

Marine Science Co-ordination Committee (MSCC)

The Ocean in a Changing Climate

December 2020

Introduction

We are at a critical time to act on the evidence showing the fundamental link between the ocean and climate change. Despite the challenges that 2020 has brought us it is important to maintain momentum in the face of COVID-19 and to continue working towards global recognition of the linkages between the ocean, climate change and biodiversity loss. The ocean will form an essential part of the economic recovery, food security, societal wellbeing, jobs and climate change resilience.

With the UN Ocean Conference, the Convention on Biological Diversity (CBD) COP15 and United Nations Framework Convention on Climate Change (UNFCCC) COP26 planned for 2021, we are at the start of the crucial decade to take forward key opportunities to drive forward global action on the ocean, climate change and biodiversity, moving from science to solutions.

This statement highlights the UK's Marine Science Co-ordination Committee reflections on the growing body of literature showing the accelerating decline of the ocean as a result of climate change. This includes the Intergovernmental Panel on Climate Change Special Report on the Ocean and Cryosphere in a Changing Climate (IPCC SROCC - <https://www.ipcc.ch/srocc/>), and the UK Marine Climate Change Impacts Partnership Report Card 2020 (<http://www.mccip.org.uk/impacts-report-cards/full-report-cards/2020/>). With growing public attention on the climate emergency and the importance of the ocean in climate change mitigation and adaptation, the UK marine science community has a role to play in shaping an effective response.

- It is virtually certain that the ocean has taken up more than 90% of the excess heat in the climate system. Since 1993, it is likely that the rate of ocean warming has doubled, with marine heatwaves very likely to have doubled in frequency since 1982, and with an increasing intensity.
- Coupled with ocean acidification and decreased oxygen in our ocean, and pressures from other human activities (e.g. coastal development, contaminants and intensive fishing), marine and coastal ecosystems are being degraded.
- There is very high confidence that sea level rise is accelerating, presenting a major threat to both coastal ecosystems and human populations due to flooding and damage to key infrastructure.
- At the coast, the increased flood risk from sea level rise can be exacerbated by compound effects from other extremes, such as high intensity rainfall and storm events.

Current and future marine climate change impacts in the UK

The UK Marine Climate Change Impacts Partnership (MCCIP) has shown that there is clear evidence that warming seas, reduced oxygen, ocean acidification and sea level rise are already affecting UK coasts and seas and the communities that depend on them. UK impacts are consistent with those observed and forecast globally and highlighted by the IPCC SROCC (<https://www.ipcc.ch/srocc/>). We expect these changes to continue, and to intensify in the future.

The mean sea level around the UK has risen by 12–16 cm since 1900. At many locations, extreme sea levels that exceed critical flood-thresholds are happening more frequently than in the past. Updated UK projections for 21st century sea level rise forecast greater increases compared to previous projections (Met Office, 2018).

Coastal flooding is seen as one of the most serious threats to major cities, including London, and coastal populations around the UK, as well as worldwide. Increases in future extreme sea levels and flooding will be driven by mean sea-level changes, rather than changes in storm surges. Across the UK the central estimated projection sea-level rise ranges for 2100 are:

- London 45 – 78 cm
- Edinburgh 23 – 45 cm
- Cardiff 43 – 76 cm
- Belfast 26 – 58 cm

A range of climate change impacts on coastal and marine ecosystems are being observed in the UK. There have been clear shifts in species distributions, including declines in some traditional commercial cold-water fish (e.g. cod, herring and haddock) and an increase in some warm water species (e.g. European anchovy, Northern hake and squid). Alterations in the timing of life cycle events, and broader scale changes in marine community structures (e.g. an increase in warm water zooplankton), are affecting the wider marine food chain. The suitability of habitats for marine species, from the coast to the deep sea, is also being affected by climate change.

Evidence for other long-term physical changes, such as wind, wave and storm activity around the UK is less clear, and future projections remain highly uncertain. Natural variability is high, with long term fluctuations in atmospheric and ocean circulation affecting the position and strength of the North Atlantic storm track.

As with the global picture presented in the IPCC SROCC, there is the potential for more extreme winds, waves and storms in a warming world. A wide range of economically important marine and coastal industries are being affected by climate change. Coastal erosion, flooding, sea level rise and potential changes in storminess present multiple hazards to UK coastal communities, including an increased risk of disease as a result of higher numbers of marine pathogenic bacteria, damage to homes and infrastructure, loss of access to coastal spaces, as well as impacts on individual and societal health and wellbeing. At a national and international level, climate change impacts on society and their responses to these drivers are heavily influenced by wider external factors, such as government policies, available resources, demographic changes and societal values (Ranges depending on the greenhouse gas emissions scenarios between RCP2.6-8).

