



A spectacular cooling of Eurasia during an extreme of Arctic amplification in autumn 2016

Konrad Schlichtholz (1) and Pawel Schlichtholz (2)

(1) University of Gdansk, Faculty of Mathematics, Physics and Informatics, Poland (k.schli@hotmail.com), (2) Institute of Oceanology, Polish Academy of Sciences, Poland

Over the last two decades significant Arctic amplification occurred, that is, surface air temperature (SAT) in the Arctic region increased faster than the global mean SAT. Surprisingly, in the same period, several abnormally severe winters were observed in northern continents, especially in Eurasia. During these winters the distribution of SAT anomalies in the Northern Hemisphere extratropics was characterized by the so-called "warm Arctic/cold continents" or "warm Arctic/cold Eurasia" pattern. Several studies have attributed this pattern to the diminishing Arctic sea-ice cover, but actual mechanisms of the Arctic/midlatitude linkage remain controversial. Here we investigate a spectacular "warm Arctic/cold Eurasia" event that occurred during an extreme of Arctic amplification in autumn 2016. The study is based on monthly mean fields of SAT, sea level pressure (SLP), sea ice concentration (SIC), sea surface temperature (SST) and surface heat flux (SHF) from the ERA-Interim reanalysis. Anomaly fields for each month in 2016 were constructed by removing local means over the 1979-2016 period from the raw data. In October 2016, SAT anomalies were largely negative over vast areas of Eurasia, mainly in the Asian sector between 45°N and 60°N where their magnitude reached about 6°C. At the same time, SAT anomalies in the whole Arctic region were largely positive and exceeded 8°C in two distinct "warm spots", one in the Atlantic sector and one in the Pacific sector. This SAT anomaly pattern was driven dynamically by an abnormal atmospheric circulation, as indicated by a wavenumber-2 pattern of SLP anomalies with dominant centres of action over the northwestern North Pacific and Scandinavia. Cold air advection by northerly wind anomalies in the area along the common rim of these centres located in Asia was by far larger in October 2016 than in any other October of the 1979-2016 period (exceeded four standard deviations in that period). Arctic sea ice cover, which was abnormally diminished already in October, responded to warm air advection in the Pacific and Atlantic sectors by a record November minimum. Thermal feedback from the reduced sea ice cover reinforced the warm Arctic lobe of SAT anomalies, which in November expanded over North America. Both the Arctic and Eurasian lobes began to wane in December. The distribution and magnitude of SAT, SLP, SST and SHF anomalies suggest that the anomalous surface atmospheric circulation in October might have been triggered by air-sea interactions over the North Pacific. An alternative hypothesis that it was excited by pre-existing negative Arctic sea ice cover anomalies or a weakening of the stratospheric circulation is currently being investigated.