



# Foreword

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The ocean is an essential component of our planet's climate. Scientists know this, and have repeatedly proven it: without the ocean, our greenhouse gas emissions would have disrupted the climate machine to a much greater extent. It is hence an essential regulator that is constantly threatened by human activity and by the consequences of global climate change.

The numbers speak for themselves. The ocean covers 71% of the planet, represents 97% of its living space, holds 97% of the Earth's water, absorbs 90% of the heat and 25% of the additional CO<sub>2</sub> emitted by humans. It provides livelihoods for a substantial part of the world population and provides a substantial amount of pharmaceutical substances. Its ecosystems are worth more than the United States of America's GDP. The threats facing the ocean and the communities that depend on it are as staggering as they are alarming: acidification, warming waters, deoxygenation, rising sea-levels...

Yet, despite the threats the ocean faces, despite its prevalence in the climate's inertia, it has been swept aside from international efforts to mitigate and adapt to climate change. For over twenty years, the ocean had not been mentioned in the additional texts of the United Nations Framework Convention on Climate Change (UNFCCC). Startled by this realisation, the 70 members of the Ocean and Climate Platform (public institutions, NGOs, universities, etc.) decided to give a voice to the ocean during the climate negotiations at COP21.

According to them, the Paris Agreement symbolises an important step, an outstanding success, for the inclusion of "ocean and climate" issues. For the first time since the UNFCCC, the Paris Agreement of December 2015 explicitly mentions the ocean in its preamble. Moreover, the Intergovernmental Panel on Climate Change (IPCC) will publish a Special Report on Climate change and the oceans and the cryosphere. The ocean has now entered the climate negotiations!

But the fight for the ocean does not stop here. It is no longer solely up to diplomacy – which must still better

integrate the ocean – to mobilise. The marine civil society must take part in the Action Agenda, suggest alternatives, bring forth and support initiatives, communicate good practices and disseminate knowledge. The Ocean and Climate Platform is already on this path.

But above all, we must better understand the ocean – this vast, wide, diverse environment that contains so much biodiversity that has yet to be explored. The sea-bed embodies the last terra incognita. Physical and biological mechanisms are yet unexplained or poorly known. Scientists and policy-makers need to take action to fill the knowledge gaps on the relationships between the ocean and the climate. Last year, thanks to its strong scientific basis, the Ocean and Climate Platform published 17 scientific notes. In 2016 it extends this base by publishing the second volume.

This booklet seeks to be more inclusive and open. These notes embrace both "hard" and "human" sciences as we are convinced that "human" sciences are the second backbone to better know the ocean and the related socio-economic issues. The Ocean and Climate Platform welcomes new themes: the law for the ocean and climate, political sciences, human migrations... These new topics are meant to be food for thought in the international discussion on adaptation strategies, knowledge gaps, everyday behaviour, and form the basis for a better understanding of human challenges and solutions. We urge for a greater integration of "hard" sciences and "human" sciences alike. As to find solutions to global problems (climate change), research must be trans-disciplinary and holistic.

"Ocean and climate" science is a work in progress. It must respond to tremendous challenges: collecting sufficient and diverse data, reducing scales, understanding the local and global phenomena, studying the surface and the depths, the open-sea and the coast, biodiversity and human communities. The potential for research is massive. But it is absolutely necessary. The ocean is our "all-risk" insurance policy, and it is high time to protect it!



This set of articles goes back over some that were written for the COP21, updating data with recent advances in knowledge. This is the case for those on sea-level rise, ocean oxygenation, marine biodiversity, coral and deep-sea ecosystems.

Some topics, such as sea-level rise or the long-term consequences of climate change on the ocean, draw on one or several articles published this year. They are thus deliberately short, as to draw attention to the key facts available to us today.

Others, like ocean circulation or coral bleaching summarize in depth the available data and models.

Yet other articles further examine emerging topics, such as the role of marine protected areas in climate change, human migrations, national contributions of the Mediterranean basin, or more broadly international law.

This set of articles owes a great deal to the work of the Platform's scientific council, but also to the work of the young scientists group, initiated by FACT-O (French American Climate Talks on Ocean), who wrote or took part in the writing of nearly half of these productions.

FACT-O is a series of public conferences programmed over 2 years (2016 and 2017) in North America, during which leading scientists, civil society representatives, NGOs, political figures, journalists, and entrepreneurs will speak about oceans and the associated issues. It aims at creating a research programme for young scientists to facilitate exchanges between the two countries. The creation of the group "Youth for Oceans!" (YO!), is a declination of this project. It is an interdisciplinary and international group of young scientists seeking to promote knowledge on the links between the ocean and the climate, to encourage a dialogue between science and society, and to advocate a better integration of the ocean in international climate negotiations.

The COP22, which will be held in Marrakech from the 7th to the 18th of November 2016, appears as an opportunity to go from the Agreement to action. Indeed, the Paris Agreement is a key event in the progress of climate negotiations, thanks to the commitments made by a great number of States. This set of articles raises key issues concerning the interactions between the ocean and the climate, and may take part in the implementation of action.