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E-TEST Einstein Telescope EMR Site & Technology : Cross-border hydrogeological model

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The hydrogeological model developed within the framework of the E-TEST project must make it possible to answer 3 principal objectives:

1) to globalize the information available regionally on the hydrogeological functioning of the study area and to obtain a better understanding of the hydrogeological functioning of the aquifers
2) to quantify the volume of water that it will be necessary to drain in the galleries of the telescope and then pump it out of the site. These estimates will directly result in the dimensioning of the drains and pumps to ensure these operations without disturbing the functioning of the device. In order to provide a satisfactory answer to this question, it is necessary to take into account local scale phenomena such as faults in the vicinity of the site and the telescope elements.
3) to quantify the potential influence of these drainages on the aquifers of the area located at the border between the Fourons region, Wallonia and the south of the Dutch Limburg Province.

The aquifers likely to be impacted are (bottom to top): the Famennian sandstone aquifers, the aquifers of the Visean and Tournaisian limestones, Cretaceous aquifer, Paleogene aquifers.

On the basis of all available geological data a 3D geological model has been built using LEAPFROG ©. 4 main hydrogeological units have been used for providing first ranges of hydraulic conductivity values. North-South and West-East cross-sections in the modelled domain are shown. Conceptual choices for the regional 3D model are presented including boundary conditions, recharge conditions and pumping. For calibration in steady state, a sensitivity analysis was performed using 100,000 equiprobable distributed models generated by Monte Carlo simulations sampling stochastically within the logK values intervals of each hydrogeological unit. We used 1000 pilote points for smoothly varying K values. On the basis of results, the 10 best models (minimum RMS) are retained as starting conditions for PEST automatic calibration with 1516 pilote points (more pilote points in the top layers). Then 3 selected simulations with RMS < 15 m were kept for further developments. Results are shown in terms of calculated piezometric map in the modelled region.

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