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Interactions between weather regimes and marine surface in the North-Atlantic region

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The intraseasonal variability of the large-scale atmospheric circulation in summer (JJA) or winter (DJF) in the North-Atlantic European region can be represented by transitions between four weather regimes. The occurrence of these weather regimes goes hand in hand with changes in patterns of temperature, precipitation and storminess. These climatic impacts over Europe highlight a need for a better understanding of the mechanisms favouring their occurrence. Each of these weather regimes has a mean persistence of about a week. Thus, they can force sea surface temperature and sea ice cover anomalies that can in turn feedback onto the atmosphere. This study aims at understanding the marine surface/atmosphere interactions on intraseasonnal timescales in the North Atlantic European region.

To conduct these analyses, an ocean mixed layer model is forced with ERA40 reanalysis data with a 1-hour frequency in solar heat flux (6h hours for the other forcing fields). The model has 124 vertical levels with a vertical resolution of 1m near the surface and 500m at the bottom. This high vertical resolution combined with a high temporal forcing resolution is essential to reproduce the turbulent processes involved in the oceanic upper layers evolution on daily timescales. This simulation allows to diagnoses the sea surface temperature and sea ice cover anomalies associated with the Northern Atlantic winter and summer weather regimes. A comparison with satellite data show that a 1-dimensional ocean/sea ice model is sufficient to reproduce the marine surface/atmosphere interactions on intraseasonnal timescales.

Then, sea surface temperatures and sea ice cover anomalies induced by each weather regimes in the ocean/sea ice forced experiment are prescribed to the ARPEGE AGCM model. We show that the interaction with the marine surface induces a negative feedback on the persistence of the winter and summer NAO- regimes.