The findings at the UK level are consistent with those reported in the IPCC SROCC, with

increasing evidence of impacts from climate change on all parts of the marine ecosystem. These ultimately impact society and the economy. The increased rates of change, both observed and predicted, mean that action on improving the ocean's resilience and on climate change adaptation and mitigation is more urgent than ever.

The United Kingdom has a long and distinguished history of maritime and polar research.

The UK scientific community has contributed significantly to the advancement of climate change science. The UK has some of the longest marine time series in the world. The data from these time series support the assessment that the rapid rate of change in recent decades is unprecedented. Today, the UK funds a diverse portfolio of marine research, spanning across natural, physical and social sciences. State of the art ships, sensors, drones and satellites are playing a key role in understanding the range and scale of climate change impacts, from polar regions to tropical seas, while a growing marine social science community are leaders in understanding the human dimensions of the ocean and climate change.

The UK leads and participates in a wide range of key international marine initiatives. These include the Copernicus marine environmental monitoring system; the Argo global monitoring system; and the Global Ocean Acidification Observing Network (GOA-ON), which in turn feeds into the Global Ocean Observing System (GOOS). Furthermore, the UK undertakes significant research and monitoring of fish stocks, pollution and other physical and biological parameters. These parameters are used in assessments of UK seas and the wider North East Atlantic as part of intergovernmental processes which include assessing the changes attributable to climate change.

The UK also plays a key role in international programmes monitoring the function and strength of the Atlantic Meridional Overturning Circulation (AMOC), which helps maintain a mild climate in North- West Europe. The AMOC is predicted to weaken in the 21st century in response to climate change with potential consequences for temperatures, rainfall, storm patterns and sea level around the North Atlantic basin, including the UK. When looking at future change, the Met Office Hadley Centre lays claim to some of the most sophisticated climate models in the world, with significant recent advances in near-term and long-term projections.

Next steps

Marine science and technology will continue to play a crucial role in deepening our understanding of climate change and its impacts, as well as in providing solutions.

As the UK looks forward to hosting the G7 Presidency, the UNFCCC Conference of the Parties (COP26) in partnership with Italy, and towards the UN Decade of Ocean Science for Sustainable Development (2021 – 2030) and therefore the need for evidence to support policy and action, it will be critical to maintain the science and momentum established by the IPCC SROCC and the Blue COP25 (COP25 was labelled as the Blue COP to highlight the link between the climate and the ocean following the release of the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (IPCC SROCC)).

Key activities that the UK marine science community is undertaking include:

- The Marine Climate Change Impacts Partnership (MCCIP) will identify and publish

evidence needs for the MSCC, such as a paper on key challenges and emerging issues of climate change. This comes off the back of the latest MCCIP Report Card, published in January 2020 (http://www.mccip.org.uk/media/1999/mccip-report-card-2020_webversion.pdf), where over 150 scientists from more than 50 leading research organisations contributed to a comprehensive assessment of the physical, ecological and societal impacts on UK coasts and seas.

- Work commissioned by the MSCC Social Science Task Group, published as a report in early 2020, presents a summary of social, cultural and heritage indicators in the context of marine environments (https://f44.b66.myftpupload.com/wp-content/uploads/2020/06/14796_ME5118_ReviewofMarineCulturalSocialandHeritageIndicators-3-1.pdf), providing a valuable baseline to develop further insight into how society might be impacted by climate change in the future.
- Scientific evidence from the UK ocean climate community and MCCIP is key to the Climate Change Risk Assessment (CCRA) and subsequent National Adaptation Plans (NAP) as part of the UK Climate Change Act (2008). This evidence enables policy decisions to achieve a range of greenhouse gas reduction targets and prepare the UK for future climate change.
- The recent UK Climate Projections UKCP18 provide updated projections of changing risks of sea level extremes around the UK, drawing on the latest sea level science, while earlier projections from the Maritime Industries- Environmental Risk and Vulnerability Assessment (MINERVA) illustrated plausible impacts of climate change on the wider marine environment. Over the coming years an important goal is to develop a more consistent approach to scenarios between land and the marine environment, allowing climate projections to link seamlessly between land, marine and coastal hazards.
- The North East Atlantic Ocean Acidification Hub has been established in the UK, with support from the Department for Environment, Food and Rural Affairs (Defra). As part of the Global Ocean Acidification Observing Network (GOA-ON), the Hub acts as the focus for UK ocean acidification research and as the European regional centre for conducting monitoring and research into ocean acidification, primarily within the North East Atlantic region.
- The UK is leading activity to promote high quality, sustained ocean observations through the G7 Future of the Seas and Oceans Working Group, and as part of this initiative is working with other G7 countries to establish a Coordination Centre for ocean observation platforms that will interface with the Global Ocean Observing System.
- In January 2021, the UN Decade of Ocean Science for Sustainable Development (2021-2030) will commence. This Decade is focused on generating scientific knowledge and infrastructure, enhancing ocean literacy and fostering partnerships to support efforts in reversing the decline of ocean health. The climate will be a key priority and marine science has a key role in ensuring that society has the capacity to understand and predict future ocean conditions, measuring and reducing the impact of climate change to maintain a healthy and resilient ocean, protection from ocean hazards in human communities to ensure a safe ocean for all and maintenance of a sustainably harvested ocean which may be impacted by changes in climate.

