

**Post-doctoral position in atmospheric processes:
Study of surface heterogeneities for initiation of local convection
(18 months)**

A postdoctoral position, funded by the European Project EMBRACE, is proposed by CNRM-GAME Laboratory (Meteo-France and CNRS), at Toulouse (Centre National de Recherches Météorologiques, 42 av G Coriolis, 31057 Toulouse, France).

MOANA, the host team, has a specific expertise on atmospheric convective processes, including their numerical modelling. In the last decade, the members of the team have been largely involved in the African Monsoon Multiscale Analysis (AMMA, Redelsperger et al, 2006) and carried out numerous studies on surface, boundary-layer and convective processes.

Topic: Impact of surface heterogeneities on the development of daytime moist convection

Background:

EMBRACE (<http://www.embrace-project.eu/>) is a 4-year funded European project that started in late 2011. It aims to address limitations in Earth System Models, with a focus on areas that are the most uncertain or unrealistic in present-day models. There are four working packages (WP) and this postdoctoral position belongs to the first one, which focuses on the atmosphere. A major objective is to improve the physical realism of parameterizations, in particular parameterizations of moist atmospheric convection.

Some activities in this WP1 have used a case-study of diurnal cycle of convection previously observed during the AMMA campaign over the Sahel (Lothon et al., 2011) and simulated by Couvreux et al. (2012). It has allowed testing the ability of Single Column Model versions of Earth System Models to represent key processes involved in the diurnal cycle of convection. **Even the last updated version of the models have difficulties in handling correctly the time of initiation of daytime moist convection and the cloud cover. Here, the same case will be used to explore the role of surface heterogeneities with Large-Eddy Simulations.**

Work plan:

The main objective is to study the role of surface heterogeneities on the initiation of deep convection using Large-Eddy Simulations.

Several works have shown that surface heterogeneities can have an impact on the initiation of convection. In particular, Taylor et al. (2011) have shown with satellite observations that initiation of convection occurs more often over dry soil and particularly over areas presenting a horizontal gradient of surface properties over a few tens of kilometres. Lately, Taylor et al. (2012) have shown that such surface-atmosphere feedbacks are not well represented in general circulation models. In the framework of AMMA, a land surface model has been run off-line at high resolution (4 km x 4 km), right in the area of interest (ALMIP2 project, http://www.cnrm.meteo.fr/amma-moana/amma_surf/almip2/index.html). First runs of LES (with Meso-NH, <http://mesonh.aero.obs-mip.fr/mesonh/>) of the case-study have also been performed with interactive surface scheme.

The objective is then to impose various patches of surface heterogeneities in the LES and to study their impact. In more details the work will intent:

1/ to jointly analyze the off-line ALMIP-2 runs of ISBA (the surface scheme model that is implemented in the LES) and satellite observations in order to define different patches of surface heterogeneities and initial conditions for the simulation, from very idealised one to the most realistic one.

2/ to perform and evaluate the Large-Eddy Simulations and to analyze the role of surface-heterogeneities in the simulations depending on their size and contrasts in surface turbulent fluxes among patches.

3/ to explore whether the results can be accounted for with simpler breeze models, and which guidance they can provide for parametrizations.

References:

Couvreur F, C. Rio, F. Guichard, M. Lothon, G. Canut, D. Bouniol, A. Gounou, 2012: Initiation of daytime local convection in a semi-arid region analyzed with Large-Eddy Simulations and AMMA observations, *Quarterly Journal of the Royal Meteorological Society*, **138**, 56-71, DOI:10.1002/qj.903

Guichard, F., L. Kergoat, C.M. Taylor, B. Cappelaere, M. Chong, J.-M. Cohard, F. Couvreur, C. Dione, A. Gounou, F. Lohou et M. Lothon, 2012: Interactions entre surface et convection au Sahel. *La Météorologie, N° Special AMMA*, 25-32. doi : 10.4267/2042/48129

Lothon M, B. Campistron, M. Chong, F. Couvreur, F. Guichard, C. Rio, E. Williams, 2011: Life cycle of a mesoscale circular gust front observed by a C-band radar in West Africa, *Mon. Wea. Rev.*, **139**, No. 5: 1370-1388

Redelsperger J.-L., C. D. Thorncroft, A. Diedhiou, T. Lebel, D. J. Parker and J. Polcher, 2006: African Monsoon Multidisciplinary Analysis: An international research project and field campaign, *Bull Amer. Meteorol Soc*, 87, 1739-1746

Taylor, C., A. Gounou, F. Guichard, P. Harris, R. J. Ellis, F. Couvreur, M. De Kauwe, 2011: Frequency of Sahelian storm initiation doubled over mesoscale soil moisture patterns. In press for *Nature Geosciences*, 4, 7, 430-433. DOI: 10.1038/NGEO1173

Taylor, C. M., R. A. M. de Jeu, F. Guichard, P. P. Harris, W. A. Dorigo: Afternoon rain more likely over drier soils, *Nature*, 489, 423-426

Practical aspects:

On the site of Meteo-France, it is possible to get a room in a student residence for 160 € per month. Otherwise, access from the city centre is easy by Metro and Bus.

Salary will depend on the previous experience, and may evolve along the contract, in agreement with legal and employer regulations, with a lower limit of 1900 € net pay per month.

The post-doctoral contract will be a 18-month contract, that may be extendible to 24 month.

It may start as soon as 1st September 2013, and preferably before 1st January 2014, but will remain open until the position is filled.

Qualifications:

To be eligible, the candidates should have a Ph.D. in the field of Atmospheric physics, with skills in meteorological modelling. Knowledge of atmospheric turbulence, convective parameterizations will be welcome. The successful candidate will have to run Large Eddy Simulations, in a Linux environment (with help from members of the team). He/she will be expected to attend international conferences and to publish his/her results in international peer-reviewed journals.

Applications:

Candidates should submit, by email, a cover letter with a statement of research activities and interests, a CV, as well as the contact information for two referees to:

Fleur Couvreur, fleur.couvreur@meteo.fr

Francoise Guichard, francoise.guichard@meteo.fr