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Climate Models: A New Babel?

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Today there are over 20 different climate models which are used to make climate simulations and future climate projections. These models are used as tools to understand climate variability (control runs) and to simulate how climate change will affect the planet (forced runs) not only at the annual/global average level but over specific areas of the globe. In these models the evaluation of large scale variability such as the North Atlantic Oscillation (NAO), the Pacific Decadal Oscillation (PDO), the El Nino/Southern Oscillation (ENSO), and the Pacific/North American (PNA) pattern is done at the component level. To evaluate how well the models reproduce ENSO, for example, the average temperature of the $NINO_3$ area (5deg N to 5deg S, 140deg W to 90deg W) is computed for all models and the corresponding power spectra are compared to that of the actual observations (reality). This component-level evaluation gives an idea of how well a certain mode or pattern is simulated by the models. It does not, however, give an indication of how well the models generate the interplay of a set of modes. The above mentioned oscillations as well as other modes are major atmospheric and oceanic signals in the temperature and pressure (sea and upper levels) fields. They are coupled, they often synchronize, and their collective behavior defines the large scale variability of climate at interannual and decadal time scales. Thus, if a model simulates adequately ENSO but not PDO to which is coupled, then the model does not adequately simulates their interplay and thus the dynamics. We will address the issue of comparing climate models at the “dynamics” level with a new approach involving climate networks.