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https://doi.org/10.15017/21709

出版情報：九州大学, 2011, 博士（理学）, 課程博士
バージョン：
権利関係：

The Maintenance Mechanism of Atmospheric Blocking
（大気ブロッキングの持続メカニズムについて）

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論文内容の要旨

A new eddy-feedback mechanism, the Selective Absorption Mechanism (SAM), to explain the block maintenance is proposed. In this mechanism which is based on the vortex-vortex interaction, that is, the interaction mechanism of a blocking anticyclone and synoptic eddies with the same polarity, a blocking anticyclone actively and selectively absorbs synoptic anticyclones.

The blocking anticyclone thus supplied with low potential vorticity can last for a long time against dissipation.

The SAM is verified by two main analyses. The first is to examine ten real cases of blocking using trajectory analysis. Trajectories are calculated by tracing parcels originating from synoptic anticyclones and cyclones upstream of blocking. Parcels starting from anticyclones are attracted and absorbed by the blocking anticyclone, whereas parcels from cyclones are repelled by it and attracted by the blocking cyclone if it exists.

The second analysis is to conduct numerical experiments using the nonlinear equivalent-barotropic potential vorticity equation with some different conditions, which are in shape and amplitude of blocking and in variabilities (displacement and strength) of stormtracks. These experiments indicate that the SAM effectively works to maintain the blocking without depending on these conditions.

These results show that the SAM is the general maintenance mechanism of blocking.

Next, some possible applications of the SAM are mentioned. First, the SAM is applied to a quantitative estimation of the interaction between a blocking anticyclone and synoptic anticyclones in real situations. The effect of the forcing by the interaction between the blocking anticyclone and synoptic ones is estimated.

The response to this forcing in a barotropic model well explains the pattern and amplitude of real blocking. Thus, the interaction with synoptic anticyclones plays an important role in the block maintenance.

Second, the SAM is adapted to a block in summer when the activity of synoptic eddies is thought to be the minimum through a year in general sense. However, it is found that the activity of potential vorticity is climatologically the maximum in summer, which implies that the SAM can also be adopted to summer blocking. Then, a case study for the 2010 summertime blocking is performed for investigating whether the SAM actually contributes to the maintenance of this blocking. Through the trajectory analysis, an analysis of ensemble forecast data, and a barotropic model experiment, the maintenance of this summertime blocking is also largely contributed by the selective absorption of synoptic anticyclones. Thus, even in summer, the SAM can be essential for the maintenance of blocking.