Impacts of Distinct Ocean-atmosphere Coupling Processes During the 2016 Winter Cold Surge in East Asia

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Extreme weather appears more and more frequently in the future climate scenario. In the northern hemisphere, winter cold surge (CS) is the most influential weather phenomenon. In January 2016, an unusual CS hit East Asia and caused devastating damages in many East Asia countries, potentially resulting from the polar vortex ruptured under the influence of strong El Niño teleconnections. This study analyzes the associated regional ocean-atmosphere interaction and physical processes of the January 2016 CS using the reanalysis data and global coupled model experiments. Our results show that this CS event can be divided into two regimes in time: the first regime is dominated by the atmospheric forcing and the latter is dominated by the oceanic forcing. For the atmospheric forcing-dominated regime, the strong winds and cold air associated with the CS force the sea surface temperature change through the surface heat flux. On the other hand, for the oceanic forcing-dominated regime, the oceanic noise increases (decreases) the local sea surface temperature, which in turn dominates the surface heat flux change. We further classify CS events into two types according to their cooling rates: fast-evolving and slow-evolving. The fast-evolving CSs are initially dominated by atmospheric forcing and then become dominated by the ocean, such as the extreme 2016 CS event.

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