



Sub-decadal Variability between Atmosphere and Ocean in the North Atlantic region

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The North Atlantic Oscillation (NAO) is the dominant variability mode for the winter climate of the North Atlantic sector. During a positive (negative) NAO phase the sea level pressure difference between the subtropical Azores high and the subpolar Icelandic low is anomalously strong (weak). This affects, for example, temperature, precipitation, wind, surface heat flux in the North Atlantic region but also over large parts of Europe. Our investigation is focused on sub-decadal variability of the NAO index that goes along with a large scale sea surface temperature and ocean heat content pattern, which explains a distinct part of the total variability. We determine this phenomenon in observations and in an ensemble of CMIP5 models. Our results suggest as an underlying mechanism the large-scale interaction between atmosphere and ocean, where the ocean overturning variability in the North Atlantic region plays an essential role: It sets the timescale of the variability by providing a delayed negative feedback to the NAO. The sub-decadal variability is associated with a deep-reaching dipolar circulation anomaly, in the model ensemble. The results suggest that the air-sea interaction is crucial to generate enhanced sub-decadal variability in the North Atlantic region which enables increased multi-year climate predictability.