



Recent sea-ice reduction and possible causes

Doo-Sun R. Park

School of Earth and Environmental Sciences, Seoul National University, Seoul, South Korea

Arctic sea-ice extent has been rapidly declining since the late 20th century. Given the accelerating rate of the sea-ice decline, an ice-free Arctic Ocean is expected to occur within this century. This rapid sea-ice melting is attributable to various Arctic environmental changes, such as increased downward infrared radiation (IR), sea-ice preconditioning, temperate ocean water inflow, and sea-ice export. However, their relative contributions are uncertain. Assessing the relative contributions is essential for improving our prediction of the future state of the Arctic sea ice. Most of the previous research had focused on summer sea ice, which is however sensitive to previous winter sea ice, suggesting that winter sea-ice processes are also important for understanding sea-ice variability and its trend. Here we show, for the Arctic winter of 1979–2011, that a positive trend of downward IR accounts for nearly half of the sea-ice concentration (SIC) decline. Furthermore, we show that the Arctic downward IR increase is driven by horizontal atmospheric water flux into the Arctic, and not by evaporation from the Arctic Ocean. The rest of the SIC decline likely comes from warm ocean.