features - e.g. thermal springs, major faults,...

-

Investigation methods - e.g. water level measurements, EC (electrical conductivity profiles), TDEM (geophysical), chemical and isotopic methods, age determination, IR survey, seepage meters (for Submarine Groundwater Discharge, SGD)

Slug and pumping tests were performed. Monitoring network of 40 wells/piezometers on 60 km², for measurement of water-head, physical-chemical parameters, water stable isotopes. Vertical logs of EC and T were performed.

Numerical hydrological modeling

-

Monitoring methods applied and duration - water level measurements, EC (electrical conductivity profiles - seasonal)

Continuous monitoring network formed of 13 multi-parameter probes, which hourly record water level, EC and T since August 2012. These data are compared with rainfall and hydrometric level of the Arno River. Eight piezometric and sampling surveys were performed for groundwater and surface water. Data on major elements and water isotopes are available for five surveys (253 samples).

Management methods

-

Aquifer management actions

-

Identification of existing or potential problems

The gravelly horizon of the Pisa plain multilayered system hosts a very important water resource for drinking, industrial and irrigable uses. A significant exploitation along the coastal area is however present to supply farms and tourist services. The main results point out as the gravelly confined aquifer of the Pisa Plain is interested by seawater intrusion mainly in the southern part, up to 6-7 km inland from the shoreline. This

process seems to occur by a direct intrusion of seawater within the gravelly aquifer for the heavy pumping. Despite the less amount of salt water, in the northern part of the study area, the seawater intrusion appears developing by means of more complex mechanisms, in which the water hosted in the sandy shallow aquifer is also involved.

References

Giannecchini R., Doveri M., Menichini M., Butteri M., MONITORING NETWORK OF SEAWATER INTRUSION IN THE GRAVELLY CONFINED AQUIFER OF THE COASTAL PISAN PLAIN (NORTH TUSCANY, ITALY), Poster presentation, AQUA2015, 42nd IAH Congress, 13-18 September, Rome.

Doveri M., Giannecchini R., Butteri M., 2010. SEAWATER INTRUSION IN THE VERSILIESE-PISAN COASTAL AQUIFER SYSTEM (NORTH-WESTERN TUSCANY): RESULTS FROM A HYDROGEOLOGIC-HYDROGEOCHEMICAL STUDY. Salt Water Intrusion Meeting, Azores 2010. Proceedings SWIM21, 150-153.

Butteri M., Doveri M., Giannecchini R., Gattai P., 2010. HYDROGEOLOGIC-HYDROGEOCHEMICAL MULTIDISCIPLINARY STUDY OF THE CONFINED GRAVELLY AQUIFER IN THE COASTAL PISAN PLAIN BETWEEN THE ARNO RIVER AND SCOLMATORE CANAL (TUSCANY). Mem. Descr. Carta Geol. d'It. XC (2010), 51-66.