Predicting the North Atlantic for Climate Services

BLUE ACTION

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Blue-Action contributes to defining the future Atlantic monitoring system by:

- optimizing the **monitoring systems** at the gateways to the Arctic
- assessing and enhancing the usefulness of the North Atlantic ocean observations in decadal **prediction systems**
- demonstrating the value of initialized decadal predictions in **climate services**

AtlantOS

Blue-Action contributes to the BluePrint for Ocean Observing in the Atlantic

Monitoring Systems

Warm water enters the Arctic mainly from the Atlantic across the Greenland-Scotland Ridge, and with a small contribution from the Pacific via the Bering Strait (Fig. 1). This warm, low latitude water can have a large impact on the Arctic, the effect of the inflows being described as the 'Atlantification' and 'Pacification' of the Arctic. In particular, the Barents Sea has been affected by Atlantification in recent years, with profound impacts on the sea ice.

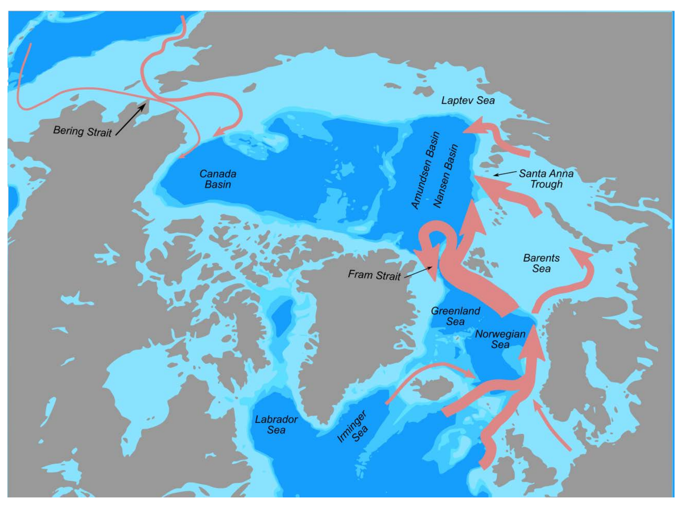
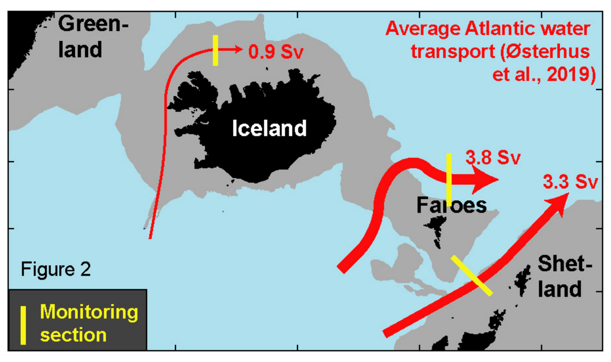


Figure 1



Warm Atlantic water enters the Arctic in three branches, mainly east of Iceland (Fig. 2). These locations have been monitored since the 1990s. **Blue-Action is working on optimising the monitoring systems there, working with new techniques and technology to sustain these vital observations.**

Prediction Systems

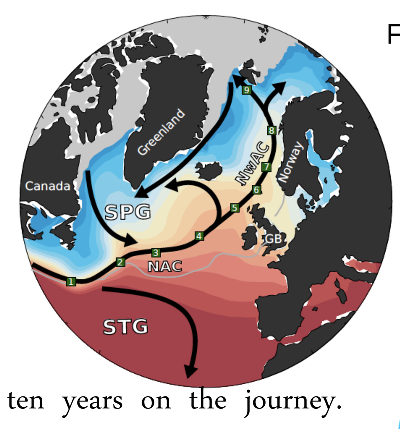


Figure 3

Temperature changes in the Gulf Stream propagate slowly northwards – from the east coast of the USA to the west coast of Norway and toward the Arctic (Fig. 3) – spending up to ten years on the journey. Observations show that there exists a robust statistical relation between these poleward propagating ocean temperature anomalies and northwestern European and Arctic climate variability.

