Observing Onshore Penetration of Sea Breeze using GPS IWV: a Student Run Research Project in Puerto Rico

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In warm tropical climates with a weak background flow, sea breeze circulations can have a dominating role in cloud formation and precipitation. This is the case on the west side of the island of Puerto Rico, where easterly trade winds that flow offshore interact with the sea breeze to enhance vertical motions. The sea breeze circulation is theorized to behave as a density current, with cooler moist air flowing on shore at low levels. The circulations predicted by this theory has been tested with wind measurements in other locations, but the actual density difference and the moisture content of the boundary layer air as it evolves with onshore sea breeze penetration have not. We plan to carry out a field campaign to investigate the penetration of the sea breeze using conventional and GPS integrated water vapor measurements as a tracer to examine the consistency with the density current model. In addition to the unique approach for investigating sea breeze moisture transport, there are two additional innovative aspects to the project: 1) the project is a grass roots effort brought about by a group of undergraduates at Purdue who realized the importance of diversifying their undergraduate experience beyond typical mid-latitude storm systems to include tropical weather and climates; and 2) it is the first time UNAVCO GPS receivers will be deployed as a mobile meteorological observing facility with low-latency processing made possible by real-time data communication to the Suominet GPS IWV processing center.

Students from Purdue will team up with students at the University of Puerto Rico, Mayaguez, to deploy instruments over spring break, March 2011. The data will serve for a range of scientific investigations designed by individual student groups as part of semester long courses at UPRM and Purdue. Because the concept was initiated by students, it is expected to have a sustaining interest on the part of undergraduates, and has high probability of impacting the decisions of undergraduates to pursue careers in research. The unique use of the GPS data is in close alignment with the objectives of the COCONet MRI project, which include providing high quality low latency GPS products for researchers, educators, and students to serve the atmospheric science objectives of better forecasting the dynamics of airborne moisture. The outreach objectives are parallel to COCONet efforts to contribute to the scientific and socio-economic development in the Caribbean, and contribute to the education of undergraduate students in atmospheric fields through the Caribbean research community.