Project	AtlantOS – 633211
Deliverable number	10.10
Deliverable title	Policy Brief and Event "The slowing Gulf Stream? What we know and potential impacts"
Description	Science Policy Briefing and Event
Work Package number	10
Work Package title	Engagement, Dissemination and Communication
Lead beneficiary	KDM e.V.
Lead author & organizer	Steffen Olsen and Jan-Stefan Fritz
Contributors	Årthun, Marius, Eldevik, Tor, Larsen, Karin, Miller, Raeanne, Oltmanns, Marilena
Submission data	Submitted 28 September 2018
Due date	Month 40
Comments	-

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement nº 633211.

Stakeholder engagement relating to this task*

WHO are your most important stakeholders?	☐ Private company If yes, is it an SME ☐ or a large company ☐? ☐ National governmental body ☐ International organization ☐ NGO x others Please give the name(s) of the stakeholder(s): - EU-level decision-makers
WHERE is/are the company(ies) or organization(s) from?	☐ Your own country x Another country in the EU ☐ Another country outside the EU Please name the country(ies): …
Is this deliverable a success story? If yes, why? **If not, why?**	x Yes, because we had a lot of participants for breakfast briefing. We also managed to write a Policy Briefing summarizing the newest science on the subject. ☐ No, because …..
Will this deliverable be used? **If yes, who will use it?** **If not, why will it not be used?**	☐ Yes, by …… ☐ No, because ….. No specific feedback to date.

NOTE: This information is being collected for the following purposes:

1. To make a list of all companies/organizations with which AtlantOS partners have had contact. This is important to demonstrate the extent of industry and public-sector collaboration in the obs community. Please note that we will only publish one aggregated list of companies and not mention specific partnerships.
2. To better report success stories from the AtlantOS community on how observing delivers concrete value to society.

*For ideas about relations with stakeholders you are invited to consult D10.5 Best Practices in Stakeholder Engagement, Data Dissemination and Exploitation.

About the event

4 September 2018, Science-policy breakfast discussion: "The slowing Gulf Stream? What we know and potential impacts", European Parliament, Brussels (BE)

From right to left: Tor Eldevik (UiB), Steffen M. Olsen (DMI), Marius Årthun (UiB), Ben Moat (UKRI-NOC), Karin Margretha Larsen (HAV),) and Marilena Oltmanns (GEOMAR)

This breakfast policy briefing was held at 8am on 4 September 2018 in Brussels, at the European Parliament.

The Policy Brief (here below) and the event were a joint effort of Blue-Action, the AtlantOS project and Searica. Searica is the European Parliament Intergroup on The Seas, Rivers, Islands and Coastal Areas. Over 50 participants attended the event, mainly from the European Parliament, European Commission and interest groups.

Yvon SLINGENBERG , Director International and Mainstreaming and Policy Coordination, at the Directorate-General for Climate Action gave a special policy keynote address

Blue-Action and AtlantOS were represented by Steffen M. Olsen (DMI), Tor Eldevik (UiB), Ben Moat (UKRI-NOC), Karin Margretha Larsen (HAV), Marius Årthun (UiB) and Marilena Oltmanns (GEOMAR) and Jan-Stefan Fritz (KDM).

The Policy Brief and the Presentations are available online at:

Policy Brief: "The Slowing Gulf Stream? What we know and potential impacts" available on Zenodo
Cite as: Olsen, Steffen, Årthun, Marius, Eldevik, Tor, Fritz, Jan-Stefan, Larsen, Karin, Miller, Raeanne, … Oltmanns, Marilena. (2018, September 3). The Slowing Gulf Stream? What we know and potential impacts (Version 4 September 2018).
Zenodo. http://doi.org/10.5281/zenodo.1408097

Presentations on "Setting the Scene" and of the Panel Discussion are available in Zenodo
Cite as: Olsen, Steffen, Eldevik, Tor, Moat, Ben, Larsen, Karin Margretha, Oltmanns, Marilena, & Årthun, Marius. (2018, September). The Slowing Gulf Stream? A science-policy breakfast discussion: Presentations. Zenodo. http://doi.org/10.5281/zenodo.1409470

