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Integrating Earth System observations by coupled model data assimilation

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A coupled climate model simulates reasonably the interactions of major components of the climate system, such as the atmosphere, ocean, land and sea-ice. However, due to insufficient observations and incomplete understanding on physical processes, models always are biased and tend to produce different variability from the real world. For climate estimation and forecast/prediction initialization, coupled data assimilation uses coupled model dynamics to extract observational information from the earth observing system and reconstructs the historical and present states of climate. Here we show how a fully-coupled data assimilation system is able to integrate the earth system observations and applied to detecting climate predictability and initializion of seasonal-interannual to decadal predictions.