

CGD SEMINAR



DATE: Tuesday 3 December, 2019

TIME: 11 am – 12 pm

LOCATION: NCAR, 1850 Table Mesa Drive
Mesa Lab, Main Seminar Room

TITLE: **Teleconnection processes linking the intensity of the Atlantic Multidecadal Variability to the climate impacts over Europe in boreal winter**

SPEAKER: Christophe Cassou, Cerfacs

ABSTRACT:

The response of the European climate to the Atlantic Multidecadal Variability (AMV) remain difficult to isolate over the observational historical period in presence of pronounced internal variability on top of anthropogenically-forced signals. We here use targeted model sensitivity experiments proposed within the CMIP6/DCPP-C framework to investigate the physical processes at play in the teleconnection between the AMV and temperature and precipitation over Europe in winter. Large ensembles of pacemaker-type simulations, which consist in restoring the modeled North Atlantic Sea Surface Temperature (SST) to an anomalous pattern that is representative of the observed AMV, have been conducted using the CNRM-CM5 global circulation model. To evaluate the sensitivity of the model response to the intensity of the AMV, twin experiments with AMV-forcing pattern multiplied by 2 and 3 (hereafter 2xAMV and 3xAMV, respectively) are performed in complement to the reference ensemble (1xAMV).

Based on a flow analog method, we show that the AMV-forced atmospheric circulation tends to cool down the European continent, whereas the residual signal mostly including thermodynamical processes contributes to warming. In 1xAMV, both terms cancel each other, which explains the overall weak AMV-forced signals in both temperature and precipitation. In 2xAMV and 3xAMV, the thermodynamical contribution clearly overcomes the dynamical cooling and is primarily responsible for milder and wetter conditions found at large-scale over Europe. The thermodynamical term includes the advection of warmer and more humid oceanic air penetrating inland as well as the modification of surface radiative fluxes linked to altered cloudiness and snow-cover reduction acting as a positive feedback with the AMV amplitude. The dynamical anomalous circulation corresponds to the combination of (i) a remote response to enhanced diabatic heating acting as a Rossby-wave source in the western tropical Atlantic and (ii) a local response associated with warmer SST over the subpolar gyre that favors the presence of anomalous High between Greenland and Northern Europe. The extratropical influence is reinforced by polar amplification due to sea ice melting in all the Subarctic Seas. The respective weight between the tropical-extratropical processes and associated feedbacks is speculated to explain part of the nonlinear sensibility of model response to the AMV-forcing amplitude. Our findings challenge the use of so-called pattern-scaling technique to evaluate teleconnectivity and related impacts associated with AMV-type of variability.

Live webcast: <http://ucarconnect.ucar.edu/live>

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