Research project objectives

Over the past 20 years, the development of earth observation satellite product enables the observation of wildfire at the global scale and show an increase of fire activity in fire-prone regions such as western USA, eastern Australia or Mediterranean Europe, most probably because of the high population living in Wildland-Urban Interface in those regions. To mitigate wildfire effects, operational forecast systems have been developed with either focus at fire scale for application in fire operational attack, or at plume scale for application in air quality. More recently, coupled fire-atmosphere systems (based on atmospheric meso-scale models) have been developed to resolve simultaneously the plume updraft/smoke dispersion, the propagation of the fire front, and their mutual interactions. While still mostly used as research tools, they are intended to become operational. These models are designed to simulate landscape-scale (>100m) propagating fires, and therefore forced to rely on highly parameterized fire models as current computational resources cannot resolve such domain size at the resolution required to capture combustion processes that are responsible of the fire front dynamics (<1cm). Fires are modeled as front lines with associated Rate Of Spread (ROS) and sensible heat flux predicted according to local terrain and modeled atmospheric variables (i.e. wind speed, humidity).

Few dataset exists that can provide simultaneous information on both the fire and the atmosphere states, and therefore can be used to run detailed validation of coupled fire-atmosphere system. One major limitation is the monitoring of fire behavior at spatial and time scales relevant to front dynamics (1-10 m). The aim of this research project is to improve current fire observation methodology of fire behavior estimation and its integration in atmospheric model. The project follows recent work done at UPC in image processing of Infra-Red open-fire airborne observation and fire modeling.

Image shows a perspective view of the simulation of a fire observed in Kruger Nation Park in June 2014. The modelled plume is shown 584s after ignition. The plume is here only formed of a passive tracer, (i.e. no microphysics). Encapsulated image shows the observed fire perimeter (black line) as estimated by the current methodology developed at UPC.
The objectives of the research are two-fold:

- On one hand **further developing the existing methodology** (based on image rectification and texture segmentation) of **fire behaviour computation from airborne observation**. Estimation of its scope of application (effect of terrain) and development of an open source platform. A new approach using stereo-vision would also be investigated. Data collected in previous fieldwork would be available as well as new data from forthcoming experiments.

- On the other hand **improving data integration and plume simulation in fire-atmospheric system**. If data are collected at high spatial and time scale, the plume can be directly modelled from fire flux extracted from observation. By simulating such fire plume with high resolution atmospheric model, we will be able to investigate the impact of fire induced fluxes from the flaming and the smouldering zones on the plume composition and evolution.

**Requisites**

We seek a candidate with a strong motivation for scientific research. He/She has to have a physics or engineering background and a Master’s degree with a good student record. The candidate has also to be fluent in English and Spanish, both written and spoken.

**Salary and start date**

The candidate is offered a 4 years full-time position. The salary will be linked to Spanish official grants for PhD students (**FPI-UPC, FII Generalitat de Catalunya, FPI or FPU Ministerio de Economia y Competitividad, FPI-UPC**) that will be soon opened. The start is expected to be on January 2021.

**Host research Centre: CERTEC at UPC-BarcelonaTech**

The Universitat Politècnica de Catalunya- BarcelonaTech (UPC) [www.upc.edu](http://www.upc.edu) is a public institution dedicated to higher education and research, specialised in the fields of engineering, architecture and science. The activity that goes on at UPC campuses and schools has made the University a benchmark institution. The University harnesses the potential of basic and applied research, and transfers technology and knowledge to society. These actions make the UPC—in partnership with industry—an agent and driver of economic and social change. The UPC puts its scientific and technological infrastructure at the service of research groups and centres, researchers and students, professionals, companies and institutions.

The successful candidate will work at CERTEC (Center for Technological Risk Studies, [www.certec.upc.es](http://www.certec.upc.es)) located at the brand-new Diagonal Besòs Campus at Barcelona. The group exists of an enthusiastic, diverse and creative team, including scientific tenured staff members (full and associate professors), Post-Doc researchers, PhD and MsC candidates and undergraduate students.

**Contact**

Those interested please, send a letter of application and a CV to:
Prof. Elsa Pastor ([elsa.pastor@upc.edu](mailto:elsa.pastor@upc.edu)) and Prof. Eulàlia Planas ([eulalia.planas@upc.edu](mailto:eulalia.planas@upc.edu))

Barcelona, June 2020.