Geophysical Research Abstracts
Vol. 21, EGU2019-4366, 2019
EGU General Assembly 2019

Routes to long-term atmospheric predictability in coupled ocean-atmosphere systems

Lesley De Cruz, Roman Solé-Pomies, and Stéphane Vannitsem

Royal Meteorological Institute of Belgium, Meteorological and Climatological Research, Brussels, Belgium (lesley.decruz@meteo.be)

The predictability of the atmosphere at short and long time scales, associated with the coupling to the ocean, is explored in a new version of the Modular Arbitrary-Order Ocean-Atmosphere Model (MAOOAM). This version features a new ocean basin geometry with periodic boundary conditions in the zonal direction. The analysis presented in this work considers a low-order version of the model with 40 dynamical variables.

First the increase of surface friction (and the associated heat flux) with the ocean can either induce chaos when the aspect ratio between the meridional and zonal directions of the domain of integration is small, or suppress chaos when it is large. This reflects the potentially counter-intuitive role that the ocean can play in the coupled dynamics.

Second, and perhaps more importantly, the emergence of long-term predictability within the atmosphere for specific values of the friction coefficient occurs through intermittent excursions in the vicinity of a (long-period) unstable periodic solution. Once close to this solution the system is predictable for long times, i.e. a few years. The intermittent transition close to this orbit is, however, erratic and probably hard to predict.

This new route to long-term predictability contrasts with the one found in the closed ocean-basin low-order version of MAOOAM, in which the chaotic solution is permanently wandering in the vicinity of an unstable periodic orbit for specific values of the friction coefficient. The model solution is thus at any time influenced by the unstable periodic orbit and inherits from its long-term predictability.