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INRAE Aix*Marseille université

PhD position
Attributing forest fires to anthropogenic climate change

Duration: 36 months, starting November-December 2023

Location

The PhD will be hosted at the RECOVER Unit at National Research Institute for Agriculture, Food and the Environment (INRAE) Aix-en-Provence, in the South of France. INRAE is a public research institution gathering a working community of 12,000 people, with 268 research, service and experimental units, located in 18 centers throughout France. INRAE is one of the world's leading institutions in agricultural and food sciences, plant and animal sciences. Its research aims to build solutions for multi-performing agriculture, quality food and sustainable management of resources and ecosystems. The INRAE Provence-Alpes-Côte d'Azur research center employs 1,200 people, including 715 permanent staff and 185 contractual INRAE staff, located on twelve sites, including three main sites: Avignon, Sophia-Antipolis and Aix-en-Provence.

Supervisors

Renaud Barbero (RECOVER, INRAE); François Pimont (URFM, INRAE)

Context and challenges

The last decade has seen an exceptional number of unprecedented extreme weather events. Previous research addressed how the likelihood of these extreme weather events might have changed with anthropogenic climate change. This approach is commonly referred to as “event attribution” and involves the comparison of the probability of extreme weather events under the current climate, against the probability under a counterfactual scenario without climate change. Attribution studies have focused so far on meteorological events such as heat waves, drought or extreme rainfall, but little attention has been given to fire.

According to the European Forest Fire Information System (EFFIS), about 60,000 fires occur on average each year across Europe burning ~500,000 ha. Large and intense fires have devastating impacts on society and have recently contributed to fatalities across parts of Europe (115 deaths in Portugal, 2017 and 102 deaths in Greece, 2018), drawing increasing attention from scientists, but also from the public and media.

There are simple, physical reasons why fires would be expected to increase in a warming climate due to increased fuel aridity. This is particularly true in the Euro-Mediterranean basin, where climate models project both warmer and drier conditions during the summer fire season. Moreover, previous efforts have shown non-linear relationships between climate and fire, with possible fire outbreaks beyond critical thresholds. In this regard, a formal attribution of anthropogenic climate change on fire activity is of great interest.

Objective

The objective of this project is thus two-fold:

Firstly, we need to understand how climate change is currently shaping fire weather conditions (i.e. the potential for fire based purely on atmospheric conditions such as temperature, precipitation, humidity and wind speed) across Europe and whether there are dangerous or important thresholds in terms of changes. The candidate will start by running fire weather indices (e.g.,Fire Weather Index) using multiple dynamical models of the atmosphere-land system under observed historical conditions as well as under naturalized versions of

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those observed conditions. We will seek to determine whether fire weather attributes during extreme fires have been made more or less likely as a result of climate change.

Secondly, we need to understand and model how fire activity already is responding to atmospheric warming. The candidate will adjust a statistical fire model to examine how fire weather attributes translate in terms of actual fire activity over a given season/region (e.g., France in 2022, Portugal in 2017 and Greece in 2018) and to what extent fire activity has been facilitated by climate change. Analyzes will be conducted at the European scale to span a large spectrum of climate and fire regimes, but a few selected specific extreme fire seasons will also be analyzed separately, from a more regional perspective. This approach may provide better estimates of the current risk of fires, taking into account current human emissions.

Required training and skills

MS in Earth science, climatology, statistics.

Programming skills (R, Matlab, Python), handling large multi-dimensional datasets, statistical modelling.

Knowledge of detection and attribution approaches will be an asset.

Salary and other benefits

The salary is determined according to the salary scale in force at INRAE (currently a minimum monthly gross of 2044 Euros). Other benefits include:

- Subsidized meals

- Possibility of home office (currently up to 3 days per week)

- Social, cultural and sports benefits (through the Association for the Development of Social Activities of INRAE)

- Access to professional training

- Social security

How to apply?

The application is to be sent by mail, **before July 20th, 2023**, to the supervisors (renaud.barbero@inrae.fr, françois.pimont@inrae.fr).

Please send a CV, a letter of motivation and indicate the contact details of one or two supervisors willing to provide a letter of recommendation if we contact them. The position can be filled before this deadline if we find a candidate with a suitable profile.