The interaction between the polar, midlatitude and tropical regions

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Over the last few decades the polar regions of the globe have experienced the largest shifts in the climate: the temperature in the Arctic has been increasing at about twice the rate of global average and the sea ice extent has decreased dramatically (March 2018 was the second lowest Arctic maximum in the 39-year satellite record). As polar regions play a central role in the Earth's climate acting as sinks in the global energy, the changes in these domains have a potential to impact both energy sources in the tropics and mechanisms by which the energy is transported poleward (e.g., midlatitude cyclone and fronts).

In this study, potential teleconnection patterns are identified using a range of techniques, including Rossby wave (RW) ray tracing (e.g. Karoly 1983, Shaman et al. 2012) and wave activity flux (WAF, Takaya and Nakamura 2001). A suit of low-frequency and stationary waves tracing experiments will be conducted with an ensemble of rays starting within Arctic/Antarctic sea ice regions and propagating into the midlatitudes or tropics to identify 'hot spots' within polar regions. Particular attention is drawn to RW rays that 'escape' the sea ice zone regions and, hence, are able to influence climate in lower latitudes. For anomalous WAF, identified within the polar regions, composite analysis will show associated anomalies of various atmospheric parameters in lower latitudes.

Our first experiments revealed that some assumptions made by the RW ray tracing approach are often violated in the real two-dimensional wind fields, meaning extra caution needs to be taken when using RW ray tracing. This has been overlooked by previous studies.

Key words: Rossby waves, ray tracing, Wave activity flux

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