Poster of the event Download the PDF

POSTER

THE SLOWING GULF STREAM

A SCIENCE-POLICY BREAKFAST DISCUSSION

4 SEPTEMBER 2018 / 8^{00}–10^{00} H

EUROPEAN PARLIAMENT / ASP 5G1

GESINE MEISSNER PRESIDENT OF THE SEARICA-INTERGROUP

RICARDO SERRÃO SANTOS VICE-CHAIR IN CHARGE OF MARINE KNOWLEDGE

SEARICA.EU

BLUE ACTION

ORGANISED IN COOPERATION WITH THE BLUE-ACTION PROJECT AND THE SUPPORT OF CPMR – SECRETARIAT OF THE INTERGROUP

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EUROPEAN PARLIAMENT INTERGROUP

Seas, Rivers, Islands & Coastal Areas

INTERGROUP
SEAS, RIVERS, ISLANDS
AND COASTAL AREAS

EUROPEAN PARLIAMENT INTERGROUP
Seas, Rivers, Islands & Coastal Areas

BLUE ACTION

The slowing Gulf Stream

A science-policy breakfast discussion

04.09.2018, 8:00-10:00
European Parliament Brussels
ASP 5G1

Is the Gulf Stream slowing down? And if it does, what will be the consequences? And how should we prepare for them?

The Gulf Stream, as a part of the Atlantic Meridional Overturning Circulation, or AMOC, transports warm water from the tropics to the North Atlantic Ocean, and plays a major role in regulating Europe's weather and climate. Now, there is speculation that the AMOC could be slowing or shut down, as the global climate continues to change. This could have important consequences for our weather and climate, potentially increasing the risk of extreme weather such as storms and heatwaves.

To predict and prepare for changes to Europe's weather and climate, it is important that we understand how changes in the ocean and changes in climate are linked. With this understanding, researchers hope to be able to quantify the risk of extreme weather events in the future, and develop early-warning indicators. Today, the monitoring of the ocean already helps scientists to predict climate seasons to decades ahead with some skill. Likewise, an understanding is emerging of the nature and variability of the AMOC and its components based on coordinated international observational efforts.

The SEARICA Intergroup, along with scientists from the EU-funded Blue-Action project and their collaborators, AtlantOS, are hosting a discussion event to explore the impacts of Atlantic Ocean circulation on weather and climate. The Blue-Action project aims to better understand and explain the impact of changes in the Arctic on the weather and climate of the Northern Hemisphere. AtlantOS, meanwhile, is paving the way for a pan-Atlantic Ocean observing system, to collect the data we need to better understand and manage this ocean basin.

The Blue-Action project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727852.

*Participants are kindly requested to register as soon as possible on www.searica.eu in order to guaranty and organise the access to the EP. The day of the conference, participants are kindly requested to present themselves at **07:30** in order to avoid delays.*

08:00 - 08:10 Welcome remarks by **Ms Gesine MEISSNER,** MEP, President of the European Parliament Intergroup Seas, Rivers, Islands and Coastal Areas (Searica)

08:10 - 08:20 Setting the Scene

Mr Steffen OLSEN, Danish Meteorological Institute.
Mr Tor ELDEVIK, University of Bergen, Norway.

08:20- 09:00 Panel Discussion

Introduced and moderated by Deirdre CLUNE, MEP
Mr Ben MOAT, National Oceanography Centre, UK
Ms Karin Margretha LARSEN, Havstovan, Faroe Islands
Ms Marilena OLTMANS, GEOMAR, Germany
Mr Marius ÅRTHUN, University of Bergen, Norway
Mr Martin NESBIT, Head of Climate and Environmental Governance Programme, IEEP (tbc)

09:00 – 09:25 Feedback round

Introduced and moderated by Ricardo SERRÃO SANTOS
Ms Yvon SLINGENBERG, Director International and Mainstreaming and Policy Coordination, DG CLIMA (tbc)
Mr Gerben-Jan GERBRANDY, MEP, Searica Vice-President in charge of Healthy Seas (tbc)
Ms Sofia RIBEIRO, MEP, Searica Vice-President in charge of the Outermost Regions (tbc)

09:25 - 09:55 Q & A Session

The Blue-Action project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727852.

