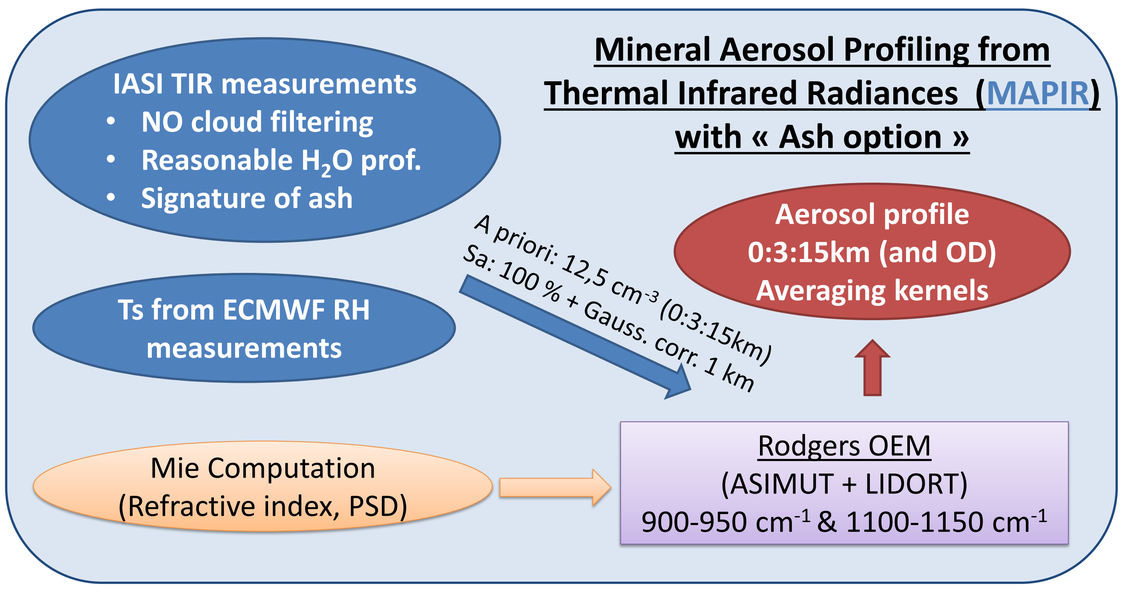
Vertical profiles of volcanic ash aerosols: a case study with the Puyehue Cordón Caulle eruption in June 2011

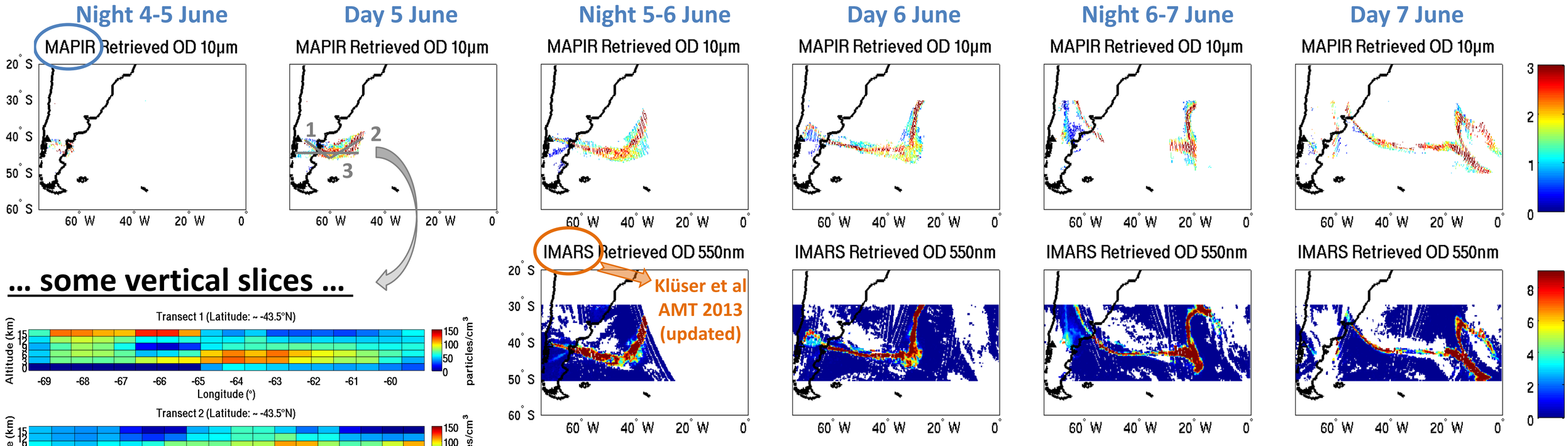
K. Maes, S. Vandenbussche, L. Klüser, N. Kumps , A.C. Vandaele, M. De Mazière

