



## **A North Atlantic sub-polar gyre climate index: a new approach**

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As decadal predictions start to become operational, the need to use, understand and extract information from them becomes essential. A climate index is a simple diagnostic quantity that can be used to characterize an aspect of a geophysical system such as a circulation pattern, and thus can be used to evaluate decadal forecasts. One of the most studied and well documented regions of the World Ocean is the North Atlantic. The North Atlantic subpolar gyre is an important region for the modulation of European climate and where skillful predictions of up to a decade can be obtained.

Ocean re-analysis (ORA-S4) data from 1959 to 2017 are used to introduce a new methodology to compute a climate index of the North Atlantic Subpolar Gyre (NASPG) that captures both the variability in its strength and shape as part of the variability of the gyre. The NASPG climate index is derived from the barotropic streamfunction and the enclosure of the NASPG is defined by a closed contour at a threshold value of  $-7.5$  Sv. The strength of the NASPG is mostly influenced by the extension of the gyre to the south, while the size of the gyre is highly correlated with the easternmost position especially in the decades before 2000. In summary, the gyre system contracts and shifts to the southwestern part of the North Atlantic during high NASPG index phases. The methodology reveals two states of the gyre (before and after 2000), the former is mainly driven by temperature and the latter by a combination of mechanisms that interact to sustain a relatively stable subpolar gyre in terms of strength.