



The changing seasonal climate in the Arctic

Richard Bintanja and Eveline van der Linden

Royal Netherlands Meteorological Institute (KNMI), Wilhelminalaan 10, 3732 GK De Bilt, The Netherlands

Ongoing and projected greenhouse warming clearly manifests itself in the Arctic regions, which warm faster than any other part of the world. One of the key features of amplified Arctic warming concerns Arctic winter warming, which exceeds summer warming by at least a factor of 4. Here we use observation-driven reanalyses and state-of-the-art climate models in a variety of standardised climate change simulations (CMIP5) to show that Arctic winter warming is strongly linked to winter sea ice retreat through the associated release of surplus ocean heat gained in summer via the ice-albedo feedback ($\sim 25\%$), and winter infrared radiation feedbacks ($\sim 75\%$). Arctic summer warming is surprisingly modest, even after summer sea ice has completely disappeared. Quantifying the seasonally varying changes in Arctic temperature and sea ice and the associated feedbacks helps to more accurately quantify the likelihood of Arctic climate change, and to assess their impact on local ecosystems, socio-economic activities and midlatitude climate.