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TWO-DIMENSIONAL NUMERICAL MODELLING OF THE ROCCAMONFINA VOLCANIC AQUIFER TO CONSTRAIN THE RECHARGE FROM DEEP RESERVOIR

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Two-dimensional numerical models can represent a valid support to regional 3D modelling. Numerical investigations can be performed isolating a few salient hydrogeological properties, to clarify dynamics, which cannot be understood with a high number of unknowns. A local preliminary 2D model was built on a 1 km section with a high concentration of observed data. The finite element code was FeFlow 6.2 and calibration of data was performed via inverse modelling through FePest (PEST code). The study area corresponds to the eastern slope of the Roccamonfina Volcano and the Riardo Plain. The geological setting was elaborated using borehole stratigraphic data. The carbonate basement is covered by 20 meters of clay deposits and by 240 meters of volcanic deposits. A volcanic and a carbonate aquifer can be distinguished at regional scale. The multilayered volcanic aquifer presents a radial flow towards gaining streams and it is recharged by direct infiltration. Regional information about the carbonate aquifer are not available, since the monitoring points are mainly placed in the Ferrarelle bottling plant. The basement upraise and the fault systems allow the local mixing between the carbonate and volcanic aquifers. As a result, the potentiometric levels nearby the mixing area are very similar in absolute values and trends. The recharge of the volcanic aquifer was calculated elaborating thermo-pluviometric data of 2000/14 period and calculating the potential evapotranspiration using Thornthwaite's method. Recharge of the carbonate aquifer is likely to upflow from the deep reservoir, but no direct information are available about rates and spatial distribution. Aim of the 2D numerical model was to test different hypothesis of possible bottom recharge ranges. Transient calibration of the model was performed trying to fit the static levels recorded in 2000/04 period into two wells, one tapping the volcanic and the other the carbonate aquifer. Groundwater levels during the monitoring period show an annual cyclic trend related to the rainfall recharge and to the agricultural withdrawals. A longer superimposed trend seems to be present in the analyzed time interval. In the 2D simplified system, rainfall recharge was applied daily as calculated from the budget and the vertical discretization of the aquifers was set according to the stratigraphic information. A constant bottom recharge was fixed, splitting the time series on a yearly basis. The calibration, performed over conductivity and specific storage, gave good results of the yearly level oscillations but seems not able to reproduce the long time trend, which therefore, requires further evaluations. The obtained results show the higher amount of the rainfall recharge (around 60%) over the carbonate recharge (around 40%). This fundamental information will be extended to the complete time series, and included in a

complex highly-parametrized regional 3D model in order to constraint the ranges of the applicable carbonate recharge.