Could Gulf Stream and Kuroshio be synchronized?

*Tsubasa Kohyama[1], Yoko Yamagami[2], Hiroaki Miura[3], Shoichiro Kido[3], Hiroaki Tatebe[4], Masahiro Watanabe[2]

1. Department of Information Sciences, Ochanomizu University, 2. Atmosphere and Ocean Research Institute, The University of Tokyo, 3. Graduate School of Science, The University of Tokyo, 4. Japan Agency for Marine-Earth Science and Technology

The Gulf Stream and the Kuroshio Current transport heat from the tropics to the extratropics, so their temperature variations affect densely-populated areas in the northern hemisphere through extreme weather and fisheries production. The two ocean currents are separated by the North American continent, and thus, they cannot exchange heat by oceanic processes within a few years.

Based on data analyses of satellite observations and global climate models (GCMs), we show that sea surface temperatures of the Gulf Stream and the Kuroshio are synchronized for the decadal time scale. This synchronization, which we refer to as the Boundary Current Synchronization (BCS), is associated with meridional migrations of the atmospheric jet stream.

Output from four global climate models are analyzed: GFDL-CM4C192, MIROC6subhires, and their counterparts with lower resolutions. Cross-spectral analysis reveals that GCMs with higher resolutions exhibit higher low-frequency coherence than those with lower resolutions. Lag-correlation analysis shows that the temperature variations are almost simultaneous between the two currents. The BCS variability is also detected by performing the Singular Value Decomposition analysis between the two western boundary current regions, and this analysis supports a notion that the temperature variability emanates from meanderings of the two ocean currents. Atmospheric GCM experiments show that SST variability of the MIROC6subhires model actively modulates the position of the westerly jet stream. On the contrary, as suggested by the conventional view, SST variability of the low-resolution version of MIROC6 has less influence on the midlatitude atmosphere.

Keywords: Western Boundary Currents, Atmospheric Jet Stream

