

Postdoctoral fellowship

MODEL DEVELOPMENT AND VALIDATION FOR SOUTHERN BRAZIL

PBAP'S

PI Supervisor: Profs. Drs. Fábio L T Gonçalves/Vaughan Phillips

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Deadline: 31/10/2018

24 months, 40 hours per week

Salary: ca. 7000 reais/month plus benefits

In the context of the project: **PRIMARY BIOLOGICAL AEROSOL PARTICLES (PBAPS): SAMPLING AND MODELING AT SOUTHERN BRAZIL ASSOCIATED TO IMPROVEMENTS OF CLIMATE MODELS**

FAPESP PROJECT (2016/06160-8), coordinators: Profs. Drs. Fábio L T Gonçalves/Vaughan Phillips

CONTEXT:

Airborne particles directly and indirectly impact Earth's climate as well as human and animal health. This project will explore the status of the current and incomplete global climatology of hail, hail formation, its relation to primary biological aerosol particles that are ice nuclei (PBAP-IN) to explain the observed behavior for the Southern region of Brazil. Remote sensing techniques and downscaling scenarios will be considered in the analysis proposed in this project and methods able to assess the impact of future climate scenarios. This research is expected to evaluate the knowledge about PBAP-IN and hail phenomena and improve the modern techniques of detection of hailstorms by satellites, including the assessment of any signal of climate change impact. Finally, the project will provide the community with observations of the local and specific conditions of

hailstorms occurrence, related to PBAP-IN and, based on these conditions, establish the synoptic or large-scale circulation patterns under which the phenomena occur in the South and Southeast of Brazil and what behavior could be expected to the future.

The postdoctoral scholar will achieve these objectives:

- ☐ Schemes to treat ice nucleation by bacteria, fungal and other bio-aerosol (e.g. algal) particles separately will be created.
- ☐ These schemes will be implemented in the WRF cloud model of the Lund side and in the Brazilian model.
- ☐ Airborne concentrations and size distributions of bacteria and fungal particles will be specified for the cases to be simulated by both sides (Lund, Brazil).
- ☐ The WRF model will be validated against all available ground-based, satellite-based and aircraft (in similar Brazilian areas) observations, either for the clouds simulated or for clouds in a similar area and time of year.
- ☐ Optionally other model improvements will be done, such as inclusion of a fully spectral model approach for the microphysics and improved treatments of sticking efficiency for aggregation and hail wet growth.

Specific Tasks

First, our empirical parameterization (Phillips et al. 2008, 2013) of biological ice nucleation will be improved by resolving the separate species of bio-aerosol (bacteria, fungal, algal particles). Time-dependence of ice nucleation will be treated in an empirical way by inspecting and simulating off-line lab studies already published, in collaboration with other experts in observations of ice nucleation in USA. Next, field observations by satellite, aircraft and from the ground, will be gathered for the two locations of our observed cases near Sao Paulo and Paraná state. The observations will include radar reflectivity, lightning flash rate, surface precipitation rate, vertical velocity histograms, shortwave and longwave fluxes observed by satellite, CCN and IN concentrations, and cloud-droplet concentrations. Simulations with our cloud models of both locations will be validated with available observations. Prediction of measurements with hail-pads will be validated in particular.