

## **SESSION: (B6) Frontiers in earth system prediction**

**(B6-06)**

### **Application of Earth system modeling tools to explore predictability of marine ecosystem stressors**

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Marine ecosystems are increasingly stressed by human-induced changes. The ocean is getting warmer, more acidic, and its oxygen content is declining. These stressors may cause large-scale shifts in marine biodiversity, with consequences for potential fisheries catches, livelihood, and food security. In addition to long-term trends sustained through anthropogenic perturbations to the Earth system, potential marine ecosystem stressors are known to exhibit variations over wide range of spatial and temporal scales associated with natural variability in the climate system. For resource management of marine ecosystems, it would be of great value if fluctuations of stressors were to be predictable with modeling resources.

Here we explore the predictability of ocean ecosystem stressors with a comprehensive global Earth system model that has been extensively evaluated against observational constraints, namely GFDL's ESM2M. Potential predictability is explored through the application of infinitesimal initial condition perturbations to a preindustrial control simulation with ESM2M in large ensemble (40 members) mode, using 6 different randomly chosen initial conditions from the pre-industrial run. Thus a total of 240 separate simulations have been performed, each of these for a duration of 10 years. The variables considered are sea surface temperature, sea surface pH, subsurface oxygen concentrations, and net primary productivity. In addition to identifying the upper limits of predictability of these variables within the Earth system model, it is also our objective to identify the relative predictability of the four variables under consideration. Given the potential importance of acidification as a stressor, the analysis will include the broader range of carbon dioxide-related variables for the surface ocean.