ROADMAP

The Role of ocean dynamics and Ocean-Atmosphere interactions in Driving cliMAte variations and future Projections of impact-relevant extreme events

DURATION
1/04/2020 - 31/12/2022

BUDGET
242 250€

PROJECT DESCRIPTION

ROADMAP aims to expand current understanding of how the Northern Hemisphere ocean surface state and ocean dynamics influence the extratropical atmospheric circulation, as well as associated impact-relevant weather and climate extremes, across time scales under both present day and future climate conditions. Specifically, ROADMAP will address:

- the impact of the ocean circulation, especially the Atlantic Meridional Overturning Circulation, on large-scale sea surface temperature (SST) patterns [WP1]
- the changing modes of variability of the Northern Hemisphere western boundary current extensions and what novel ocean-eddy resolving climate models can say about their future evolution [WP1]
- how and on which time scales extratropical ocean-atmosphere interactions control the tropospheric eddy-driven jets, cyclone variability (storm track), blocking events and the associated dynamical link to extreme conditions; and how such controls can be modified by global warming [WP2]
- the impact of tropical El Nino Southern Oscillation and Madden Julian Oscillation SST anomalies on the mid-latitude and polar atmospheric circulation [WP3]
- the multidecadal links between tropical and subtropical North Atlantic, and inter-basin connections between the Atlantic and the Pacific Oceans, as well as modifications of linkages under climate change conditions [WP3].
- the role of the Northern Hemisphere ocean surface state (SST and sea ice) for driving impactrelevant atmospheric extremes, such as atmospheric and marine heat waves and droughts, including compound weather extremes and Mediterranean mesoscale cyclones; both largescale natural variability modes and climate-change induced anomalies will be considered [WP4]
- the identification of key spatial-temporal variability patterns as well as cross-scale causal coupling between different variability modes of ocean and atmosphere [WP5 jointly with WP2 and WP3].

ROADMAP will exploit the wealth of simulations recently produced in other (international) research activities, such as CMIP6 and single-model large ensemble (~100 members) of simulations as well as frontier ocean-eddy resolving simulations from H2020 project PRIMAVERA. Existing simulations will be complemented with dedicated sensitivity experiments, encompassing cutting-edge numerical modelling techniques, such as pacemaker experiments based on data assimilation and interactive ensemble modelling. The sensitivity experiments will partly employ very high-resolution atmospheric grid configurations. Novel observational indices will be developed to investigate yet poorly understood historical ocean circulation variability.

ROADMAP

Analysis will be based on new advanced dynamical and statistical methods as well as novel approaches from the field of machine learning designed to infer complex, non-linear relationships. Analysis will also be performed in a multi-model framework, crucial for assessing the robustness of the results. Key results achieved will be disseminated to the scientific, stakeholder and climate service community as well as the general public.

The ROADMAP consortium encompasses leading climate research institutions from seven European countries, including universities as well as institutions providing (national) meteorological and climate services. ROADMAP will continue a long-standing history of international collaboration between its partners within the framework of previous joined projects, making significant contributions to climate variability, predictability and response, as well as climate extremes, particularly in the North Atlantic/European sector.

The Royal Meteorological Institute is co-leading the WP 5 whose aim is to develop and provide methodological tools to be applied in the analysis of the interaction between the different components of the climate system.

The potential impact of the research is to clarify the link between the North Atlantic region and the other different key regions expected to provide low-frequency variability and predictability over the North Atlantic and Europe. Knowing this type of information allow for getting a clear picture of the potential for long term predictability over Europe. From the side or RMI, the expected results are: (1) improve techniques for detecting causal links; (2) Understanding the link between the Tropical Regions and the extratropics, in particular the North Atlantic and Europe; (3) Understanding the interaction between the ocean and the atmosphere.

CONTACT INFORMATION

Coordinator (Belgian contribution)

Stéphane Vannitsem
Royal Meteorological Institute of Belgium (RMI)
Stephane.Vannitsem@meteo.be

General coordinator

Daniela Matei
Max Planck Institute für Meteorologie
Germany

LINKS

http://www.jpi-climate.eu/joint-activities/joint-calls/CPILoud/ROADMAP