Appendix

The Marine Science Co-ordination Committee and Climate Change

The Marine Science Co-ordination Committee (MSCC) was formed in 2008 at the request of the UK Government and Devolved Administrations to improve collaboration and co-ordination of scientific knowledge, resources and communication, and to support UK evidence needs for policy decisions by making best use of the UK's world class marine science capabilities.

The MSCC oversees the Marine Climate Change Impacts Partnership (MCCIP), which was established in 2005 to make research on climate impacts on the marine environment accessible to the UK policy community. The MCCIP provides quality assured science at a national level for decision makers. Since 2005, over 300 authors and 150 reviewers have contributed to MCCIP report cards, producing authoritative, regularly updated state of the science reports and summary report cards for the UK.

MSCC groups also include the UK Integrated Marine Observing Network (UK-IMON) to ensure measurements from observing programmes are fit for purpose and available to all participants under Open Government Licence and, where appropriate, to European and international programmes such as Copernicus and the Global Ocean Observing System (GOOS). Additionally, there is the Marine Environmental Data and Information Network (MEDIN) of the MSCC that consolidates the adoption of MEDIN protocols across the UK as the national framework for marine data management, promotes the re-use of data, and stores and manages UK marine monitoring data for all to use.

The MSCC International Working Group (IWG) brings together individuals from across the UK marine community to form a collaborative and coherent input to a variety of marine and climate international initiatives. For example, the MSCC IWG has been designated the UK National Decade Committee, whose role it will be to facilitate the engagement of the UK science community and Government in the work of the UN Decade of Ocean Science for Sustainable Development.

About the UK Marine Science Co-ordination Committee (MSCC)

UK Marine Science Co-ordination Committee membership comprises senior representatives from government departments, the Devolved Administrations, government agencies, research institutes and UK Research and Innovation (UKRI).

Member organisations are as follows:

- Agri-Food and Biosciences Institute (AFBI)
- Centre for Environment, Fisheries and Aquaculture Science (Cefas)
- Defence Science and Technology Laboratory (Dstl)
- Department for Business, Energy & Industrial Strategy (BEIS)
- Department for Environment, Food & Rural Affairs (Defra)
- Department for Transport (DfT)

- Department of Agriculture, Environment and Rural Affairs (DAERA)
- Environment Agency (EA)
- Foreign, Commonwealth & Development Office (FCDO)
- Joint Nature Conservation Committee (JNCC)
- Marine Alliance for Science and Technology for Scotland (MASTS)
- Marine Biological Association (MBA)
- Marine Management Organisation (MMO)
- Met Office
- National Oceanography Centre (NOC)
- Natural Resources Wales (NRW)
- Plymouth Marine Laboratory (PML)
- Scottish Environment Protection Agency (SEPA)
- Scottish Government (SG), including Marine Scotland (MS)
- Sea Fish Industry Authority (SEAFISH)
- United Kingdom Hydrographic Office (UKHO)
- UK Research and Innovation (UKRI)
- Welsh Government

These members sit alongside the Chairs of the MSCC subgroups:

- Communications Working Group
- International Working Group <https://projects.noc.ac.uk/iwg/>
- Marine Assessment and Reporting Group
- Marine Climate Change Impact Partnership (MCCIP) <http://www.mccip.org.uk/>
- Marine Environmental Data and Information Network (MEDIN) <https://www.medin.org.uk/>
- Marine Industries Group
- Research Vessel Working Group
- Social Science Task Group
- UK Integrated Marine Observing Network <http://www.uk-imon.info/>

- Underwater Sound Forum <https://projects.noc.ac.uk/usf/>

This statement was prepared by the UK Marine Science Co-ordination Committee (MSCC)