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Skilful near term predictions over the North Atlantic region

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The recently emerged field of near-term (decadal) climate prediction aims at skilfully predicting the regional climate variations for a time horizon of up to 30 years. Initialized decadal climate predictions attempt at capturing both the internally generated (due to the slow varying climate components, mainly ocean) and forced predictability (due to changes in atmospheric composition). Across various model resolutions, initialisation procedures and skill measures, a robust decadal predictive skill and statistically significant added value from the ocean initialization is found over the North Atlantic Subpolar Gyre (SPG), eastern subtropical North Atlantic and Western Mediterranean basins. Especially, the SPG region stands out as a hot spot, exhibiting the highest surface and subsurface decadal predictability beyond the warming trend. The dominant mechanism for the North Atlantic climate predictability is of dynamics origin and can be attributed to the accurate initialization of the ocean circulation, thus explaining the reoccurrence of high predictive skill within the second pentad of the retrospective hindcasts experiments. Recent results indicate that such a mechanism may be at play at even higher latitudes, bringing predictability up to a decade ahead to the Atlantic domain of the Nordic Seas (where the North Atlantic Water has its main imprint on the ocean surface) and even up to Barents Sea. The predictive horizon of various climate quantities and processes is thus set by both an accurate initialisation and intrinsic ocean predictability. Especially the ability to predict the strength of ocean dynamical fluctuations has proved to be crucial in forecasting the full evolution of abrupt climate extreme events, such as the strong mid1990s SPG warming shift, with a couple of years in advance. All these already achieved substantial forecast capabilities of the physical climate system could pave the way to future multiyear marine ecosystem predictions.