09:55 - 10:00 Conclusions by **Gesine MEISSNER,** MEP, President of the European Parliament Intergroup Seas, Rivers, Islands and Coastal Areas (Searica)

The Blue-Action project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727852.

Firstname	Name	Organisation
Alberto	Zocchi	European Commission / EASME
Andreas	Krell	Eu liaison office of the German research organisations (KOWI)
Anna-Natasa	Asik	European Commission / EASME
Ann-Katrien	LESCRAUWAET	Flanders Marine Institute VLIZ
BAMIDELE SUNDAY	DENNIS	NATIONAL CENTER FOR YOUTH DEVELOPMENT
Ben	Moat	National Oceanography Centre, UK
Chiara	Bearzotti	Danish Meteorological Institute
David	Connor	European Commission, DG ENV
Diego	Yanes	Canary Islands Liaison Office in Brussels
Dina	Eparkhina	EuroGOOS - European Global Ocean Observing System
Elin	Mortensen	Mission of the Faroes to the EU
Fabio	Dalan	European Commission / EASME
Franz	Immler	European Commission / EASME
Frederico	Cardigos	Azores EU Office
GAELLE	LE BOULER	EUROPEAN COMMISSION - EASME
George	Westmeijer	JPI Oceans
Guenter	Hoermandinger	European Commission, DG ENV
