

# An approach to evaluate aerosol optical depth at marine boundary layer: the Pico-Graciosa measurement platform.

Diamantino Henriques<sup>1</sup>, Fernanda Carvalho<sup>1</sup>, Paulo Fialho<sup>2</sup>

<sup>1</sup>Instituto Português do Mar e da Atmosfera

<sup>2</sup>Universidade dos Açores



# Scientific background

**Aerosols** are an important constituent of the atmospheric **boundary layer**. Aerosol particles provide surfaces for heterogeneous chemical processes, they also act as a condensation sink for atmospheric trace species. In the **marine** atmosphere originate from a variety of production and transformation processes that includes sea spray aerosol produced at the sea surface through the interactions between wind and surface waves (Liss and Johnson, 2013).

# Scientific background

**Marine aerosols** have also origin from ship and volcanoes emissions. Thus, natural and anthropogenic aerosols have a **strong source in the marine boundary layer**.

**Anthropogenic aerosols** are responsible for a **radiative forcing (RF) of climate change** through their interaction with radiation, and also as a result of their interaction with clouds (Boucher et al., 2013).

# Why marine aerosols ?

Quantitative **evaluation** of this forcing is **full of uncertainties** (Haywood and Boucher, 2000; Lohmann and Feichter, 2005) contributing to the largest uncertainty in the total anthropogenic RF (Haywood and Schulz, 2007).

RF from **marine aerosols** has received **less attention** than the anthropogenic RF (Liss and Johnson, 2013). Nevertheless, there are **good reasons** for **quantifying** the marine RF, it gives **insight into pre-industrial radiative effects of aerosols** and **the decrease in sea-ice extent**, due to climate change, leads to an increase in sea salt generation (Bellouin et al. 2011). Climate change also impacts the activity of ocean biogeochemistry and the associated **DMS emissions** into the atmosphere (Halloran et al. 2010). These changes impact the RF of marine aerosols and the Earth's radiative budget.

# The approach

The **aerosol characteristics** that are needed to quantify the RF are: **optical depth, single-scattering albedo, size distribution, and vertical profile** (Yu et al. 2006).

**Aerosol optical depth** is better constrained, with dedicated ground-based and satellite instruments providing routine retrievals (Holben et al. 2001; Remer et al. 2008; Kokhanovsky and de Leeuw 2009; de Leeuw et al. 2011b). However, there are no ground based or satellite measurements that can **distinguish boundary layer and tropospheric components**. One way to get some inside into this lack of information is to measure optical depth at **different heights**, for example, **under and above de Marine Boundary Layer**.

**Geographical and topographical** features of the **Azores** offer a reasonable approach to accomplish this kind of measurements.





