# Long-term change in stationary eddy heat flux related to Arctic-midlatitude climate linkage

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Recent studies have shown the importance of the stratosphere for Arctic-midlatitude climate linkage, in which upward propagation of planetary-scale waves, eddy-mean flow interaction, and downward propagation of polar vortex anomalies provide a dynamical link between Arctic surface changes and midlatitude weather and climate (e.g. Nakamura *et al.*, 2015, Hoshi *et al.*, 2017). Within this dynamical framework meridional eddy heat flux plays a key role as it characterizes upward propagation of planetary-scale waves. From the viewpoint of poleward atmospheric energy transport the meridional eddy heat flux represents the eddy component of the sensible heat transport. However, it is known that uncertainties exist in all atmospheric data, irrespective of whether it is from reanalyses or model outputs, due to a non-conservative nature of the atmospheric mass in data (Trenberth, 1997). For instance, the latitudinal distributions of the total atmospheric energy transport differ amongst reanalyses when calculated without mass correction. The first and necessary step towards understanding of the stratospheric role in the Arctic-midlatitude climate linkage is to derive a mass correction scheme that is dynamically consistent and computationally feasible. This becomes increasingly important for a discussion on long-term changes in heat flux components because biases can be potentially accumulated, which may lead to spurious results.

In this talk, after introducing a new mass correction scheme for the atmospheric energy transport and its components, we shall discuss long-term change in the stationary eddy sensible heat flux over the last 30 years using the JRA-55 reanalsyis data. The results indicate an increase in the early-winter averaged eddy sensible heat flux in northern high latitudes after 2000 compared with an early decade. This is highly consistent with a notion that recent Arctic sea-ice reduction partially explains the Arctic-midlatitude climate linkage through stratospheric processes.

**References**

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