Henry-Christian	Reese	ÉNERGIE Franco-Allemande
Jessica	Demblon	EBCD
John	Hanus	German Marine Research Consortium (KDM)
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Kate	Sanderson	Foreign Service, Government of the Faroe Islands
Konstantinos	Kokosis	Aquabiotech Group
Marco	Weydert	European Commission, DG RTD
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Maris	Stulgis	European Commission, DG MARE
Marius	Arthun	University of Bergen
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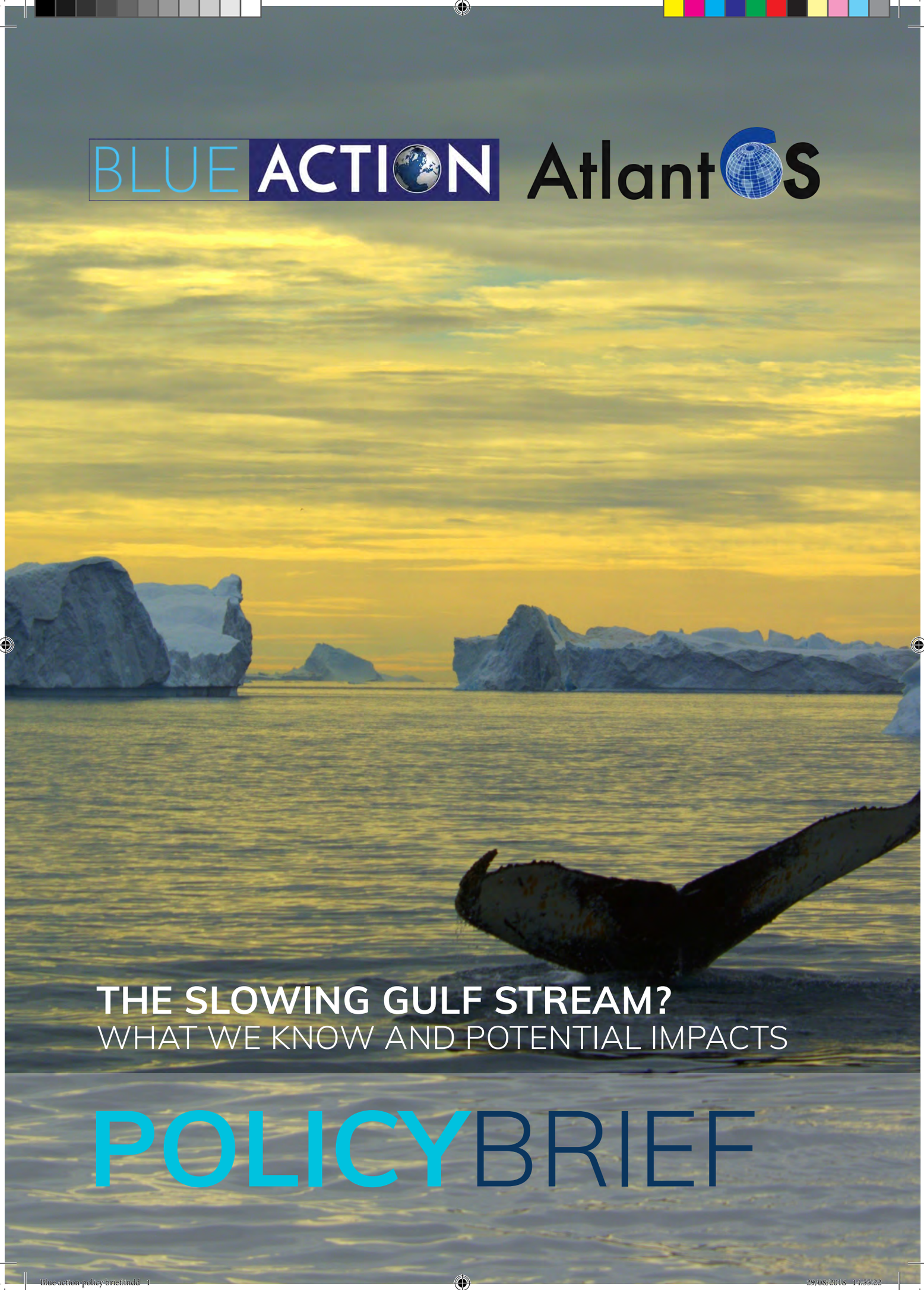
Stefano	Spinaci	European Parliament
Steffen	Olsen	Danish Meteorological Institute
Stéphane	Peyhorgue	Nouvelle-Aquitaine
Tom	Redd	JPI Oceans
Tor	Eldevik	University of Bergen
William	Hay	UCLouvain
Winfried	Hoke	European Climate Research Alliance
Gesine	Meissner	MEP, Searica Intergroup
Yvon	Slingenberg	European Commission, DG Climate
Ricardo	Serrao Santos	MEP, Searica Intergroup
Bruno	Castanho Valerio	European Parliament
Jan-Stefan	Fritz	German Marine Research Consortium (KDM)
Attilio	Gambardella	European Commission, DG RTD
Klaas	De Boer	Searica Intergroup


