oceanic and climate predictions at the decadal timescales: challenges and opportunities

Climate predictions at the decadal timescale offer a unique opportunity to investigate the future of our ocean in the context of climate change. Predictions of the future decade are now routinely performed in several modelling centers, triggering exciting developments. These predictions are typically performed from combining oceanic observations and climate models, so as to benefit from the memory the oceanic state provides to the climatic state and of the dynamical predictions provided by climate models. IPSL-EPOC decadal prediction system has long relied on a relatively simple approach, where only the anomalous surface oceanic information is nudged into the system. This approach was initially selected because of its simplicity to implement, allowing the group to rapidly produce its first predictions. Original nudging strategy towards surface temperature and salinity anomalies has proven to be effective to initialize important features of the climate system, including the large scale oceanic circulation and air-sea carbon fluxes. Yet, this approach does not take into account observation errors and uncertainty, nor horizontal and vertical dependence among various regions. Furthermore, surface information has been shown to hardly penetrate into the deep ocean thereby limiting the potentiality for deeper oceanic predictions. For all these reasons, we recently implemented a new approach based on ensemble optimal interpolation applied to both surface temperature and surface salinity, still using anomalies. In this approach, the surface information has an impact on depth based on covariances between surface and subsurface variables calculated in a reference simulation. Moreover, with this methodology, observation uncertainties are explicitly take into account. We present here results from these successive predictions systems, insisting on opportunities and challenges of the development of decadal predictions of the ocean based on climate models.

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