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VORTEX-VORTEX INTERACTIONS FOR THE MAINTENANCE OF BLOCKING : THE SELECTIVE ABSORPTION MECHANISM

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en salle de conférences Joël Noilhan

Abstract :

A new block maintenance mechanism, the selective absorption mechanism (SAM), is proposed. According to this mechanism, which is based on vortex-vortex interactions (i.e., the interactions between a blocking anticyclone and synoptic eddies with the same polarity), a blocking anticyclone actively and selectively absorbs synoptic anticyclones (strictly, air parcels with low potential vorticity). The blocking anticyclone, which is thus supplied with low potential vorticity of the synoptic anticyclones, can subsist for a prolonged period, withstanding dissipation. The SAM was verified through real case studies and numerical experiments.

In the case studies, trajectory analyses were conducted. Ten actual cases of blocking were examined. Trajectories were calculated by tracing parcels originating from synoptic anticyclones and cyclones located upstream of the blocking. Parcels starting from anticyclones were attracted to and absorbed by the blocking anticyclone, whereas parcels from cyclones were repelled by the blocking anticyclone.

The numerical experiments performed here were based on the nonlinear equivalent-barotropic potential vorticity equation, with varying conditions with respect to the shape and amplitude of blocking, the characteristics of storm tracks (displacement and strength), and the characteristics of background zonal flow. The experiments indicate that the SAM effectively maintains blocking, independently of the above conditions. By applying a channel model on a beta plane, numerical experiments were conducted using a uniform background westerly with a jet. Results show that the presence of a jet promotes the effectiveness of the SAM. Two spherical model experiments were also performed; the SAM was as effective as the beta-plane model in explaining the maintenance of blocking. Moreover, a quantitative experiment showed that the SAM maintained a real block under realistic meteorological conditions, demonstrating that the SAM is effective.

The above results verify that the SAM is an effective general maintenance mechanism for blocking.

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