

SPARC Water Vapor Assessment: Dehydration and rehydration in the Arctic Polar Vortex 2010 inferred from in-situ balloon and air-borne measurements.

Sergey Khaykin[†]; Ines Engel; Christopher Hoyle; Luo Beiping; Thomas Peter; Vladimir Yushkov; Ivan Formanyuk; Aleksey Lykov; Rigel Kivi; Genrikh Shur

[†] Central Aerological Observatory of Roshydromet, Russia

Leading author: sehamic@yandex.ru

We present the results of accurate in-situ water vapour observations obtained within the two Arctic field campaigns in Winter 2010: the M55-Geophysica aircraft deployment in Kiruna within RECONCILE project and the LAPBIAT balloon campaign held at FMI-ARC, Sodankylä. The airborne water vapour measurements were conducted using FLASH-A and FISH instruments operating on board M55-Geophysica, while the balloon observations carried out in coordination with aircraft flights were performed using the FLASH-B instrument flown together with CFH sonde. Water vapour soundings were accompanied by aerosol and ozone measurements carried out using COBALD backscatter sonde and ECC sonde respectively. The analysis shows that during the second half of January 2010 very low temperatures reaching 182 K were encountered inside the Arctic Polar vortex, which led to formation of ice PSCs within a large spatial extent. The observations of water vapour by independent measurement techniques, incorporated by trajectory modeling, clearly suggest that these conditions resulted in an irreversible dehydration of the airmasses within 20-24 km and consequent redistribution of water vapour within 18- 24 km range. The results of a particular sounding, capturing the very process of ice PSC formation, are analyzed in more detail using box modeling.