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# Building and testing of the first super earth system model

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An interactive ensemble based on three state-of-the-art earth system models is developed. The method is called supermodelling and it forces the models to synchronize every month to the same sea surface temperature, using data assimilation. The assimilated SST observation is a weighted combination of the output SST of the individual models but the full ocean state is constrained by the ensemble covariance. The synchronization of the models during the run makes this approach different from the multi-model ensemble approach in which model outputs are combined a-posteriori, which tends to damp very strongly the variability. The data assimilation method used is the Ensemble Optimal Interpolation (EnOI) scheme, for which the covariance matrix is constructed from a historical ensemble and we connect NorESM, MPIESM and CESM. The performances of a first version of the supermodel based on equal weights is compared to the individual models performances for the period 1980 to 2010. Synchronisation of the surface ocean is achieved in most places and dynamical regimes such as ENSO are occurring in phase. The biases are overall reduced and the Gulf Stream is improved. The variability of the connected models is slightly too low side but still reasonable. Perspectives for the supermodelling method are presented and discussed.