Atmospheric moisture budget in the Arctic and sub-Arctic

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The presentation addressed the atmospheric moisture budget from the following points of view (a) climatology, (b) role of air moisture, clouds, and precipitation in the climate system, (c) historical, ongoing, and projected changes, and (d) knowledge gaps. Climatological distributions of seasonal means of the vertically integrated water vapour, evaporation, northward moisture transport, precipitation, and net precipitation were presented on the basis of atmospheric reanalyses. The role of air moisture in the climate system is related to cloud formation, cloud water/ice content, clear-sky radiative transfer, and the water vapour feedback in climate change. Clouds are essential for radiative transfer and turbulence in the atmosphere, the surface energy budget, and the cloud-radiation feedback in climate change. All these processes are sensitive to cloud properties, such as the phase, droplet size and concentration, base height, and thickness. Precipitation and evaporation are important for the mass balance of ice sheets, glaciers and sea ice, the ocean and terrestrial freshwater budgets, and the surface albedo. Since late 1970s in the Arctic, specific humidity has increased and, according to climate model projections, will further increase. Cloudiness has probably increased, especially for low clouds, and is expected to further increase. Precipitation has increased and is expected to further increase. Evaporation trends over the ocean are uncertain; most probably there has been increase over the open ocean in autumn, but an increase in the moisture flux from lower latitudes has a compensating effect. Remaining challenges are related, among others, to (a) insufficient amount and limited accuracy of observations of air humidity, clouds and precipitation, (b) considerable model biases in the boundary layer, and (c) problems in modelling cloud microphysics and distribution of precipitation between rain and snow.