MASTER IN PHOTONICS – "PHOTONICS BCN"
ERASMUS+ "EUROPHOTONICS"

MASTER THESIS PROPOSAL

Dates: April - September 2019

Laboratory: CommSensLab (Communications and Sensing Lab),
http://www.tsc.upc.edu/en/research/commsenslab , http://www.tsc.upc.edu/en/research/rslab
Institution: Universitat Politècnica de Catalunya (UPC)
City, Country: Barcelona, Spain

Title of the master thesis: *Remote Sensing for atmospheric observation: Precipitation*

Name of the master thesis supervisor: Prof. Francesc Rocadenbosch,
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Keywords: *Remote Sensing, Optical sensing, microwave sensing, data processing, rain, precipitation, classification.*

Summary of the subject (maximum 1 page):

MSc thesis on the *Remote Sensing and Data Processing* at the CommSensLab, an Excellence Unit of the UPC, in collaboration with different US institutions.

Multi-instrument remote sensing of the atmosphere combined with advanced computational techniques offers unprecedented capabilities to characterise the evolution and classification of *key atmospheric parameters* such as clouds and precipitation and their critical role in the development of storms and associated hazards. Using long-term, high-resolution observations from active and passive ground-based remote sensing systems including lidars (laser radars), weather radars, and emerging optical and microwave-based technologies, it is expected to characterise these parameters over distinct regions of the Earth.

The Verification of the Origins of Rotation in Tornadoes Experiment - Southeast (VORTEX-SE, https://www.nssl.noaa.gov/projects/vortexse/), which began in 2016 and continues through

2019, is an effort to understand how environmental factors as of the southeastern U.S., affect the formation, intensity, structure and path of tornadoes in this region. The Microware and Remote Sensing Lab (MIRSL) of the University of Massachusetts (UMass), the National Oceanics and Atmospheric Administration (NOAA) and Purdue University deployed a wealth of mobile remote-sensing profilers (2.9-GHz radar profilers, backscatter and Doppler lidars, multi-channel radiometers) and rain gauges in northern Alabama. These instruments collected near-continuous observations of water vapor, temperature, precipitation and wind profiles in the lowest part of the troposphere as well as highly-resolved vertical velocity profiles, Doppler spectra and optical backscatter returns. CommSensLab is participating in the data analysis and signal processing tasks related to this instrumentation.

Proposed tasks:

- Development of a Graphic User Interface and a basic data-processing platform to cross-examine observational data and atmospheric products from the above remote-sensing instruments. This task is supported by a large amount of existing and ongoing developments in the research team.
- Study and classification of observation events (e.g., rain, no-rain) during VORTEX-SE 2016 and 2017.

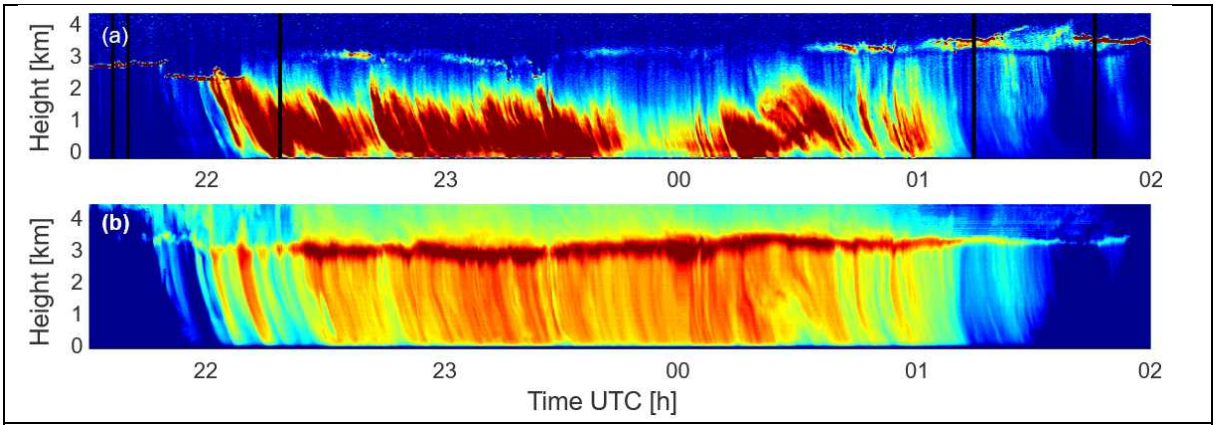

Fig. 1. An example from co-operative remote sensing observation in the proposed MSc thesis. (a) Lidar observation. (b) Weather-radar observation showing a rainfall curtain.

Additional information:

* Required skills: Matlab or Python software.
Knowledge of basic remote sensing instruments (either optical or microwave based, e.g., lidar, radar) and interest in computer and programming science would be beneficial.

* Miscellaneous: Suitable areas of knowledge are Physical sciences, Remote sensing, Telecommunications Engineering, Computer Sciences, Atmospheric sciences.

The MSc student will integrated in a research team of senior and junior researchers from UPC, Univ. of Massachusetts and Purdue University.