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Synchronization of modulated travelling baroclinic waves in thermally driven rotating annulus flows ALFONSO A. CASTREJON PITA, PETER L. READ, Clarendon Laboratory, Department of Physics, University of Oxford, Parks Road, OX1 3PU, Oxford, UK — Synchronization in a fluid dynamical analogue of atmospheric circulation is studied experimentally by investigating the dynamics of a pair of rotating annulus systems, coupled in real time via their thermal boundary conditions, in both periodic and chaotic regimes. The combined effects of differential heating in the horizontal and background rotation leads to the formation of a zonally-symmetric baroclinic jet flow that may become unstable under some conditions to travelling baroclinic waves which may be steady or modulated in amplitude, and a range of more complex spatiotemporal flows. Synchronization tools such as phase analysis and frequency locking are used to study the resulting dynamics of the coupled system and, depending upon the coupling configuration (master-slave or bidirectional), coupling strength and parameter mismatch, demonstrate various degrees of synchronization including partial/imperfect phase and complete phase synchronization (at various frequency ratios). These results suggest the possible importance of synchronization in natural climate variability since the studied coupled system forms a direct analogue of coupled weather systems in different locations in the atmosphere on seasonal and intraseasonal timescales.

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