Geophysical Research Abstracts
Vol. 13, EGU2011-5155, 2011
EGU General Assembly 2011

Atmospheric response to the Gulf Stream: Shallow & Deep Heating Modes

Shoshiro Minobe (1), Masato Miyashita (1), Akira Kuwano-Yoshida (2), Hiroki Tokinaga (3), and Shang-Ping Xie (3)

(1) Graduate School of Science, Hokkaido University, Sapporo, Japan (minobe@mail.sci.hokudai.ac.jp), (2) Earth Simulator Center, Japan Agency for Marine-Earth Science and Technology, Yokohama, Japan, (3) International Pacific Research Center and Department of Meteorology, University of Hawaii at Manoa, Hawaii, U.S.A.

The atmospheric response to the Gulf Stream front in sea surface temperature is investigated using high-resolution data from satellite observations and operational analysis and forecast. Two types of atmospheric response are observed with different seasonality and spatial distribution.

In winter, surface wind convergence is strong over the Gulf Stream between the Cape Hatteras and the Great Banks, consistent with atmospheric pressure adjustments to sea surface temperature gradients. The surface convergence is accompanied by enhanced precipitation and the frequent occurrence of middle-level clouds. Local evaporation and precipitation are roughly in balance. In summer, strong precipitation, enhanced high clouds, and increased lightning flash rate are observed before and shortly after the separation at the Cape Hatteras, without seasonal surface convergence enhancement. For the precipitation maximum near the coast, local evaporation supplies about half of water vapor, and additional moisture is transported from the south on the west flank of the North Atlantic subtropical high.

Atmospheric heating estimated by a Japanese reanalysis reveals distinct seasonal variations. In winter, a *shallow-heating mode* dominates after the Gulf Stream separation, with strong sensible heating in the marine atmospheric boundary layer and latent heating in the lower troposphere. In summer, a *deep-heating mode* is pronounced before and shortly after the separation, characterized by latent heating in the middle and upper troposphere due to deep convection. Possible occurrences of these heating modes in other regions are discussed.