Eastern North Atlantic (ENA)
Graciosa Island - ARM Facility

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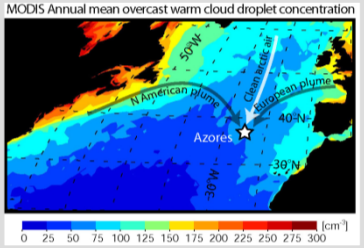
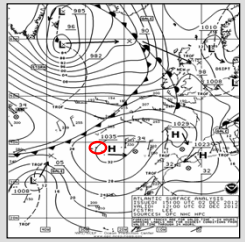
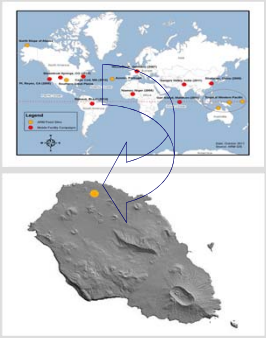
Why the Azores?

- One source of uncertainty that thwarts accurate and comprehensive representation of the present and future climate processes in the models is the role of the marine stratocumulus clouds that prevails over the eastern subtropical oceans that have been proved plays a critical role in the boundary layer dynamics and in the global climate (e.g., Klein and Hartmann 1993[1] ; Bony and Dufresne 2005[2]).
- The recent deployment of the ARM Mobile Facility at Graciosa Island, Azores (2009-2010) , in the context of the Clouds, Aerosol and Precipitation in the Marine Boundary Layer (CAP-MBL) field campaign, added the most extensive (19 months) and comprehensive dataset of marine boundary layer (MBL) clouds to date. Solid preliminary findings an valuable data sets have been used since that to promote a true climatology of marine cloud structure over the north Atlantic. Details can be seen on Rémillard et al. (2012)[3].
- From the promising results of this campaign, Azores have been identified as having the mix condition to becoming an fixed site, focused on the life cycle and characteristics of marine stratocumulus clouds and ocean atmosphere interactions.







Graciosa Island

- Graciosa (28°W 39°N) is the second smallest island of the nine of the archipelago of the Azores (Portugal). Graciosa is one of the few subtropical Eastern Ocean sites that is sufficiently remote to be clear of direct continental influence (1500 km from Europe, 2200 km from Newfoundland coast), is small (4×8 km) and low enough (<400 m) that the marine clouds are not strongly influenced by its presence.
- The subtropical maritime climate of Graciosa is strongly affected by the seasonal migration of the North Atlantic Anticyclone (Azores High, that predominates at summertime), and its confrontations with the Polar Front meandrous in circulation by north from west (responsible for the wintertime rainy weather). Air temperatures at sea level ranges from 14.1 ºC in Winter to 22.3 ºC at summertime. The annual precipitation at the shore line reaches 845 mm, with a minimum at July of 34 mm and a maximum of 116 mm by November. An detailed climatology of clouds and boundary layer properties can be seen in Rémillard et al. (2012).
- Graciosa is ideally suited to study the transitions from overcast stratus/stratocumulus to broken trade cumulus. Transitions from closed to open cellular structures are observed in this region. Also of particular interest from a microphysical perspective is the strong air mass variability arriving at Graciosa Island, which include pristine arctic air masses that have been transported through mid-latitude oceanic regions to the north and cleaned by precipitation; air masses that have been circulating around the Azores high pressure system over the ocean for several days; markedly polluted continental air masses from both North America and Europe (Wood et al., 2007)[4].
- The Azores typically experiences relatively clean conditions with northerly flow, but with periodic episodes of continentally influenced polluted air masses. The Intercontinental Transport of Ozone and Precursors (ITOP) experiment, the European contribution to the ICARTT 2004 experiment, revealed considerable variability in aerosol composition and origin in the Azores region. Extensive pollution plumes containing sulfates and organics were sampled at low level whose source was the north eastern United States, and biomass burning aerosol from wildfires in Canada and Alaska are common during the summer months. This makes the Azores a particularly interesting site for studying the effects of aged aerosols on marine boundary layer cloud (Wood et al., 2007).

The Eastern North Atlantic (ENA)- Graciosa Island ARM Climate Research Facility

- The new facility will be operational with data collections commencing on the **1st of October 2013**. Due to variations in supply lead-times, instrumentation will be installed and commissioned when procured and delivered to the site. The adjacent table indicates the approximate date of instrument availability.
- BBSS Operations – 2 flights per day.
- The facility includes ample accommodation options for guest instrumentation and in addition office space for visiting scientists and students.
- The ENA facility would not be possible without the support of the local Graciosa and Azorean community.
- Project Management and local coordination activities are provided by the Universidade dos Açores.

INSTRUMENT	Azores Install August/ Sept. 2013	Azores Install FY2014
MPL	X	
AOS	X	
BBSS	X	
CSPHOT	X	
ECOR/SEBS	X	
GNDRAD	X	
MWRSC	X	
ORG	X	
SKYRAD	X	
SMET	X	
VCEIL	X	
2DVD		X
AERI		X
AOS		X
DL		X
HSRL		X
KaW SACR		X
KAZR		X
MWRP		X
Parsivel		X
TSI		X
WBRG		X
XSAPR		X

1 - Klein, S. A., and D. L. Hartmann, 1993: The seasonal cycle of low stratiform clouds. J. Climate, 6, 1587–1606.
2 - Bony, S., and J.-L. Dufresne, 2005:Marine boundary layer clouds at the heart of tropical cloud feedback uncertainties in climate models. Geophys. Res. Lett., 32, L20806, doi:10.1029/2005GL023851.
3 – Remillard J, P Kollias, E Luke, and R Wood. 2012. "Marine boundary layer cloud observations in the Azores." *Journal of Climate*, 25(21), doi:10.1175/JCLI-D-11-00610.1.
4 – Wood,R.;Bretherton, C.;Albrecht, B.;Coe, H.; Fairal, C.; Garreaud, R.; Ackerman, T.; Stevens, B.; Feingold, G.; Turner, D. (2007) – Clouds, Aerosol, and Precipitation in the Marine Boundary Layer (CLAP-MBL) – A Proposal to the ARM Climate Research Facility.