BLUE ACTION
AtlantOS
THE SLOWING GULF STREAM?
WHAT WE KNOW AND POTENTIAL IMPACTS
POLICYBRIEF

ABOUT BLUE-ACTION:

Blue-Action aims to improve our ability to describe, model, and predict Arctic climate change and its impact on Northern Hemisphere climate, weather, and their extremes, and to deliver valuated climate services of societal benefit. Blue-Action contributes to the implementation of the Trans-Atlantic Ocean Research Alliance, to the EU'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 SDG 8, 9, 13.

This briefing document was produced in support of the SEARICA Science-Policy breakfast discussion on the Slowing Gulf Stream, on the 4th September, 2018, at the European Parliament ASP 5G1.

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www.Blue-Action.eu
Twitter: @BG10Blueaction

THE SLOWING GULF STREAM?
WHAT WE KNOW AND POTENTIAL IMPACTS

- The North Atlantic Ocean has a significant influence on Europe's weather and climate. This is related to the sea surface temperature and heat transported by ocean currents.
- Recent research suggests that we could use our understanding of the North Atlantic Ocean to predict winter temperatures in Europe and Arctic sea ice extent 5-10 years in advance.
- To improve predictions of weather and climate in the future, and to better understand how climate change could affect Europe, we must continue to pursue trans-national research that links oceanography, climate and atmospheric sciences.
- Early-warning indicators for approaching climate impacts, fit-for-purpose ocean observing systems, and development of mitigation strategies should be prioritised.
- Investments in ocean and atmospheric sciences are essential to Europe's global leadership in weather and climate science and for safeguarding regions and communities from the risks posed by a changing climate.

It is becoming increasingly apparent that Europe's climate is linked to the physical characteristics of the Atlantic Ocean. The Gulf Stream is an ocean current that forms part of the Atlantic overturning circulation. It transports heat northwards from the tropics, and is largely responsible for the relatively mild climate of Western Europe. A reduction in overturning circulation could lead to lower temperatures in the North Atlantic Ocean, which would affect the climate in Europe.

However, the pathways and processes that govern the link between Europe's climate and the North Atlantic Ocean are not well understood. This makes it challenging to accurately predict weather and climate outcomes for Europe months or decades in advance. By observing and understanding how Atlantic overturning circulation varies naturally, we should be able to extend our prediction horizon for weather and climate in Europe.

Why is this important?

Skilful predictions of weather and climate offer many benefits to society. They can help businesses plan for future weather and climate risks to their operations, enable new business sectors to develop, help governments plan for weather- and climate-related risks to infrastructure and human health, and inform policymakers to govern in ways that help societies to adapt to forthcoming climate changes and impacts.

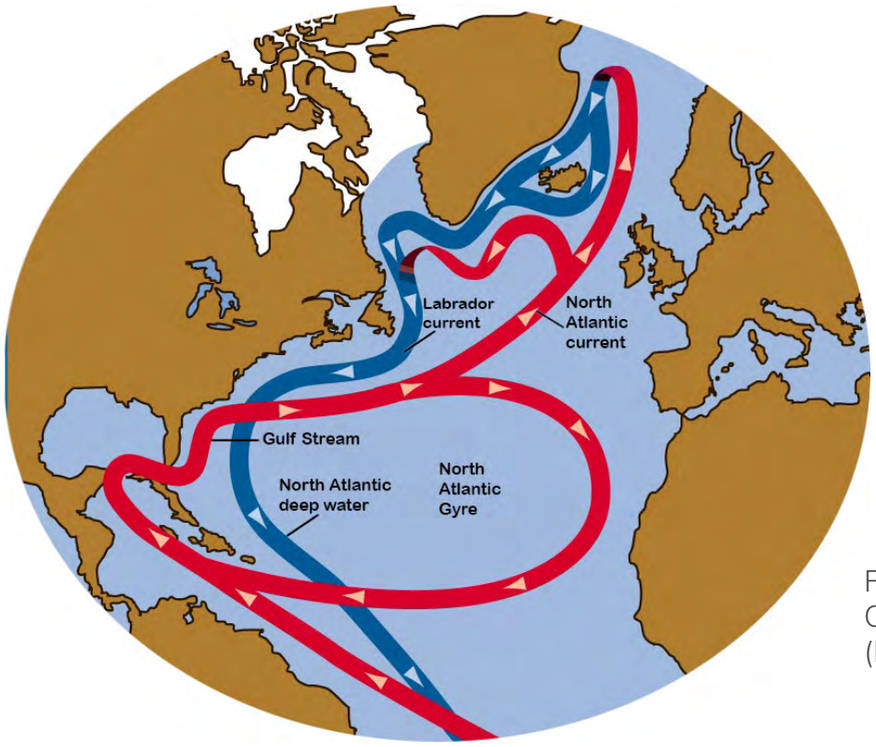


Figure 1: North Atlantic Overturning Circulation. (Image: ESA eduspace)

The Challenge

While the link between Atlantic Ocean temperatures and the European climate is clear, the pathways and processes that control this link are not. Two key knowledge gaps are:

