OVERCOMING CHALLENGES IN GROUNDWATER MANAGEMENT

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To protect valuable water assets, ensure water security for communities, and safely manage critical resources, geoscience and engineering teams need an in-depth understanding of surface and groundwater interactions. But it is difficult to interpret and communicate complex conditions without a common understanding across teams, disciplines and the technologies employed by all. Discover how the effective combination of Geophysical inversion of electromagnetic (EM) data with a geological model derived implicitly using borehole information can accurately constrain the underlying aquifer, in a shareable 3D model. Also, learn how the modelling process and communication with a multi-disciplinary team is efficiently streamlined through interactive data management.

The evolution of the "Nebraska State Aquifer Project", created using publicly available airborne EM and borehole data downloaded from the Nebraska GeoCloud (NGC) digital platform (housing geophysical geological, and groundwater data), shows the process of running a cloud-hosted 3D Geophysical inversion to discern the relative conductivity distribution of the subsurface, constraining the extents of an aquifer. This geophysical inversion is then imported into a 3D geological model which has been created from pre-existing borehole data. The addition of the geophysical data allows for the refinement of the subsurface model and more accurate identification of the aquifer extents.

To truly understand the subsurface, a multidisciplinary approach is required, with the ability to rapidly collaborate with colleagues. Furthermore, the ability to invert geophysical information allows the integration of subsurface conductivities to be correlated to the geological model obtained from borehole data alone. The relative conductivity distribution of the subsurface can be related to various geological units of the aquifer-aquitard system in our geological model. As conductivity can be indicative of mineralization, fluid content and porosity, among other material properties, correlating the geophysical inversion with the geological model allows one to begin to make sense of the subsurface findings and form solid interpretations of the geological units of interest. Furthermore, the high resolution of the geophysical data provides additional insight into the geological model, which contains limited borehole information through the aquifer. Integrating geophysical inversions with a 3D geological model can aid in subsurface understanding and ultimately inform better drilling decisions.

To facilitate collaboration, the project is hosted on a cloud server so that different teams and stakeholders can access the project and raw data, view the subsurface digital twin in 3D, and track the changes made to the project as they happen. Cloud hosting also introduces multiple modeler workflows to simplify the sharing of data and projects between colleagues. The ability for 3D visualization and commenting on each revision permits interactive collaboration directly within the project, so the important discussions are easily accessible to everyone, and key decisions around future work can be made with confidence. New data can be incorporated with ease to further refine the model, allowing for an iterative update process to monitor ground water aquifers well into the future.