Although Aquanty has existed only since 2012, the development of HydroGeoSphere (HGS), Aquanty’s flagship water resources simulation platform, began in the early 1990s at the University of Waterloo. Since its inception as an integrated groundwater–surface water model, extensive functionality has been added to HGS through the efforts of numerous PhD students, postdoctoral researchers and visiting scientists within the research groups of Professor René Therrien at Laval University, and the longtime holder of the Canada Research Chair in Quantitative Hydrogeology, Professor Ed Sudicky at University of Waterloo.

HGS has come to be recognized as one of the world’s leading fully integrated hydrologic simulators. Hundreds of scientific journal articles have used HGS to help answer complex questions relating to how water (as well as potential water contaminants) moves across the land surface and through soil and subsurface geological materials.

Furthermore, much of HGS’s functionality has been developed in order to address hydrologic questions in regions of the world where there are significant seasonal differences in weather and climate, like Canada. Snow accumulation and melting, soil freezing and thawing, and temporally and spatially varying crop and vegetation water requirements must all be considered. For all these reasons, HGS is ideally suited to serve as the hydrologic simulator for the Assiniboine River Basin (ARB).

For the Manitoba Forage and Grassland Association’s Aquanty Assiniboine River Basin (ARB) project, not just one but five HGS models will be constructed, with coverage of the individual models ranging from over 150,000 km² for the
entire river basin, to 40,000 to 60,000 km² for each of the three major sub-basins that lie within the major river basin, down to 7,000 km² for the Birdtail Watershed, which is to be the subject of a very detailed analysis.

While the multiple models will have the ability to perform stand-alone simulations, they are being designed so they can take advantage of HGS’s unique ability to “nest” local-scale models within large regional-scale models. Model nesting, which can be considered analogous to telescoping from a wide-field low-resolution view of the landscape to a narrow-field high-resolution view, allows hydrologic information to be translated across multiple models so that small-scale, very highly resolved simulations can reflect the influence of large-scale regional hydrologic processes, such as groundwater flows or widespread snowmelt or precipitation events.

Since each of the HGS models will consist of over one million computational points, the data management and computational demands of this project are enormous. Hence the participation of ISM Canada (an IBM company) is an integral component of the ARB project. IBM advanced data analytics and visualization tools will be used to interpret output from the HGS models, and the simulations will be run on an IBM cloud-based High-Powered Computing platform. The combination of advanced data management technology provided by IBM and state-of-the-art water resources simulation science provided by HGS will result in a decision support tool for the Assiniboine River Basin that is best-in-class at a global level.