

Predictions using fuzzy metrics-based aggregation of climate models

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Data acquisition tools and climate models have developed considerably in recent years, yielding a variety of predictions available to stake holders and the public at large. This leads to a typical data analysis problem, i.e., the multitude of data available cannot be efficiently processed, used, or merged in the decision making process. We are searching for a solution in this direction via ensemble-like aggregation of climate models. Let us consider a prediction of a certain feature (e.g. boundary of the dry zone) that will be used in the decision making process by stake holders. For an informed decision one has to take into account several models. But it is a difficult problem to answer which models should be taken into account and onto what degree. The predictions that have produced better results on historical data for the lower dimensional feature that we want to predict, should have higher weights in an aggregated prediction. We propose an aggregation method based on a fuzzy rule-based systems, able to incorporate expert knowledge and modeling into an aggregated prediction.

A fuzzy set, intuitively, is a set with uncertain boundaries and it can be mathematically represented through a function whose values range between 0 and 1, interpreted as the membership grade of an element to the fuzzy set. A fuzzy set can be used as a model for linguistic variables such as for example low, medium or high similarity of the model output to observation. A fuzzy rule-based system is able to incorporate expert knowledge into predictions, by using the compositional rule of inference, that is able to evaluate fuzzy rules. An example of a very simple rule based system is as follows:

If model to observation similarity is *High (resp. Medium, Low)* **then** the model's weight in the aggregation is *High (resp. Medium, Low)*

In order to make the system meaningful, we will use model to observation fuzzy similarity measures based on climate models.