



EUropean CLimate and weather Events: Interpretation and Attribution

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3 year project under the FP7-SPACE Call, started January 2014.

Brings together 11 European partners. Aims to demonstrate the potential for operational attribution through the development of attribution methods and systems and evaluate their potential via a set of test cases prototyped with targeted users

TEST CASES:

- ☐ Heat waves
- ☐ Cold spells
- ☐ Droughts
- ☐ Floods
- ☐ Storm surges



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❖ **WP1,2 (Peter Stott, Met Office)**

Management and scientific coordination

❖ **WP3 (Pete Walton, Oxford)**

Stakeholder User Panel

❖ **WP4 (Hans von Storch, HZG)**

Stakeholder Engagement

❖ **WP5 (Myles Allen, Oxford)**

Methodologies / Framing Issues

❖ **WP6 (Robert Vautard, CNRS CEA)**

Evaluation & Diagnostics

❖ **WP7 (Geert Jan van Oldenborgh, KNMI)**

Targeted Test Cases

❖ **WP8 (Nikos Christidis, Met Office)**

Near-real time attribution service



Highlights of progress

- Substantial input to BAMS annual reports explaining extreme events of previous year from a climate perspective
- Substantial input to National Academy of Sciences report on Extreme Weather Event attribution
- Development of methods
 - Statistical based on observations
 - Pre-computed assessments using coupled model runs
 - Seasonally updated assessments using state of the art climate model forced with observed SSTs
 - Analogue methods that partition changes between dynamic and thermodynamic drivers
- Development of systems
 - Fast track
 - Seasonal timescale
- Better understanding of user needs

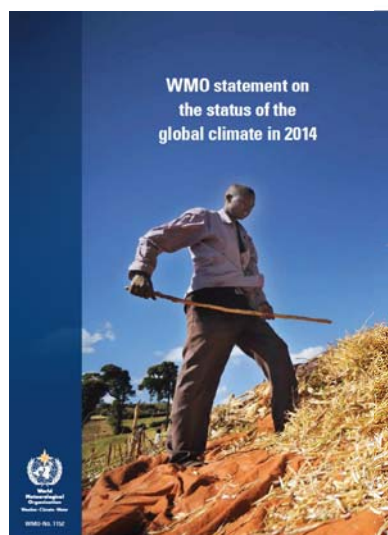


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Pre-computed tables of the FAR



Event attribution: an application to the global and United Kingdom record temperatures of 2014

Reference: Christidis, N., P.A. Stott and F.W. Zwiers, *Pre-computed attribution assessments based on the odds of warm extremes*, *Climate Dynamics*, 2015 (online early-view). Authors: Nikos Christidis, Peter Stott

Detection and attribution studies have demonstrated that human influence on the climate has been a main driver of the unequivocal warming of the global climate system observed since the 1950s, according to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Human influence has also led to significant regional temperature increases in the continental and subcontinental temperature distributions are also expected to bring more frequent and intense events. It is interesting to note that the observed slowdown in temperature increase over the last decade has continued to increase at smaller spatial scales. The fast-track event attribution has been a key scientific tool to determine anthropogenic climate change events by estimating the odds of extremes relative to a baseline that is not influenced by a new event attribution to the global and UK mean of 2014.

Event attribution assessments can help to identify the possible influences on the occurrence of events in a specific case, that is, irrespective of the specific conditions at the time of the event under consideration, until more thorough slow-track investigations become available. A fast-track attribution methodology was published last year by scientists of the Met Office Hadley Centre in the United Kingdom based on pre-computed tables of the change in the likelihood of temperature extremes. Tables can be constructed for any region of the world and are available for the study of both annual and seasonal temperature extremes.

The methodology comprises three steps. First, the UK record of 2014 lies within both distributions, albeit more to the extreme warm tail of the pre-distribution (Figure 15(a)). The UK distribution is broader and overlies a higher value to the attributed anthropogenic changes at the smaller scale. At a global scale, the relative contribution of the anthropogenic component is much larger, and thus the distributions overlap hardly at all. It is estimated that human influence has increased the likelihood of the observed record-breaking temperatures in the United Kingdom by a factor of ten.

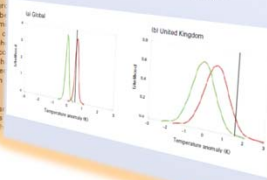
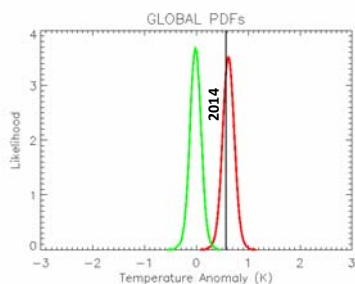


Figure 15. Distributions of (a) global mean and (b) UK mean annual temperature anomalies relative to 1981-1990 from the fast-track attribution methodology with (red line) and without (green line) the effect of human influence on the climate. The temperature record of 2014 are represented by the black vertical lines.