- Understanding how and why the Atlantic overturning circulation has changed over time, and how it will change in the future
- Understanding the processes that link ocean temperature with European climate, and how they will change in a warming world

Global warming is shifting the planet's water cycles, accelerating glacier and sea-ice retreat, and increasing melting of the Greenland Ice sheet. There has been some speculation that circulation in the North Atlantic Ocean could reach a 'tipping point' in response to these changes, and that the heat- and salt-related component of the circulation could slow or shut down. Such a slowing or shut down could have a substantial impact on the weather and climate in Europe. It is imperative that we better understand these ocean and atmospheric processes to quantify the risks of change, and to develop early-warning indicators and fit-for-purpose ocean observing systems.

Blue-Action is supporting scientific research and transatlantic cooperation to assess how the physical conditions in the North Atlantic Ocean govern the weather and climate in Europe. As an important transporter of heat northwards, and the cause of Europe's relatively mild climate, the stability of the Atlantic overturning circulation is of particular interest.

Measuring the Atlantic overturning circulation

As part of the Global Ocean Observing System, international programmes are measuring overturning circulation in the North Atlantic Ocean, supported in part by Blue-Action and other EU programmes. Transport mooring arrays measure changes in

overturning circulation over time, and enable researchers to identify and understand the physics of ocean circulation. Climate model development depends on the understanding derived from these observational studies. Blue-Action researchers are observing the overturning circulation at 26°N (the RAPID array, www.rapid.ac.uk, since 2004), at 57°N (the OSNAP array, www.o-snap.org, since 2014), and at other areas including the Greenland-Scotland Ridge (Figure 2).

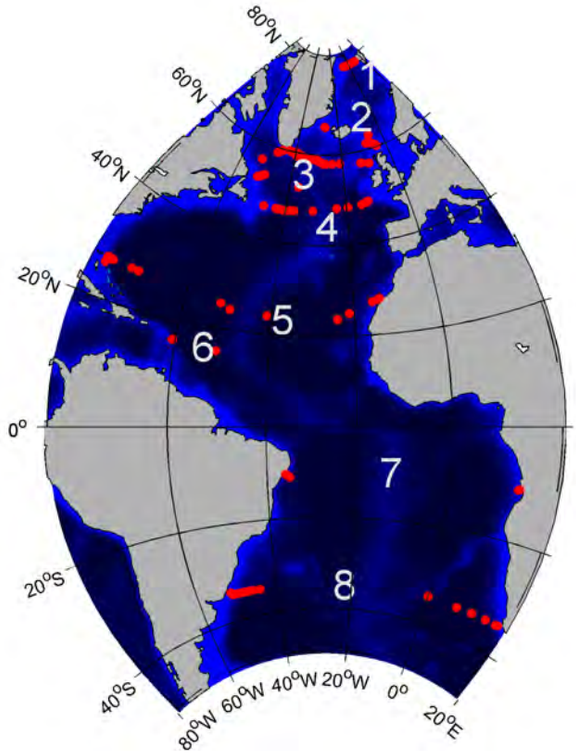


Figure 2: Transport mooring arrays installed in key locations in the Atlantic represent an important part of the Atlantic observing system. These arrays measure long time series of volume, heat, and freshwater fluxes in locations of strong flows.

