Models as Networks of Belief

Many environmental systems models are strictly deterministic in nature. This means that they describe the world with specific numbers or labels (i.e. the area contains ten trees or the farm population is 25,000) and the relations between elements in a model are specified with exact mathematical formulas (i.e. Flood Runoff = Amount of Precipitation - Water Absorbed by Ground and Vegetation). Although such models make their computations quite straightforward, they lack an intuitive way to convey uncertainty in the formulas and in the quality and quantity of the data being fed into the models.

In ARIES, probabilistic models are used to describe the systems under study. The state of the world and the relationships between model elements are therefore represented by probability distributions rather than specific values. One immediate benefit of this approach is that the amount and types of uncertainty in the model are inherently conveyed through the shape of these distributions.

Additionally, as a means of addressing concerns over the origin of the formulas in many deterministic models, ARIES draws on its AI underpinnings and proceeds by learning the causal relationships between model elements directly from the empirical data. This machine learning approach helps to strengthen the validity and believability of its models and even makes it possible to measure how much uncertainty is associated with these learned rules.