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Numerical assessment of chemical species infiltration in the Prosecco area

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The multidisciplinary research project SWAT - Subsurface Water quality and Agricultural pracTices monitoring - has been set up to assess pesticides contamination risks for groundwater in the hills of Prosecco in the north-east of Italy. The unconfined aquifer underneath the typical Glera grape-variety vineyards of Valdobbiadene and Conegliano is used as water supply resource for human consumption. The principal aim of the project SWAT is to obtain a thorough information on the impact of contaminants coming from agricultural practices and infiltrating in the soil of well protection areas. Based on specifically designed field experiments, a study on water and solutes infiltration process is developed to understand the movement and evolution of chemical species in the vadose zone. A one-dimensional transport model for unsaturated media (BRTSim - Maggi, 2015) is used to simulate solute infiltration and estimate the soil hydraulic parameters. Monitoring activities started in November 2018 in two experimental sites (the Settolo site in Valdobbiadene and the Colnù site in Conegliano) near supply wells surrounded by vineyards. A mixture of Bromide and Glyphosate was identically applied on two parcels of 25 m^2 for each experimental site to obtain information about spatial heterogeneity and to collect independently water and soil quality measurements. Porous cups, for the collection of infiltrating water, and capacitive sensors, to gauge temperature and Volumetric Water Content (VWC), were installed beneath the sectors at three depths (-0.1, -0.3, -0.7 m). In each site meteorological station provides hydrological data. At first, laboratory analysis on soil samples collected at the same depths gave a vertical distribution of the sector-specific soil texture that was used as input for Rosetta to obtain initial estimations of retention curve behaviour and the saturated hydraulic conductivity. These data allowed us to develop an open-loop simulation using the early meteorological observations as hydrological forcing. As the laboratory analysis on soil and water samples proceed and the number of in-situ measurements increases, different data windows are tested to improve the performances of the calibration procedure performed using PEST. In all tests a spin-up procedure is applied to mitigate the dependency of the results on the imposed initial data by repeating the first month of hydrological forcing three times. The results of the transport model using Rosetta parameters are already satisfactory in terms of VWC trends even if they are considerably shifted respect to the measured values. The calibration reduces the gap between model results and observations, but the behaviour seems to get worse in dry conditions. Improvements are achieved in the upper layer (-0.3 m) applying evapotranspiration along the root zone. The Bromide simulations agree with the

infiltration behaviour: its movement is well represented up to -0.3 m, while at -0.7 m the observed values are overestimated. Ongoing investigations on the glyphosate dispersion process show limited infiltrating mass in the water collected samples.