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Arctic atmospheric water vapour and cloud liquid water climatologies generated from satellite passive microwave data using advanced algorithms

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Based on the effective technologies, long-term high-quality well-maintained observations of the atmospheric water vapor and cloud liquid water, including those over the Arctic Ocean, are of high importance. In this study, new climatologies of the atmospheric water vapor and cloud liquid water for the Arctic Basin are generated for the period 1979-2010 using reprocessing of satellite passive microwave data from Nimbus-7/SMMR and DMSP/SSM/I sensors. The reprocessing is based on the new developed polar regional retrieval algorithms, applicable for the Arctic Basin. These algorithms are physically-based and employ solution of the radiative transfer equation for the atmosphere-ocean system using Neural Networks (NNs) as an inversion operator. They are trained and extensively validated using radiosonde data sets from polar island stations. For the atmospheric water vapor retrieval new NNs-algorithm is compared with the global operational algorithm developed by Remote Sensing Systems. This comparison demonstrats the advantages of NNs-based polar regional algorithm in comparison with the global operational one. Spatial distribution as well as interannual and decadal variability of the atmosphere water vapor and cloud liquid water over the Arctic Ocean, derived from satellite passive microwave measurements for the period 1979-2010 using new algorithms, is analyzed. Trends in these parameters are estimated and the linkages between them and atmosphere temperature are studied. Generated climatologies of atmospheric water vapour and cloud liquid water are compared with existing climatologies, based both on satellite, in-situ and modeled data.