# Setup

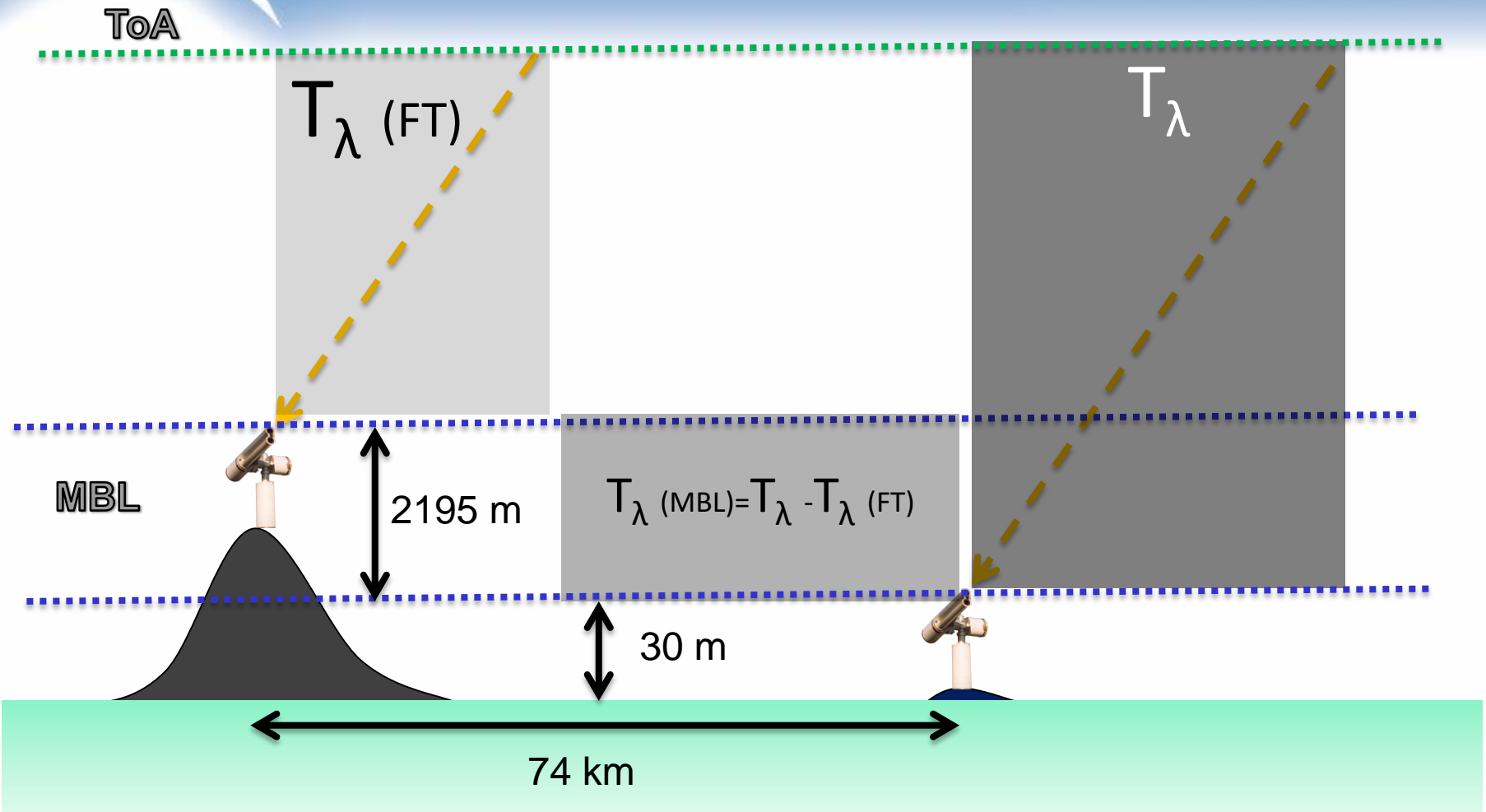


Pico-NARE: 2225 m a.m.s.l.

ENA-ARM: 30 m a.m.s.l.

Pico-Graciosa horizontal distance: ~74 km

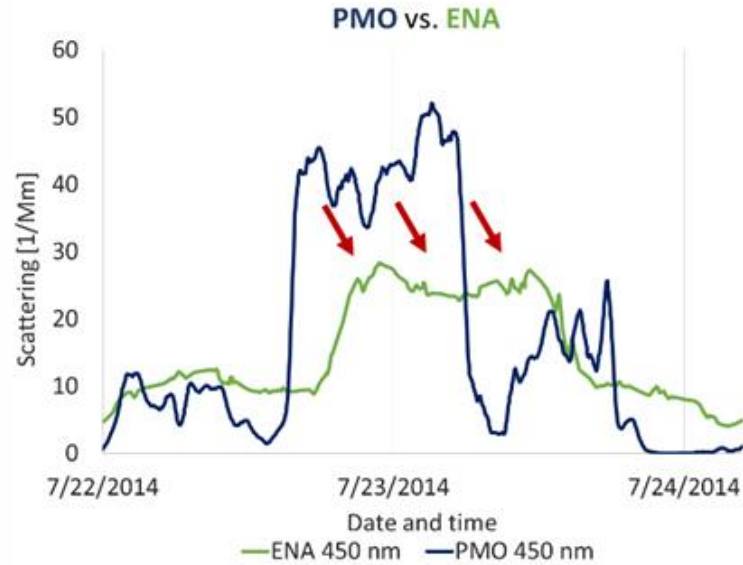
# Setup



# Main Challenges

- Install and run a Cimel sunphotometer at Pico-NARE during 2 or 3 summer seasons.
- Measurements at both sites with simultaneous direct sun conditions.
- Measurements of the same free troposphere air mass.

Courtesy of  
Claudio Mazzoleni



Thank you for you  
attention.