Image: AtlantOS/OceanSITES

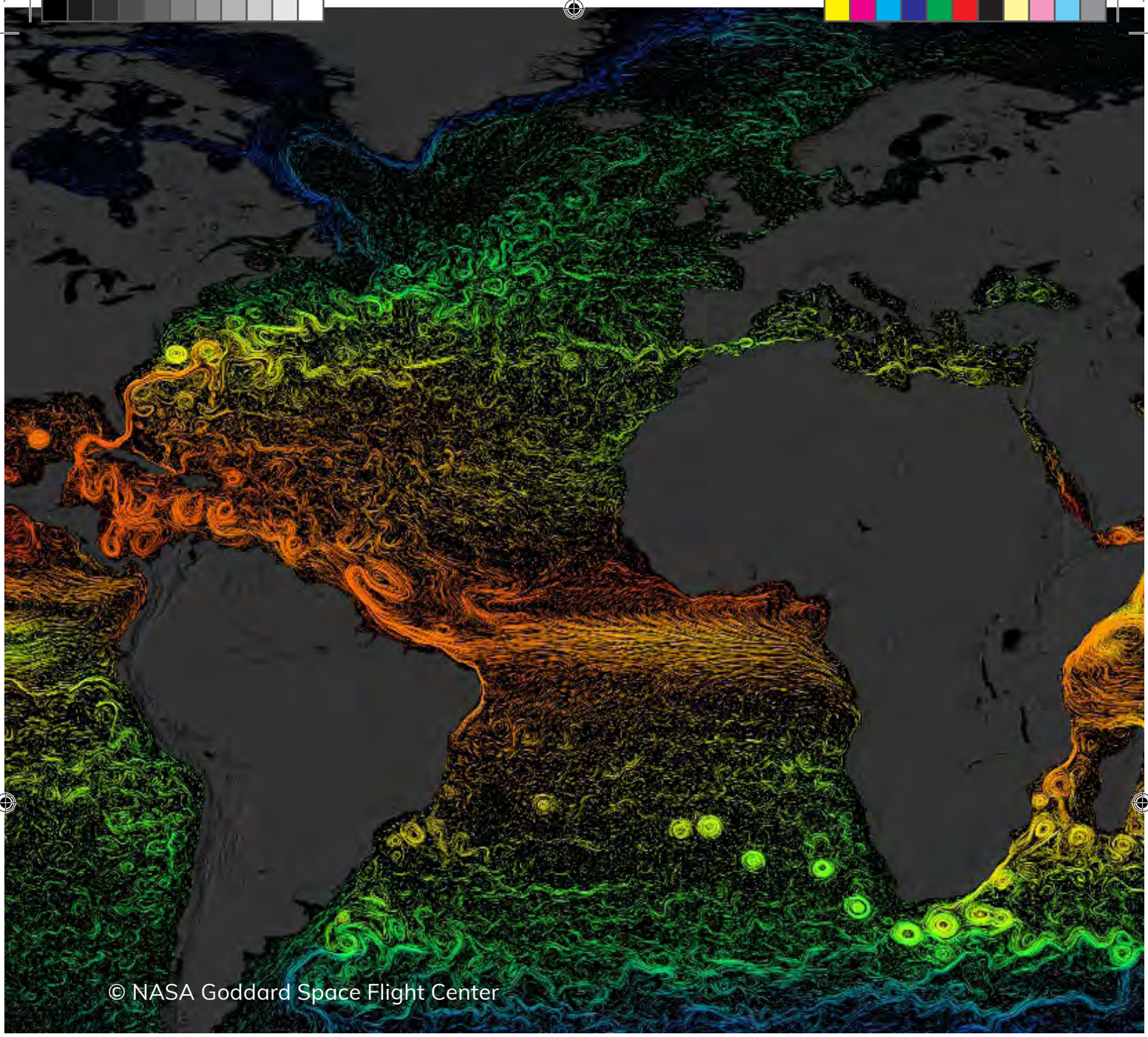
(1) Fram Strait.
(2) Greenland Scotland Ridge.
(3) OSNAP Overturning in the Subpolar North Atlantic Program.
(4) NOAC North Atlantic Changes.
(5) RAPID-MOCHA-WBTS Rapid Climate Change Meridional Overturning Circulation Heat-flux Array Western Boundary Time Series.
(6) MOVE Meridional Overturning Variability Experiment.
(7) 11˚S.
(8) SAMBA-SAMOC South Atlantic Meridional Overturning Circulation.

Is there a slow-down in Atlantic overturning circulation?

