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A study for dynamical origin of the Arctic Oscillation

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The Arctic Oscillation (AO) is well known as dominant sea-level pressure (SLP) anomaly pattern in Northern Hemisphere. The AO influences on climate in Northern Hemisphere including Japan. It is important to understand the mechanism of AO.
In this study, we investigated the dynamical origin of the AO using Barotropic S-model.
First, long-term integration is conducted to monitor the time variation of barotropic height caused by each model terms. Although obvious feedback onto AO by the model terms did not emerge for short period, averaged field of barotropic height by nonlinear term frepresented an AO-like pattern.
Next, AOI equation is derived, to investigate the relation between AOI and each model terms quantitatively. Correlation between AOI and nonlinear term was high(For 3months running mean, correlation cofficient was 0.78).
After linearly regressing the nonlinear term, eigenmode analyses are conducted. As a result of the analysis, the regressed term feedbacks positively onto dynamical eigenmodes in terms of the growth rate.
Since it is demonstrated that AO is stationary mode with 0 eigenvalue (Tanaka and Matsueda 200 5), regressed term and diffusion coefficient are shaded so that EVP-1 has 0 eigenvalue. As a result of the experiment, in the case that the regressed term is somewhat reduced, EVP-1 had 0 eigenvalue and formed AO-like pattern.
From these results, it is found that AO is a dynamical mode and varies depending on nonlinear wave-wave interaction.

Keywords: Arctic Oscillation, Barotropic General Circulation Model, Wave-Wave Interaction, Singular Eigen mode