Blue-Action is working on predicting northern climate up to a decade in advance, based on upstream ocean conditions (Fig. 4).

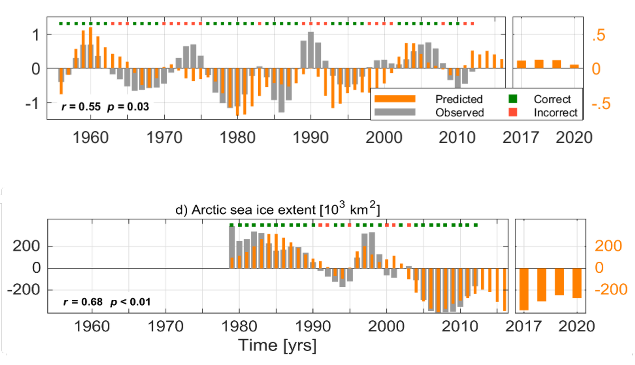
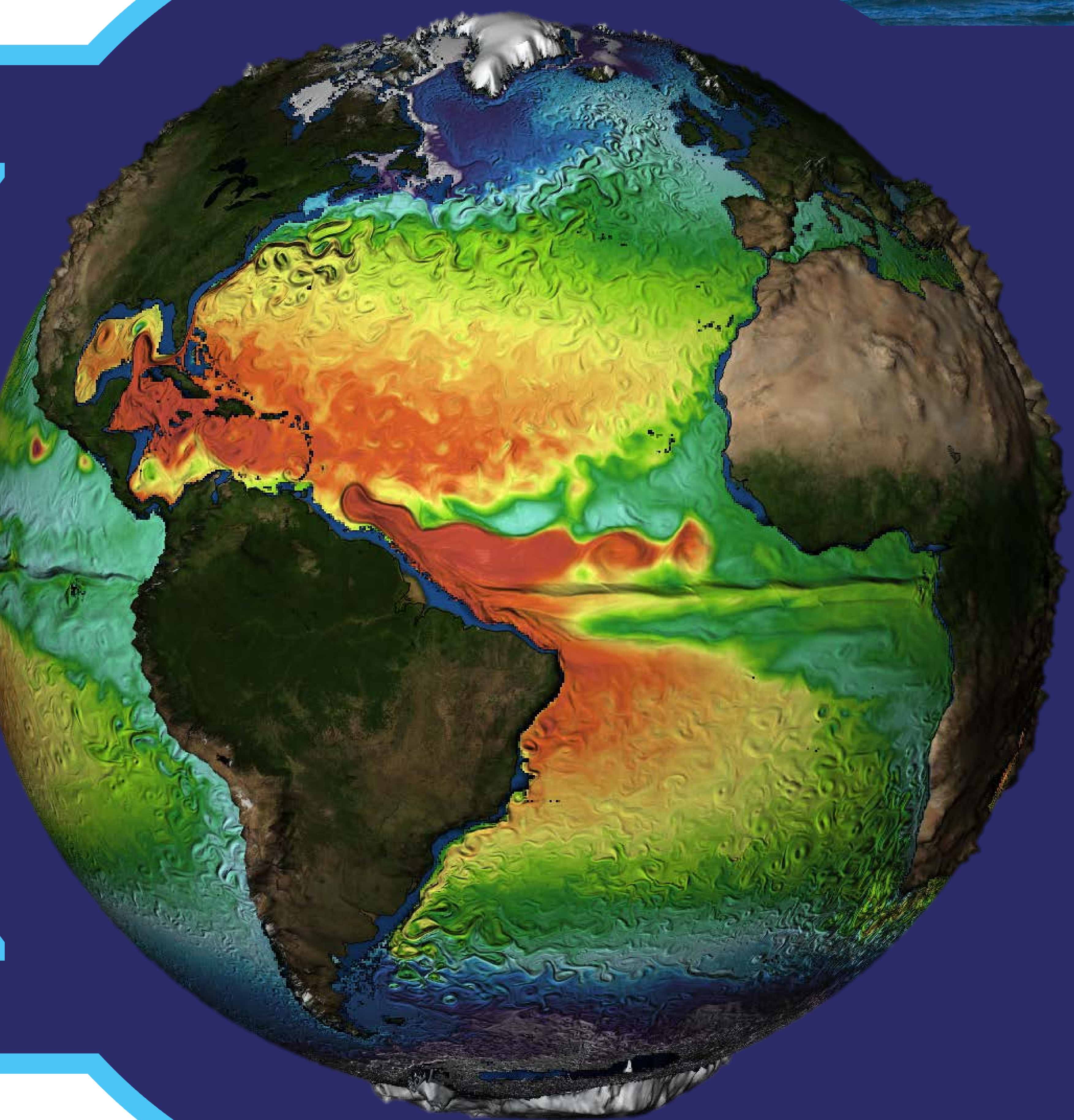