A slow-down in Atlantic overturning circulation has been observed in some areas of the North Atlantic Ocean, but not in others. For example, data from the array of instruments spanning the Atlantic at 26°N suggest that the Atlantic meridional overturning circulation has been in a state of reduced overturning since 2008 as compared to 2004-2008. (Smeed et al, 2018).

The Nordic Seas are an important area for another part of the overturning circulation, and have a strong impact on the climate of North West Europe. The warm salty waters of this limb of the overturning circulation cross the Greenland Scotland Ridge separating the Norwegian Sea from the North Atlantic Ocean. Flows across this ridge have been observed since the mid 1990s, and show no long term trend in volume transports (Berx et al. 2013, Hansen et al. 2015), indicating that this branch of the overturning circulation is very stable (Olsen et al. 2008).

Ocean temperatures and salinities measured at the Greenland Scotland Ridge show large variability on inter annual to decadal time scales. Historically, these measurements have tended to vary together, but recently a sudden decrease in salinity was not reflected in recorded temperatures. This discrepancy could be an early indicator of changes in this part of the overturning circulation.



Warmer summers are increasing the risk of a shut down of ocean convection

The Labrador and Irminger Seas around Greenland are important areas driving the overturning circulation because this is where warm, salty Atlantic water mixes with colder, fresher Arctic water, and cools and sinks. There are signs that this mixing process is changing because of warmer summers that are characterised by increased sea surface temperatures, freshwater concentrations, and ice melt. In the subsequent winters, more heat is retained and surface water stays more buoyant, meaning that freshwater does not mix down into deeper water, delaying convection (Oltmanns et al. 2018). This build-up of freshwater on the surface may be amplified by melting of the Greenland ice sheet.

Research led by Blue-Action suggests that these processes could drive a slowing or shutdown of ocean convection in the subpolar North Atlantic (Oltmanns et al. 2018), one of the important drivers of the Atlantic overturning circulation. This could have substantial consequences for the climate of Europe.

Linking the North Atlantic Ocean to Europe's weather

By linking ocean and atmosphere, Blue-Action scientists and partners have, for the first time, assessed the causes of variability in air temperatures over Europe on a regional basis, over different timescales (Årthun et al. 2018). This provides a higher-resolution picture of the different processes and mechanisms influencing the weather in different regions. For example, we now know that the climate of Eastern Europe is dominated by 10 year patterns of variability in large-scale atmospheric circulation (known as the North Atlantic Oscillation). Meanwhile, the climates of Northern and Southern Europe vary on longer time scales, associated with North Atlantic Ocean temperature changes carried into the region by dominant westerly winds. As ocean temperatures in the North Atlantic are predictable several years in advance, European climate could also be predictable (Årthun et al. 2017).

Summary

To make progress in understanding how the ocean influences Europe's weather and climate we must combine observational programmes with model development. Observations of the overturning circulation have revolutionised our understanding of the physical processes and natural variability in the system. In the last 20 years, observations of the northern parts of the overturning circulation which flow between Greenland and Scotland suggest that circulation remains stable. In other locations, observations suggest a downward shift in the strength of the overturning circulation in recent years, which could be linked with climate change. Research led by Blue-Action suggests that warmer summers in the sub-polar North Atlantic could be contributing to changes in overturning circulation.

Looking forward

Our ability to provide regional predictions of anomalous or extreme temperatures for Europe is limited by current climate model technology. However, oceanographers are able to predict the surface temperatures of the North Atlantic Ocean up to a decade in advance, though crucially depending on adequate ocean observations. This suggests that by understanding how the North Atlantic Ocean temperatures influence the climate of Europe, we could extend our prediction horizon to up to a decade in the future. At even longer timescales, a better understanding of physical processes of the North Atlantic Ocean through observational programmes and model development will enable us to anticipate potential abrupt changes to ocean circulation and consequences for the climate in Europe.

This would enable communities, businesses, health services, and policymakers to plan and adapt to future changes in climate and weather years, if not decades in advance, to ensure future prosperity across the region.

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BLUE ACTION AtlantOS

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