GISGroundwater － A seamlessly coupled GIS and distributed groundwater flow model

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Geographic Information System (GIS) is the major data source for many numerical groundwater models; and it is common practice to couple the models with GIS. There are three methods for coupling numerical groundwater models with a GIS, namely '*loose*', '*tight*', and '*seamless*'. In seamless coupling a model code is written into, and run from within, a GIS. A *seamless* GIS groundwater model facilitates the construction and simulation of the model, and the visualisation of the results all within the GIS environment. Currently, there is no seamlessly coupled GIS numerical groundwater-flow model. We have addressed this by developing a *seamless* GISGroundwater model, which consists of a finite-difference groundwater flow model and a user-interface, which are packaged up as an add-in for ArcGIS^{TM}. It can represent heterogeneous aquifers, variably confined and unconfined conditions, and distributed groundwater recharge and abstraction. GISGroundwater has been validated against analytical solutions to groundwater-head profiles for a range of aquifer configurations. It offers benefits in terms of ease of use and in streamlining the model construction and application process. This has been demonstrated in constructing a regional groundwater flow model for the Chalk aquifer in the Thames Basin, UK. Therefore, it allows non-modellers, such as scientists, students and even policy makers, to carry out numerical groundwater flow modelling in GIS. In addition, GISGroundwater can potentially be coupled with any GIS that handles raster datasets.