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Benefits of ice-ocean coupling for medium-range forecasts in polar and sub-polar regions

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Dynamic sea ice and ocean have long been recognised as an important components in the Earth System Models used to generate climate change projections and more recently seasonal forecasts. However, the benefit of forecasts on the timescales of days to weeks has received less attention. Until recently it was assumed that sea-ice-ocean fields change so slowly that it is acceptable to keep them fixed in short and medium-range forecasts. However, at the ice edge the presence of sea ice dramatically influences surface fluxes, particularly when the overlying atmosphere is much colder than the open ocean so errors in the position of the sea ice, caused by simply persisting this field, have the potential to degrade atmospheric skill. To address this and similar issues, the European Centre for Medium-range Weather Forecasts (ECMWF) recently took the pioneering step of coupling a dynamic-thermodynamic sea ice-ocean model to the Integrated Forecast System, developing the first coupled medium-range forecasting system. This was a major step towards making ECMWF's forecasts seamless across all timescales.

In this study we assess the benefits of including coupled sea-ice ocean processes in the medium-range by comparing set of ten-day forecasts with and without dynamic ice-ocean coupling, focussing on forecast performance at the edge of the sea ice and in the surrounding region. We demonstrate that dynamic coupling improves forecasts of the sea ice edge at all leadtimes. Further, the skill gained is larger during periods when the ice edge is advancing or retreating rapidly. We will also explore whether dynamic coupling has an impact on forecast skill in atmospheric parameters downstream of the ice edge.