Belgian Institute for Space Aeronomy – 3 avenue Circulaire, 1180 Brussels, Belgium – sophiev@aeronomie.be

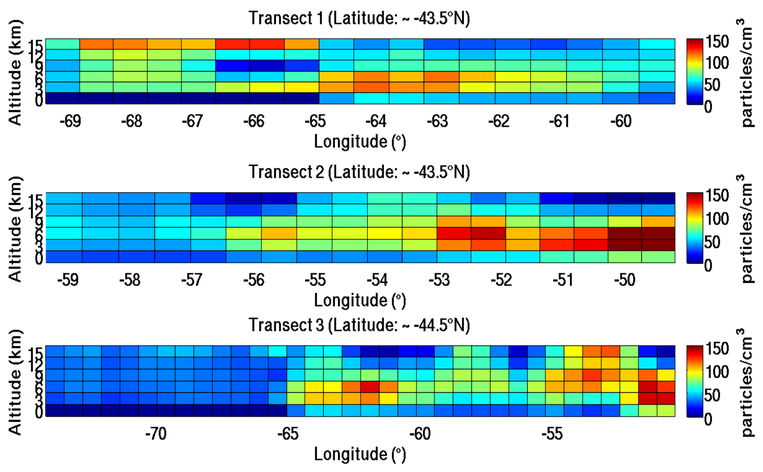
Volcanic ash is a **threat** to humans and animals when present in ambient air, and to aviation when present in the planes track. **Characterization** of the ash clouds (**geolocation** and **altitude**) is therefore very important. Current satellite-based measurements provide **mostly AOD**, with no or **very limited altitude information**. Altitude is most often derived from **transportation models**, from the geolocation of the plume and the volcano, and wind fields. Here, we propose a method to obtain **ash vertical profiles from TIR IASI data (MAPIR algorithm)**. The method is applied to study the **Puyehue Cordon Caulle eruption** of **4 June 2011**, which was followed by a second less intense eruption on **June 11-12**.



Plume's first days: 2D comparisons …



… some vertical slices …

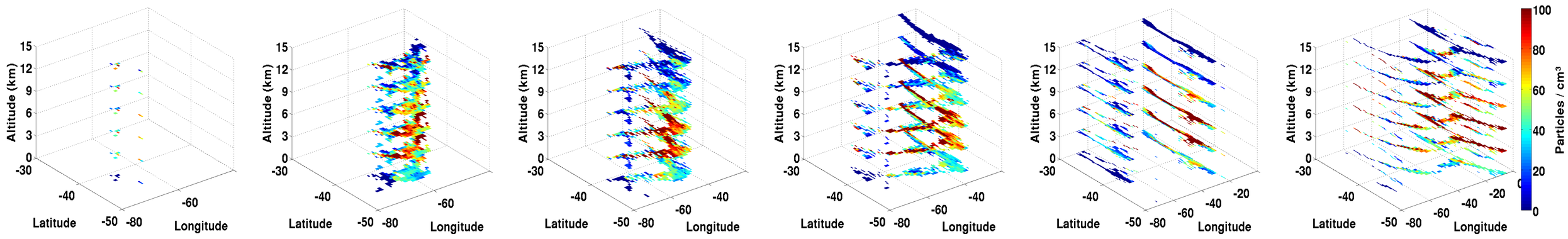


Very high OD's observed!
Geolocation of the plume by MAPIR and IMARS match very well.

MAPIR: main plume at ~6km. Ash also seen at 12-15 km
Trajectory backtracking (Klüser et al 2013): 6 to 16km

S.V. acknowledges the Belgian Science Policy « complementary researcher » program, the Belgian Science Policy / ESA A3C PRODEX program, and the ESA CCI aerosols phase 2 project for funding the research on dust aerosols, on which this research has built.

