Geophysical Research Abstracts
Vol. 20, EGU2018-13098, 2018
EGU General Assembly 2018

The sporadic nature of atmospheric heat transport in a hierarchy of models

Gabriele Messori (1), Ruth Geen (2), and Arnaud Czaja (3)

(1) Department of Meteorology, Stockholm University, and Bolin Centre for Climate Research, Stockholm, Sweden (gabriele.messori@misu.su.se), (2) College of Engineering, Mathematics and Physical Sciences, University of Exeter, Exeter, United Kingdom, (3) Space and Atmospheric Physics Group, Department of Physics, Imperial College London, London, United Kingdom

Meridional atmospheric heat transport by transient motions is a fundamentally sporadic process. This holds both when considering the transport at single locations and zonally integrated transport values across a given latitude circle. Here, we analyse the spatial and temporal variability of such transport in the extratropics in a hierarchy of datasets. These are a highly idealised two-layer model seeded with point geostrophic vortices, an intermediate complexity GCM and the ERA-Interim reanalysis data. In both the two-layer model and the GCM the largest values (or pulses) of zonally integrated transport are associated with extended regions of anomalously strong local meridional heat transport. In the two-layer model these large-scale coherent transport regions are linked to densely packed baroclinic vortex pairs and can be diagnosed as low wavenumber streamfunction anomalies. In the GCM they are associated with both the warm and cold sectors of mid-latitude weather systems. Interestingly, the cold sectors can drive local transport extremes comparable in magnitude to those associated with the warm sectors. These very large local transport values imply that, at any given location in the extra-tropics, the net seasonal heat transport is effectively set by a few extreme days every season. The above features are also found in ERA-Interim: the large-scale coherent transport regions match weather systems and occur primarily in the storm track regions, which in turn correspond to planetary-scale climatological streamfunction anomalies. Local extremes can be orders of magnitude larger than the long-term mean local transport values. We hypothesise that the temporal variability of the zonally integrated heat transport is a manifestation of the cyclical variations in the storm track activity, also referred to as storm track lifecycle. The existence of such pronounced variability in both the local and the zonally integrated meridional heat transport has important consequences for the interplay between mid-latitude dynamics and the energy balance of the high latitudes.