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A reduced semiempirical model for the barotropic dynamics of the atmosphere

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A reduced semiempirical model, describing the time evolution of the leading Empirical Orthogonal Functions (EOFs) of the barotropic dynamics of the atmosphere, is presented. The EOFs are computed from a long term integration of the barotropic vorticity equation (full model) with a realistic forcing. The leading EOFs represent low frequency variability patterns such as the AO and the NAO. The reduced model is constructed by projecting the full model on a small number of leading EOFs. Thus, in contrast to previous studies [1,2], the reduced model is based on the same governing equation as the full model. Non-resolved scales are parameterized using an empirical linear closure, the closure was found by linear regression. The simulated mean and variance by the reduced model agree to a high accuracy with those from the full model.

The response of the reduced model to an anomalous external forcing in the tropics is studied. It is shown that the reduced model is able to reproduce the response of the full model, correlations are between 0.7 and 0.9. This result is an encouraging step towards applying reduced semiempirical models for coupled atmosphere-ocean simulations.

References

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