Coherent Multidecadal Atmospheric and Oceanic Variability in the North Atlantic: Blocking Corresponds with Warm Subpolar Ocean

S. Hakkinen, P.B. Rhines and D.L. Worthen

ABSTRACT:

Winters with frequent atmospheric blocking, in a band of latitudes from Greenland to Western Europe, are found to persist over several decades and correspond to a warm North Atlantic Ocean. This is evident in atmospheric reanalysis data, both modern and for the full 20th century. Blocking is approximately in phase with Atlantic multi-decadal ocean variability (AMV).

Wintertime atmospheric blocking involves a highly distorted jetstream, isolating large regions of air from the westerly circulation. It influences the ocean through windstress-curl and associated air/sea heat flux. While blocking is a relatively high-frequency phenomenon, it is strongly modulated over decadal timescales.

The blocked regime (weaker ocean gyres, weaker air-sea heat flux, paradoxically increased transport of warm subtropical waters poleward) contributes to the warm phase of AMV.

Atmospheric blocking better describes the early 20thC warming and 1996-2010 warm period than does the NAO index. It has roots in the hemispheric circulation and jet stream dynamics. Subpolar Atlantic variability covaries with distant AMOC fields: both these connections may express the global influence of the subpolar North Atlantic ocean on the global climate system.