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Respective roles of direct GHG radiative forcing and induced Arctic sea ice loss on the Northern Hemisphere atmospheric circulation

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Arctic sea ice decline in the recent decades has been reported in observational studies. Modeling studies have confirmed that this downward trend in Arctic sea ice is mainly caused by increasing Greenhouse Gases (GHGs) concentrations into the atmosphere. The IPCC-AR5 report concluded that Arctic sea ice will continue to decrease and is projected to disappear in the middle of the 21st century, yielding to an ice-free region during boreal summer season. Arctic sea ice loss is expected to strongly impact the climate system. Recently, the climate community has conducted a number of studies to evaluate and understand the Arctic sea ice loss implications on climate.
While some studies have shown that Arctic sea ice decline can significantly affect the large-scale atmospheric dynamics at high and mid-latitudes of the Northern Hemisphere, by altering the storm-tracks, the jet stream (position and strength) and the planetary waves, large uncertainties remain due to a low signal-to-noise ratio and experimental protocol differences leading to a large inter-model spread.
In this work, we investigate the respective roles of Arctic sea ice loss and GHGs increase on the atmospheric dynamics by means of an idealized experimental set-up that uses the coupled model CNRM-CM5. The experimental set-up, based on a flux correction technique, will allow separating the contributions of Arctic sea ice loss from the GHGs increasing. We will focus mainly on the atmospheric circulation response in the Northern Hemisphere and on the associated synoptic variability, represented by the storm-tracks. We show that Arctic sea ice loss is responsible for an equatorward shift of the northern hemisphere jet, which is opposed to the GHGs effect. Finally, we show that these shifts are consistent with the storm-tracks response.