

***Internship 2016***

**Influence of vertical heterogeneity of foliage on the canopy reflectance of tropical forests using radiative transfer modeling.**

**Structure welcoming the student:**

Irstea is a French public research institute focusing on major issues of responsible agriculture and sustainable land use planning, water management and associated risks, drought, floods, flooding, the study of complex ecosystems of biodiversity in their interrelationship with human activities.

**Context :**

Global monitoring of the state of tropical ecosystems is a priority for decades to come in the context of an accelerated erosion of biodiversity, due to many environmental and climatic factors associated with human activity. Remote sensing allows for the temporal monitoring of these environments characterized by poor accessibility, and represents a high potential tool for monitoring the rainforests from local to global scale.

- From a methodological perspective, studies at the local scale demonstrated the possibility to finely characterize the foliar chemistry and to map biodiversity.
- From an instrumental perspective, the development of new sensors ( Sentinel- 2 EnMap ...) requires to study the feasibility of adapting to a wider geographical scale the existing methods already developed and validated only at local scale.

For this purpose, it is essential to achieve a finer physical interpretation of the signal, in order to understand and take better account, for example, of the influence of vertical heterogeneity of leaf density, inclination or chemistry on the signal reflected by the canopy and measured from space. Approaches based on three dimension radiative transfer modeling are particularly suited to study these complex environments and define the level of detail necessary for their description. The analysis of this data allows to decompose the simulated signal based on the biophysical properties of these simulations.

The HyperTropik project, funded by the TOSCA group of the French Space Agency (CNES), aims to develop a modeling platform for testing performance of existing methods for mapping of biodiversity on the current and forthcoming sensors, in relation to instrumental and environmental factors. This project particularly focuses on the hyperspectral sensor project HYPXIM developed by CNES. This internship is funded by the TOSCA as part of this project.

**Work expected from the student :**

The objective of this internship is to specifically study the influence of the vertical heterogeneity of leaf chemistry on the canopy reflectance, based on simulations generated by the 3D radiative transfer model DART and parameterized with data collected in the field as part of HyperTropik project.

During this internship, the candidate will contribute to the development currently in progress of a modeling platform (Python + DART) in order to integrate data collected in the field and simulate realistic satellite images corresponding to variable forest complexity, especially the tropical rainforests.

At the end of this study, the results obtained should allow to specify the level of detail to be adopted to realistically simulate the complex forest environments. This will help optimizing protocols for field data collection, and also improving the sensitivity studies developed to evaluate the potential of different sensors for mapping tropical biodiversity and characterization of leaf traits.

**Specifically, this will involve :**

- **Learning how to use the modeling platform based on the DART model and scripts in Python.**
- **Developing and documenting a protocol to study the influence of vertical gradients of leaf chemistry on the signal reflected by vegetation across the solar spectral domain.**
- **Applying the protocol to different types of vegetation of varying complexity, from eucalyptus plantation to tropical rainforest, based on data acquired in the field.**
- **Analyzing results from simulations and prepare the next simulations for the development of methods of mapping tropical biodiversity.**

The intern will be co-supervised by two researchers from IRSTEA. A part of working time is left to the student for writing the internship report.

**Profile :**

- Master 2 student or engineer in remote sensing / image processing, with skills and interest for physics and ecology.
- Programming skills (python, R)
- Ability to work in interdisciplinary environment and to organize and perform field data collection.
- Ability to write, read and speak good scientific english (bibliography and redaction of international publications)

**Duration :**

Internship for Master 2 : 6 months between March and September 2016.

**Interest of the internship for the student :**

Contribute to the work done within the framework of the preparation of the hyperspectral satellite mission HYPXIM, and for the processing of the Sentinel -2 satellite data. Applied research and development that will require numerous contacts with research partners on the site and at national level (Labex CEBA, Cesbio , CNES , CNRS) .

Opportunity to start a PhD on this topic at the end of the internship.

**Localisation :**

IRSTEA Montpellier

UMR TETIS, maison de la télédétection

Agropolis, 500, rue JF. Breton, 34093 Montpellier.

**IRSTEA**

361, rue J.F. Breton B.P. 5095 - 34196 Montpellier cedex 5 [www.irstea.fr](http://www.irstea.fr)

**Contact & informations :**

Jean-Baptiste Féret - IRSTEA (0033 4.67.54.87.49).

Eloi Grau - IRSTEA.

Mèl : [jb.feret@teledetection.fr](mailto:jb.feret@teledetection.fr) , [eloi.grau@teledetection.fr](mailto:eloi.grau@teledetection.fr)

**Allowance** : 554,40€/mois

**IRSTEA**

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