EMS Annual Meeting Abstracts
Vol. 15, EMS2018-159-1, 2018

Polar-Midlatitude teleconnections in a simple climate

Paolo Ruggieri (1), Fred Kucharski (2), and Lenka Novak (3)

(1) CMCC Foundation, Bologna, Italy (paolo.ruggieri@cmcc.it), (2) Abdus Salam International Centre for Theoretical Physics, Trieste, Italy (kucharski@ictp.it), (3) Division of Geological and Planetary Sciences, California Institute of Technology, CA, (lenka@caltech.edu)

Given the recent changes in the Arctic sea ice, understanding of the effect of the resultant polar warming on the global climate is of great importance. However, the interaction between the Arctic and mid-latitude circulation involves a complex chain of mechanisms, which leaves state-of-the-art general circulation models unable to represented this interaction unambiguously. This study uses an idealized general circulation model to provide a process-based understanding of the sensitivity of the mid-latitude circulation to the location of high-latitude warming. A simplified atmosphere is simulated with a single zonally localized mid-latitude storm track which is roughly analogous to the North Atlantic storm track. 34 sensitivity experiments are conducted, each with an ensemble of 50 initial conditions, prescribing a high latitude surface heating. It is found that even small changes in the position of the forcing relative to that storm track can lead to very different responses in the mid-latitude circulation. More specifically, it is found that heating concentrated in one region may cause a substantially stronger global response compared to the same amount of heating applied across all longitudes at the same latitude. It is also revealed that the location analogous to the currently warming Barents-Kara region is one of the locations that are most conducive to strong mid-latitude response when heating is applied there. This response affects the entire hemisphere and is the result of nonlinear interaction between eddies and the mean flow. These results can be used to design and interpret experiments with complex state-of-the-art models targeted at Arctic-midlatitude interaction