Geophysical Research Abstracts
Vol. 19, EGU2017-17252, 2017
EGU General Assembly 2017

Impacts of the Atlantic Multidecadal Variability on the North Pacific Ocean

Yohan Ruprich-Robert (1,2), Rym Msadek (3,4), Frederic Castruccio (5), Stephen Yeager (5), Thomas Delworth (2), and Gokhan Danabasoglu (5)

(1) Princeton University, Princeton NJ, United States (yohan.ruprich-robert@noaa.gov), (2) GFDL, Princeton NJ, United States, (3) Cerfacs, Toulouse, France, (4) CNRS, France, (5) UCAR, Boulder CO, United States

The Atlantic Multidecadal Variability (AMV) is associated with marked modulations of climate anomalies over many areas of the globe. This includes droughts in Africa and North America, decline in sea ice, changes of tropical cyclone activity in the Atlantic, and changes in the atmospheric large-scale circulation. However, the shortness of the historical observations compared to the AMV period (∼60-80yr) makes it difficult to show that the AMV is a direct driver of these variations. To isolate the AMV climate response, we use a suite of global coupled models from GFDL and NCAR, in which the North Atlantic sea surface temperatures are restored to the observed AMV pattern, while the other ocean basins are left fully coupled. In order to explore and robustly isolate the AMV impacts, we use large ensemble simulations (between 30 and 100 members depending on the model) that are integrated for 10 years. All models show that during boreal summer the AMV alters the Walker Circulation and generates precipitation anomalies over the whole tropical belt. During boreal winter, the AMV warming is associated with large anomalies over the Pacific, with a response that projects onto a negative phase of the Pacific Decadal Oscillation (PDO). In this presentation, we focus on a hierarchy of experiments in which the ocean-atmosphere coupling is globally or regionally precluded to extract the physical mechanisms leading to the Pacific response. We show that the PDO response comes from a lagged adjustment of the tropical Pacific Ocean to the AMV forcing in summer, and it is reinforced by ocean-atmosphere coupling over the extratropical Pacific. It is then show that the PDO response contribute to precipitation and temperature anomalies over North America. Therefore, our study highlights the importance of using a global coupled framework to investigate the climate impacts of the AMV.