Figure 4. Figures adapted from Årthun et al. (2017), showing prediction skill of northern climate 7-10 years ahead.



Blue-Action contributes to the achievement of the Trans-Atlantic Ocean Research Alliance, to the European Union's Blue Growth Agenda, and to a long-term strategy to support sustainable growth in the marine and maritime sectors as a whole. Blue-Action supports the implementation of the Galway and the Belem Statements and the achievement of UN Sustainable Development Goals 8, 9, 13, 14

UN SDG 8 Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

UN SDG 9 Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

UN SDG 13 Take urgent action to combat climate change and its impacts

UN SDG 14 Life below water

Climate Services

Blue-Action builds on the results delivered by its monitoring and prediction components to develop innovative and valued climate services. The five case-studies each incorporate small- and medium-sized enterprises (SMEs) into a co-development framework to produce new climate services whose value is quantified. The focus areas are:

- **Winter tourism centers in Northern Finland**, developing seasonal time-scale forecasts of snow-making conditions for use by Rukakeskus ski resort.
- **Temperature-related human mortality in European regions**, developing forecasts and early-warning systems of heatwave events that can be used by public health authorities.
- **Extreme weather risks to maritime activities**, developing probabilistic forecasts of polar lows for incorporation into risk-management tools currently used by shipping insurance companies.
- **Climate services for marine fisheries**, developing seasonal-to-decadal forecasts of the distribution of marine fish species to aid management and planning in the fisheries sector.
- **Yamal 2040: Scenarios for the Russian Arctic**, linking climate knowledge and projections into the community driven production of development scenarios for the Yamal autonomous region.

About Blue-Action

Blue-Action is a collaborative research project that is looking at the drivers of warming in the Arctic and the subsequent impact on global climate.

We are developing and using advanced modelling techniques to improve the accuracy of forecasting, across timescales from a few weeks to decades. Blue-Action is also working to understand the role of the Arctic in generating weather conditions that lead to hazardous conditions and climatic extremes.

Our aim is to improve the safety and wellbeing of people in the Arctic region and beyond, by sharing knowledge, reducing risks in Arctic operations, and supporting evidence-based decision-making by policymakers worldwide.

Blue-Action received funding from the European Union's Horizon 2020 research and innovation programme Grant agreement no. 727852

Fig 1. Warm ocean currents entering the Arctic ocean, Gerard McCarthy. Fig 2. Average Atlantic water transport, Bogi Hansen (adapted from Osterhus et al. 2019, Arctic Mediterranean exchanges: a consistent volume budget and trends in transports from two decades of observations.). Fig 3. Dominant ocean and atmosphere circulation in the North Atlantic sector, Marius Årthun (adapted from Årthun, Marius, et al. "Skillful prediction of northern climate provided by the ocean." Nature communications 8 (2017): 15875.). Fig 4. Predicted and observed climate, Marius Årthun (adapted from Årthun, Marius, et al. "Skillful prediction of northern climate provided by the ocean." Nature communications 8 (2017): 15875.)