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Neural networks-based algorithms for atmospheric water parameter retrievals from satellite passive microwave data: development and validation

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Neural networks (NNs)-based algorithms for retrievals of total atmospheric water vapor content, Q and total cloud liquid water content, W, from satellite passive microwave measurements, applicable for the Polar Regions, are considered in this study. Suggested algorithms are based on NNs regression technique, employed for the radiative transfer equation inversion. The simulated - by means of numerical integration of radiative transfer equation - values of brightness temperatures for Advanced Microwave Scanning Radiometer – Earth Observation System (AMSR-E) and Special Sensor Microwave/Imager (SSM/I) are used to develop Q and W retrieval techniques for nonprecipitating conditions over the open ocean. Sets of sea surface temperature (SST), surface wind and radiosonde reports collected by Russian research vessels served as input data for the integration. The data with SST less than 15^{O}C are selected for algorithm development. Simulated radiometer noise was added to the calculated values of brightness temperatures. The performance of NN-based algorithm is compared with the performance of non-linear multiple regression (NMR) algorithm. It is shown that NNs-based algorithms perform better than standard regression techniques. The theoretically developed algorithms are tuned and extensively validated for AMSR-E radiometric measurements.