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Title: *Variability of moisture conditions in the Arctic in the period of the first International Polar Year 1882/1883*

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Water vapour as a main greenhouse gas is a driving force of many atmospheric processes. Recognizing the nature of change and the reasons for its concentration is essential to understand the Earth's climate system. In order to broaden the knowledge about climate changes and to predict them in the future, information about past changes and, in particular, about historical times are extremely important.

The paper presents a detailed analysis of a unique series of humidity measurements carried out with hourly resolution at nine meteorological stations, relatively evenly distributed in the Arctic, during the first International Polar Year 1882/1883 (IPY-1). It gives an overall view of the moisture conditions prevailing at that time in the Arctic. The collected humidity data are definitely the best in terms of coverage, quality, resolution, etc. out of all early instrumental data available for this variable for the studied area. Therefore, they allow to validate the reconstruction of moisture fields for the Arctic, performed in the 20thCentury Reanalysis (20CR).

The spatial distribution of atmospheric water vapour in the Arctic during the IPY-1, in the common observational period (May-August 1883), was similar to the present one. In the annual course the highest values of water vapour pressure during the IPY-1 were noted in July and August, while the lowest ones in the cold half of the year. In the Norwegian Arctic, more water vapour (by about 1.3 hPa) was in the autumn than in spring, while the opposite relation occurred in the Siberia and in the American Arctic. Monthly means of the relative humidity were high and most often exceeded 80%. A comparison of water vapour data gathered during the IPY-1 with the data for that period taken from the 20CR shows that the latter demonstrate a strong bias in May (positive) and in August (negative). Day-to-day changes of mean daily water vapour calculated on the basis of the data taken from the 20CR are smaller and smoother than the similar ones obtained from observational data.

The quality of reanalysis depends on the quality and quantity of raw data assimilated to the model. It is particularly true in the case of the Arctic where the density of stations is sparse. Therefore, an intensified search for new historical meteorological data for the Arctic is urgently needed.