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Integration of agricultural, hydrological and hydrogeological stressors into the modelling of groundwater used for drinking water extraction

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Groundwater is Germany's dominant source of drinking water; in particular near-surface groundwater resources. Long-known pressures as well as emerging stressors such as unprecedented hydrological extremes, their related water quality issues and increased use competitions challenge the assessment of these resources' sustainability. More integrated modelling along with innovative model applications that go beyond climate impact model chain experiments are needed. As part of the funding measure BMBF LURCH, the StressRes project develops a coupled modelling approach that aims to assess stress on groundwater by way of specifically designed stress test model experiments. This contribution shows how the agro-economic model PALUD, the hydrological model RoGeR and the groundwater model MODFLOW are combined towards this task. In particular, we assess the challenges encountered in the case study area which encompasses several different drinking water protection areas in southwest Germany. The challenges include the two-way coupling of RoGeR and MODFLOW in the large catchment area that drains from the fissured mountain aquifer towards the alluvial valley aquifer recharging the aquifer at the foot of hillslopes as well as through rivers. The land use of the region is highly diverse and water quantity and quality need to consider crop rotations at small scales and irregular irrigation practices may affect the water balance. The underlying agro-economic decisions made in particular for the region-specific crops may affect nitrate leaching after drought events, which is one of the issues drinking water suppliers are facing. We present a baseline model along with the stress test scenarios that will be implemented.