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The Modular Arbitrary-Order Ocean-Atmosphere Model of the RMIB: MAOOAM

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The coupled ocean-atmosphere system exhibits a decadal variability at midlatitudes, which gives rise to the North-Atlantic Oscillation (NOA). The driving mechanism behind this variability has been the subject of much interest and debate in recent years. This conundrum was addressed using several low-order coupled ocean-atmosphere models for midlatitudes, with an increasing level of physical realism: OA-QG-WS v1 [1], v2 [2], and most recently, VDDG [3]. The VDDG-model was designed to capture the key dynamics of the coupled ocean-atmosphere system, featuring a two-layer atmosphere over a shallow-water ocean layer with passively advected temperature. It incorporates both frictional coupling and an energy balance scheme which accounts for radiative and heat fluxes between ocean and atmosphere. The spectral expansion was truncated at 10 atmospheric and 8 oceanic modes, and a coupled low-frequency variability was found.

We present an extended version of the VDDG model, in which an arbitrary number of atmospheric and oceanic modes can be retained. The modularity of the new model version allows one to easily modify the model physics. Using this new model, named the "Modular Arbitrary-Order Ocean-Atmosphere Model" (MAOOAM), we analyse the dependence of the model dynamics on the truncation level of the spectral expansion. Indeed, previous studies have shown that spurious behaviour may exist in low-resolution models, which can be unveiled by a comparison with their high-resolution counterparts [4]. In particular, we assess the robustness of the coupled low-frequency variability when the number of modes is increased.

References

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