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New dynamical variables for Empirical Model Reduction approach: application to ENSO prediction

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We propose a novel empirical modeling technique that combines two previously developed approaches which were independently used for ENSO prediction: a new method of spatially distributed data decomposition - linear dynamical mode (LDM) decomposition, and multilevel empirical model reduction (EMR). According to results of International Research Institute for Climate and Society (IRI) ENSO real-time prediction plume (Barnston et al. 2012), the EMR model that utilizes dynamical variables obtained by the commonly used empirical orthogonal function (EOF) decomposition (Kondrashov et al. 2005), had achieved a very competitive ENSO prediction skill. At the same time, in Gavrilov et al. 2018, the new LDM decomposition with optimization of time scales for each principal component was shown to provide better modes for the reconstruction of nonlinear evolution operator, compared to EOF decomposition.
In the presented work we use LDM modes as dynamical variables at the main level of multilevel linear EMR model. For model learning, a spatially distributed series of monthly mean values of SST in the tropical belt (latitude from 30S to 30N) with a resolution of 2x2 degrees in the time interval from 1960 to 2014 is used. The results of comparing skill of the retrospective predictions of the SST-based ENSO indices obtained for EMR model with LDM and EOF decompositions, will be presented and discussed.

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