

**ECOLE DOCTORALE DES SCIENCES DE L'ENVIRONNEMENT**  
**D'ILE DE France N° 129**  
**Proposition de sujet de thèse pour la rentrée 2020**

Nom du Laboratoire d'accueil : LATMOS N° UMR :8190  
Nom du Directeur du laboratoire : RAVETTA Francois  
Adresse complète du laboratoire : Sorbonne Université, Jussieu, Paris

Nom de l'Equipe d'accueil et adresse si différente de celle du laboratoire :

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- **Titre de la thèse en Français :**
- **Titre de la thèse en Anglais : Short-Lived Climate Forcers in the Arctic**

- **Résumé Sujet en Français (1 page maximum) :**
- **Résumé Sujet en Anglais (1 page maximum) :**

The Arctic is undergoing unprecedented fast warming. In addition to the forcing of increasing CO<sub>2</sub> concentrations, Arctic climate change is also driven by changes in important Short-Lived Climate Forcers (SLCFs) including methane, tropospheric ozone and a variety of anthropogenic aerosols (e.g. black carbon (BC), sulphate (SO<sub>4</sub>), nitrate, organic aerosols (OA)). As well as direct radiative effects, aerosols can also impact climate via indirect effects such as aerosol-cloud interactions or BC deposited on snow/ice (AMAP, 2015). However, significant uncertainties still surround our ability to quantify these impacts due to uncertainties in our knowledge about the contributions of different sources, processing during transport and loss processes such as wet and dry deposition. As well as anthropogenic sources transported from mid-latitude emission regions or emitted locally in the Arctic, boreal fires represent a significant high-latitude source of SLCFs with large uncertainties. Warmer and drier conditions have already led to increases in fire activity in many high latitude regions, such as Siberia, Alaska and northern Scandinavia (e.g. June 2019 saw unprecedented fire activity, see Copernicus Atmosphere Monitoring Service, <https://bit.ly/2LfdQ1x>) and boreal fire activity is projected to increase over the coming century.

The student will use a regional chemical-aerosol model, WRF-Chem, to study the sources, transport, processing and impacts of SLCFs on Arctic climate and on regional air pollution with a focus on the spring and summer. The model will be run using recent/new emission inventories, and results will be evaluated using existing ground-based, aircraft and satellite data over source regions and the Arctic. The sensitivity of model results to different emission data, in particular for boreal fires, will also be investigated, and used to diagnose the contributions from anthropogenic sources and boreal fires to abundances and distributions of aerosols and ozone in the Arctic, as well as their impacts. The model will also be used to examine future scenarios including possible changes in anthropogenic and fire emissions.

The proposed PhD topic is linked to a new international project ACROBEAR (Arctic Community Resilience to Boreal Environmental change: Assessing Risks from fire and disease), coordinated by S. Arnold, at U. Leeds, UK. As part of the project regional model simulations, including WRF-Chem, will be compared to global model simulations, for example, using the UK Earth System Model, and new fire emission datasets are being developed. Research carried out as part of this PhD will also contribute to the international initiative PACES (air Pollution in the Arctic: Climate, Environment and Societies - <http://www.igacproject.org/PACES>) and to the Arctic Monitoring and Assessment Programme (AMAP) work on SLCFs. The PhD will be jointly supervised between LATMOS and U. Leeds. The TROPO group in LATMOS has been working for several years on long-range transport of pollution to the Arctic (e.g. see *Law et al., BAMS, 2014*), and local Arctic pollution (*Law et al., Ambio, 2017*). The School of Earth and Environment at U. Leeds actively contributes to research on global and regional climate change including the role of aerosols and ozone.

• **Type de financement autre que ED 129, précisez si envisageable ou acquis (CNES, CEA, ADEME etc...) :** ED129

• **Encadrement :**

. **Liste des autres doctorants que vous encadrez ou co-encadrez au 1<sup>er</sup> janvier 2020**  
(Nom, Université d'inscription, type de financement, date de soutenance envisagée)

IOANNIDIS, Eleftherios, Sorbonne U., MOPGA/EUR, décembre 2021