Eucleia Pre-computed tables of the FAR

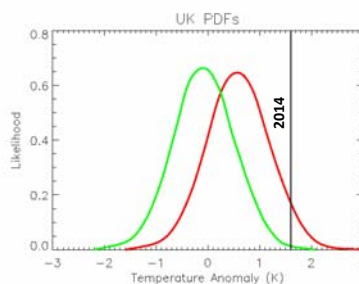
Application: The record global and UK temperatures of 2014



The global mean 2014 temperature is highly unlikely in a world without human influence on the climate

Met Office press release, January 2015

WMO Annual Statement, No 1152, March 2015

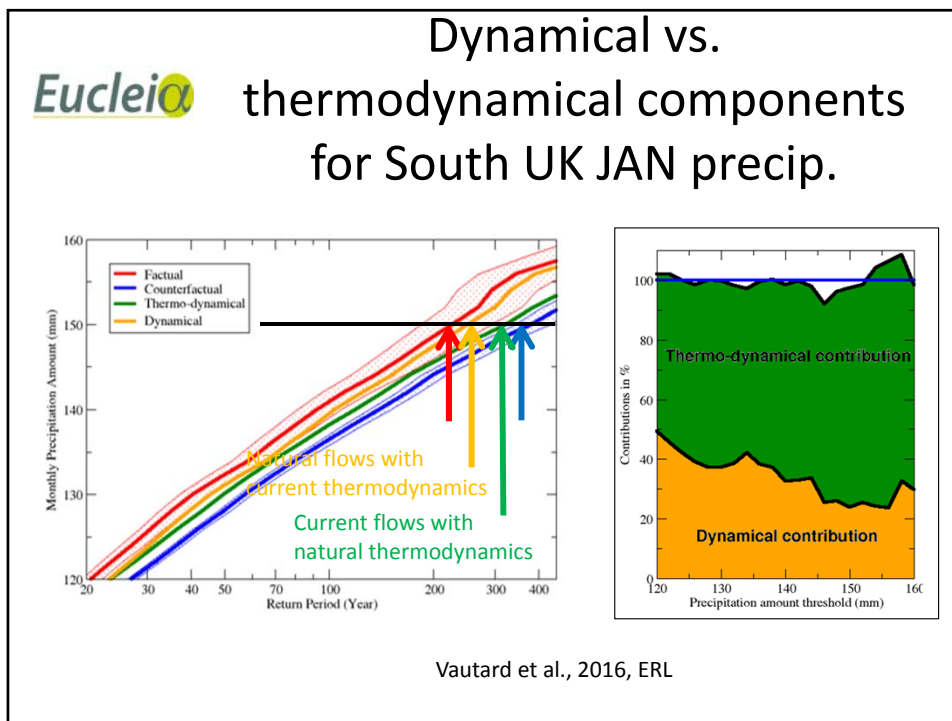
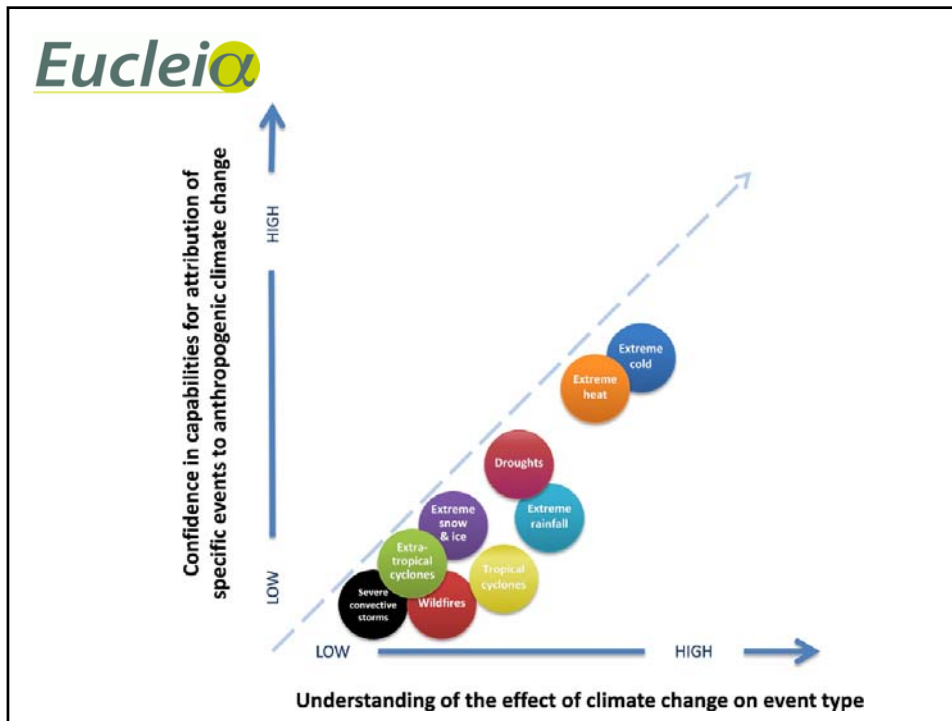


