EXPECT

MS3.1: Internal workshop on methods to assess drivers of annual to decadal changes in climate

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1 About

On Monday 9 September (14.00 – 17.15 CET) and Tuesday 10 September (13.00 – 17.00 CET), the EXPECT consortium hosted an online internal workshop on methods to assess drivers of annual to decadal changes in climate. The primary objective of this two-day workshop was for each contributing institution to present their plans for Work Package 3 (WP3; Drivers of annual to decadal changes in climate). This included a detailed overview of the methods to be employed, with the intention of increasing general awareness, receiving feedback and suggestions on the approach, and establishing potential collaboration opportunities. The workshop also provided an opportunity to gather the working hypotheses from each contributing institution.

The online workshop was held just a few months after the start of the project. The rationale for this timing was that it can be valuable to obtain feedback on the methodology at an early stage, to ensure an efficient research set-up and to involve relevant people also from other research themes.

2 Executive summary

Organized by VU Amsterdam, this two-afternoon online workshop featured prominent scientists from almost all EXPECT institutions, focusing on climate and atmospheric dynamics. The event was moderated by Rikke Stoffels, Vera Melinda Galfi and Dim Coumou with in total 11 presentations of each 20 minutes and 28 participants. The workshop resulted in some collaborative Insights through the presentations and discussions. Participants shared insights from latest climate research, ranging from climate modeling, extreme events, and atmospheric patterns to innovative methodologies (e.g. AI) to study atmospheric circulation changes. The closing session focused on refining individual working hypotheses and planning collaborative next steps for further research, emphasizing the sharing of resources.

3 Workshop outline

3.1 Workshop program

The workshop on methods to assess drivers of annual to decadal changes in climate was hosted online and comprised two sessions, each with a number of presentations and time allocated for discussion. We aimed to group the presentations by theme, with data-driven methods, for instance, covered on the second afternoon. The full program is outlined in the tables below.

Time (CEST)	Speaker	Presentation title
14.00-14.05	*General introduction*	
14.05-14.35	**Hamed Ibrahim** (University of Toronto)	Diagnosing the role of land surface vegetation type and position in simulations of extreme hydrological and heat events
14.35-15.05	**Emily Black** (University of Reading)	Drought
15.05-15.15	*Coffee/toilet break*	
15.15-15.45	**Paul Kushner** (University of Toronto)	Value added of regionally refined earth system models in simulation of climate extremes and hazards
15.45-16.15	**Eylon Vakrat** (University of Toronto)	Dynamical Methods to Spot Persistent Impactful Blocking
16.15-16.30	*Coffee/toilet break*	
16.30-17.00	**Tamara Happé** (VU Amsterdam)	Decomposition of observed circulation trends in boreal summer using ERA5-reanalysis and CMIP6
17.00-17.15	*General discussion, closure*	

Table 1: Workshop program for the first afternoon

Time (CEST)	Speaker	Presentation title
13.00-13.05	*General introduction*	
13.05-13.35	**Rikke Stoffels** (VU Amsterdam)	Explainable Neural Network for identifying (tropical) teleconnection patterns
13.35-14.05	**Stefano Materia** (BSC)	Data-driven methods to identify and quantify the roles of climate drivers
14.05-14.15	*Coffee/toilet break*	
14.15-14.45	**Julianna C. Oliveira** (Universität Leipzig)	Variational auto-encoders for identifying summer weather regimes and temperature variability in Europe
14.45-15.15	**Buwen Dong** (University of Reading)	Anthropogenic influence on excess warming in Europe during recent decades
15.15-15.30	*Coffee/toilet break*	
15.30-16.00	**Markus Donat & Gerard Marcet** (BSC)	Attributing climate features to internal drivers by constraining ocean variability in large ensemble simulations
16.00-16.30	***Doug Smith & Melissa Seabrook** (Met Office)*	*Exploiting model differences to identify drivers*
16.30-17.00	*General discussion, next steps, closure*	

Table 2: Workshop program for the second afternoon

3.2 Workshop summary

The workshop was organised by VU Amsterdam, with Rikke Stoffels acting as chair and moderator on the first afternoon and Vera Melinda Galfi in the same role on the second afternoon. Dim Coumou opened both sessions with a general introduction and facilitated the concluding general discussion on the second afternoon.

The first session included five 20-minute presentations, each followed by 10 minutes of discussion. The second session comprised six presentations, with additional time at the end of the session for a comprehensive discussion on individual working hypotheses and next steps.

To allow participants to ask questions and provide feedback to the presenters throughout the session, the meeting chat was open to all attendees.

3.2.1 Attendance list

The participants are (in order of joining the online meeting):
Dim Coumou (VU Amsterdam), Vera Melinda Galfi (VU Amsterdam), Rikke Stoffels (VU Amsterdam), Frank Selten (KNMI), Caihong Liu (VU Amsterdam), Paul Kushner (University of Toronto), Emily Black (University of Reading), Buwen Dong (University of Reading), Marlene Kretschmer (Universität Leipzig), Eylon Vakrat (University of Toronto), Hamed Ibrahim (University of Toronto), Goratz Beobide-Arsuaga (Universität Hamburg), Julianna C. Oliveira (Universität Leipzig), Gerard Marcet (BSC), Antje Weisheimer (ECMWF), Melissa Seabrook (Met Office), Christian Lessig (ECMWF), Bernd Funke (IAA-CSIC), Markus Donat (BSC), Doug Smith (Met Office), Stefano Materia (BSC), Patrick McGuire (University of Reading), Daniel Befort (ECMWF), Tamara Happé (VU Amsterdam), Vikki Thompson (VU Amsterdam/KNMI), Étienne Plésiat (DKRZ), Allende Solaun Boada (ARCTIK), Lluís Palma (BSC), Cheng You (University of Toronto)

4 Workshop outcomes

4.1 Working hypotheses

During the final discussion at the end of the second session, we gathered some working hypotheses of contributing institutions. They are listed below.

Institution	Working hypothesis
BSC	The recent multi-decadal trends in NH summer circulation, showing a circumglobal wave-5-like pattern, are driven by a combination of anthropogenic forcing and climate variability. Different parts of this circumglobal phenomenon are likely a consequence of different drivers.
Universität Leipzig	The regional dynamical drivers of European summer extremes can be identified using a targeted, non-linear machine learning clustering approach which gives additional insights in terms of the dynamical phase space and the target variable compared to conventional methods (PCA + kmeans clustering). Moreover, causal inference will help quantify and disentangle the contributions from different spring and summer teleconnections relevant for European summer weather.

Met Office	The wave 5 pattern is driven by the tropical Pacific and model differences can be exploited to understand the physical mechanisms and derive an emergent constraint to narrow uncertainties in future projections.
VU Amsterdam	The circumglobal wave-5 pattern can be divided into two separate patterns, each having their own drivers. We focus on tropical convection as a potential driver.
University of Reading	At least part of the observed trend pattern in circulation over Eurasia is due to forcing, whereby aerosol-forcing play a major role
University of Toronto	Dynamical linkages between impactful European and North American climate extremes and large-scale teleconnections can be efficiently studied by focusing on the dynamics of the most persistent atmospheric circulation states. Such states remain robust under projected climate change, but dynamical downscaling and hydrological modelling, accounting for land-use change, is required to quantitatively project their surface impacts and associated hazards.

Table 3: Working hypotheses

5 Next steps

The closing session focused on refining individual working hypotheses and planning collaborative next steps for further research, emphasizing the sharing of resources.