Geophysical Research Abstracts
Vol. 18, EGU2016-10802-1, 2016
EGU General Assembly 2016

Description of the atmospheric circulation in the boundary layer over a tropical island: Case study of Guadeloupe Archipelago

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Over past two decades the use of atmospheric sounding methods as Sodars, Lidar equipped drones increased sharply. Compare to weather balloon, these modern methods allow measure of profile at constant heights during long period. There are few studies using this type of equipment in tropical climates and lesser on small island.

Wind regime on island of diameter less than 50 km are mostly considered as oceanic. Many author consider that thermal effect are negligible in land. But recent observations and simulations show importance of the thermal circulation at small- and meso- scales particularly in atmospheric pollution process. Up to 2009 no wind profile data were available continuously to study atmospheric circulation in Guadeloupe Archipelago (GA) which is one of the islands of the Lesser Antilles Arc. In first approximation wind was evaluated based on measures done at the most upwind island of the GA for many application as wind power and atmospheric pollution.

From 2009 to 2012 a measurement campaign of the Atmospheric Boundary Layer (ABL) have been performed by the University of Antilles (UA) in GA. To assess effects of dynamic of ABL on air quality in sub urban area, particularly during the sunset and sunrise, UA monitored two sites with a weather station and a doppler sodar (REMTECH PAO). Both sites are close to the sea with one in a coastal area and the other in an open landfill surrounded by densely populated building and a mangrove swamp. Thermal and chemical measurements with a portable mass spectrometer were made in the vicinity of the landfill and showed the existence of urban heat islands.

This study presents the first Doppler Sodar long measurements campaign in GA. Statistical analysis of the three year of doppler sodar data (i.e. wind components and its fluctuations) allow to identified and characterized the complex circulations on the two sites in the ABL between 25 and 500m above the sea level. Orographic and thermal effects due to urban area were isolated. Dynamic and origin of the turbulence of the ABL of a tropical island were analyzed

Keywords: Sodar PAO, Dynamic, Atmospheric Boundary Layer, Turbulence