Human influence has also made breaking the current UK temperature record about ten times more likely (FAR = 0.9)

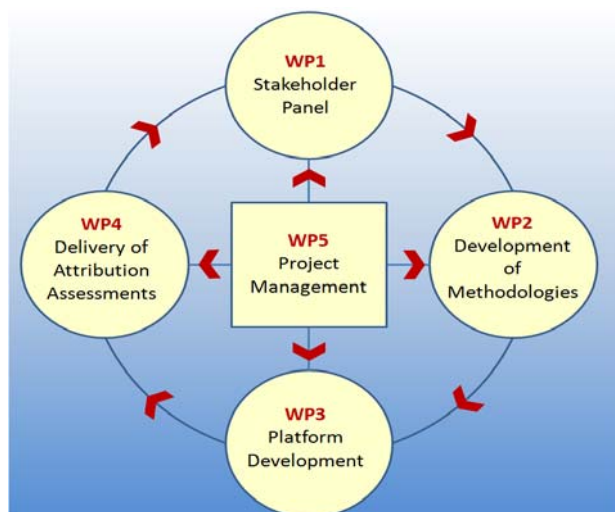


Lessons learned

- Transparency
 - It should be possible to trace route from press release to source material that allows user to understand how the result was obtained
 - This is particularly important when multiple methods have been synthesised
- Layering
 - Tailoring to different decision frameworks requires bi-directional communication between providers and users
 - For event attribution for Europe need to develop a (back office) scientific platform which will enable cross European coordination and synthesis and will allow the delivery of user-oriented assessments (shop window)
 - EUPHEME proposal under ERA4CS call
- Disclosure
 - Emphasise what we understand (qualitative)
 - Be open with uncertainties (which we may not fully quantify)
 - Communicate carefully how further research might affect current results



EUPHEME



Objectives

1. Derive requirements from targeted user groups
2. Develop methods for event attribution including development of experimental designs and clear ways of framing
3. Identify key processes driving extreme events and develop methodologies for representing level of confidence in attribution results
4. Demonstrate the utility of the attribution system on a set of test cases of European weather and climate extremes
5. Deliver quasi-operational attribution assessments on a range of timescales in the aftermath of extreme events



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Quasi operational capability

- Reports submitted to annual BAMS attribution reports
 - Short summary reports with two figures
 - Peer-reviewed
 - Appears in Autumn following year in question
 - Depends on interest of research groups and passing peer review



What are the further research needs?

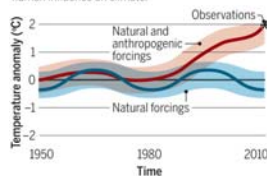
Robust event attribution

Scientists use two main approaches to determine the contribution of climate change to extreme weather events.

Approach 1

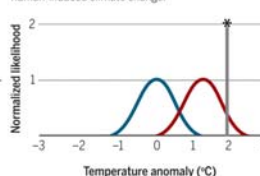
Observed and modeled temperature changes

Scientists compare changes in observed temperatures to modeled temperatures with or without human influence on climate.



Distribution of possible temperatures

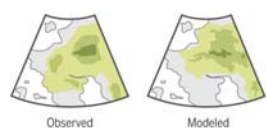
They use this comparison to assess how likely the observed temperatures are with and without human-induced climate change.



Approach 2

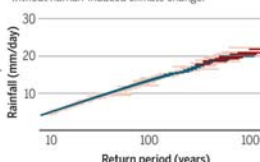
Observed and modeled rainfall distributions

Researchers look for rainfall events in the large ensembles of model runs that are similar to the observed rainfall event.



Return times for extreme rainfall events

They determine return times for such events in large model ensembles of model runs with and without human-induced climate change.





How recommendations of previous review were implemented

- Engagement with some other key stakeholders and end-users (media, policy makers, general public) has been patchy and would benefit from more effort
 - Major outreach following publication of Schaller et al. Daily Mail, BBC News, Carbon Brief etc
 - Major input to US National Academies of Science report on event attribution
 - Major outreach following publication of US National Academies of Science report. Carbon Brief, Science magazine, Climate Central
 - Peter Stott has accepted opportunity to provide Perspective piece for Science
 - We should note however that EUCLEIA was designed to develop event attribution capability in a closed setting – thereby learning lessons – before providing a public facing – and potentially error-prone – capability
 - We have been able to learn lessons from the WWA exercise
 - Importance of clear language : probability ratio better than FAR
 - Importance of traceability of statements
 - Importance of not over-promising based on limited capability



ERA4CS: EUPPHEME

- KNMI, Met Office, CNRS, Meteo France, Reading University, Met Eireann, CGCRI, BRGM
- To develop scientific infrastructure to deliver event attribution for fast track and slow track attribution assessments
- Built around a shared scientific platform on which can be built operational attribution services
- Unfavourable funding model means work will need to be heavily aligned with existing commitments and involve minimal management overheads, ie a small consortium based on EUCLEIA members