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# A physical data model for fields and agents

Kor de Jong, Merijn de Bakker, and Derek Karssenberg
Department of Physical Geography, Faculty of Geosciences, Utrecht University, The Netherlands (k.dejong1@uu.nl)

Two approaches exist in simulation modeling: agent-based and field-based modeling. In agent-based (or individual-based) simulation modeling, the entities representing the system's state are represented by objects, which are bounded in space and time. Individual objects, like an animal, a house, or a more abstract entity like a country's economy, have properties representing their state. In an agent-based model this state is manipulated. In field-based modeling, the entities representing the system's state are represented by fields. Fields capture the state of a continuous property within a spatial extent, examples of which are elevation, atmospheric pressure, and water flow velocity.

With respect to the technology used to create these models, the domains of agent-based and field-based modeling have often been separate worlds. In environmental modeling, widely used logical data models include feature data models for point, line and polygon objects, and the raster data model for fields. Simulation models are often either agent-based or field-based, even though the modeled system might contain both entities that are better represented by individuals and entities that are better represented by fields. We think that the reason for this dichotomy in kinds of models might be that the traditional object and field data models underlying those models are relatively low level.

We have developed a higher level conceptual data model for representing both non-spatial and spatial objects, and spatial fields (De Bakker et al. 2016). Based on this conceptual data model we designed a logical and physical data model for representing many kinds of data, including the kinds used in earth system modeling (e.g. hydrological and ecological models). The goal of this work is to be able to create high level code and tools for the creation of models in which entities are representable by both objects and fields. Our conceptual data model is capable of representing the traditional feature data models and the raster data model, among many other data models. Our physical data model is capable of storing a first set of kinds of data, like omnipresent scalars, mobile spatio-temporal points and property values, and spatio-temporal rasters.

With our poster we will provide an overview of the physical data model expressed in HDF5 and show examples of how it can be used to capture both object- and field-based information.

References

De Bakker, M, K. de Jong, D. Karssenberg. 2016. A conceptual data model and language for fields and agents. European Geosciences Union, EGU General Assembly, 2016, Vienna.