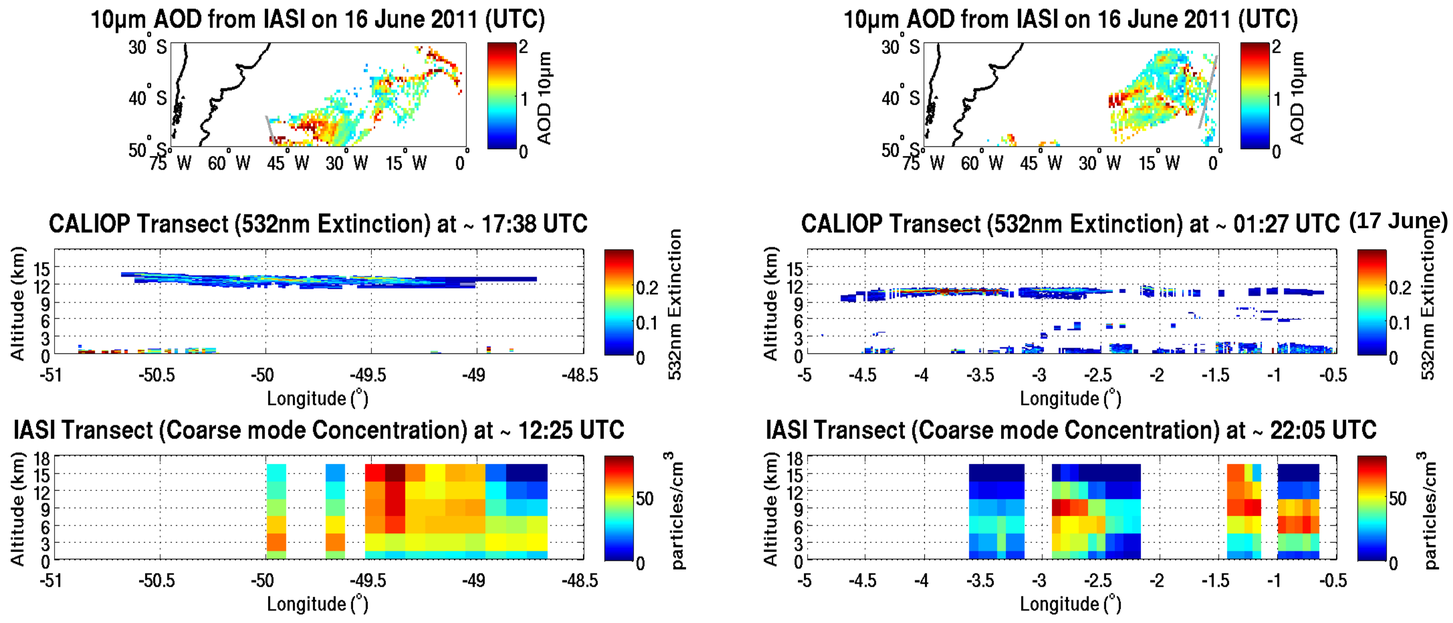
… and a full 3D view!



A little bit later… when CALIOP is back (16 June 2011)

ODs are quite smaller
IASI (ash) - CALIOP **coincidences are not so numerous**…

CALIOP: consistent low extinction plume at **9-15km**, some extinction at **~6km**.
Trajectory backtracking (Klüser et al 2013): **4-7km** and **9-11km** (from the 11-12 June eruption).
MAPIR retrievals range mainly from **6 to 15km**, the layer is less clearly defined w.r.t. CALIOP but high aerosol load are detected.



Conclusion

For the first time, IASI measurements have been used to derive **vertical profiles of volcanic ash** in the atmosphere. The Puyehue plume detection and general spatio(2D)-temporal evolution is consistent with previously reported results (Klüser et al, AMT 2013). Vertical profiling is, to the extent of possible comparisons, **highly reasonable** while not really validated yet because of the lack of comparable data. This method is therefore **very promising** for improving ash « crisis management » and the general knowledge of ash 3D distribution.

The **main issues to be solved for further improvement and application** of this method are: the issue of ash mixed with ice particles, the generalisation to any eruption (ash refractive index and size, altitude range), foreseen difficulties above cold surfaces.

Vandenbussche, S. et al: Retrieval of desert dust aerosol vertical profiles from IASI measurements in the TIR atmospheric window, AMT 6, 2577-2591, 2013.
Klüser, L. et al: Observation of volcanic ash from Puyehue–Cordón Caulle with IASI, AMT 6, 35-46, 2013.