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Concurrent patterns of changes in the moisture transport for precipitation with Arctic sea ice melting

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In this work, part of the results of the project EVOCAR are discussed, a project with the objective of a characterization of the transport of moisture in the Arctic through a Lagrangian perspective and an attempt has been made to relate this transport to climate change indicators observed in the region. The study of the transport of moisture in the Arctic is motivated by the recent changes observed in this region, which have an important implication in the atmospheric branch of the hydrological cycle. Knowing their climatological behavior constitutes a first step in the study of these implications as well as the causes of the observed changes.

In this study, we use the term moisture transport for precipitation (MTP) for a target region as the moisture coming to this region from its major moisture sources that then results in precipitation over it. We have identified the patterns of change in moisture transport for precipitation over the Arctic region, the Arctic Ocean, and its 13 main subdomains concurrent with the major sea ice decline occurred in 2003. The pattern consists of a general decrease in moisture transport in summer and enhanced moisture transport in autumn and early winter, with different contributions depending on the moisture source and ocean subregion. The pattern is not only statistically significant but also consistent with Eulerian fluxes diagnosis, changes in the frequency of circulation types, and any of the known mechanisms of the effects of the increments of precipitation as snowfall or rainfall on ice in the Arctic. The results of this paper also reveal that the assumed and partially documented enhanced poleward moisture transport from lower latitudes as a consequence of increased moisture from climate change seems to be less simple and constant than typically recognized in relation to enhanced Arctic precipitation throughout the year in the present climate.