

Combining Information Sources to Develop Bayesian Predictions

The Bayesian framework offers the opportunity to combine diverse information sources in modeling and prediction, while managing uncertainties associated with those sources. I suggest that in complex settings, the use of substantial prior information contained in mechanistic models and theories is needed to form a sound basis for prediction. However, such models and theories are imperfect typically. The Bayesian approach is suggested to seek quantifications of and adjustments for such imperfections. In this talk I review and exemplify the incorporation of physical models in hierarchical Bayesian models. Also, in many modern settings, physical models are themselves complex, high-dimensional and often require large-scale numerical computations. I discuss options for incorporation of large-scale computer model output into Bayesian models. Several illustrations indicating the wide range of possible analyses are presented including the use of climate system models in the context of climate change analysis.