

2007 Annual Aerosol Update

"Observations of Dust Transport in the
South Atlantic Ocean:

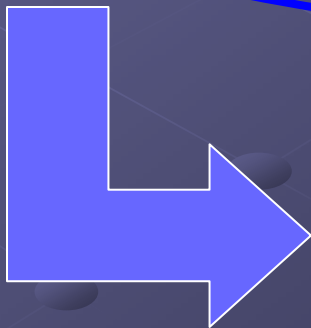
Implications for Marine Biology and
Paleo-Climate Studies"

Santiago Gassó

GEST/UMBC

Dust and the Climate System

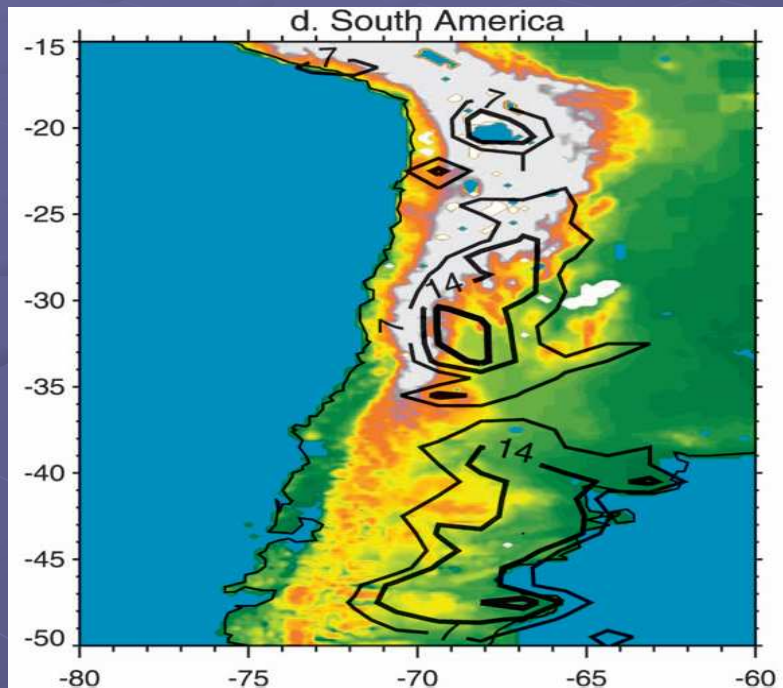
- Dust plays an important role in the radiative balance of the Earth's atmosphere.
(e.g direct effect)
- Dust is a tracer of past and present climate.
(e.g. ice-cores in Antarctica)
- Dust is linked to phytoplankton activity and carbon cycle
(e.g. fertilization experiments in the Southern Ocean)



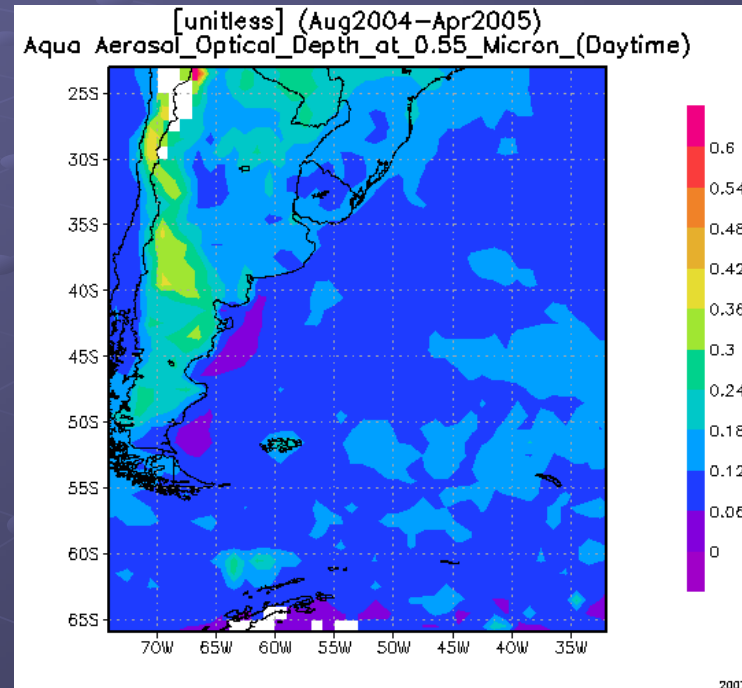
Where does the dust come from? it turns out we know very little about dust activity in the Southern Hemisphere, in particular S. America.

Satellites: Complementary but Incomplete Characterization

TOMS/OMI detectors



MODIS detectors



- Information on the aerosol type
- Not very sensitive to BL aerosols
- Retrieval over clouds

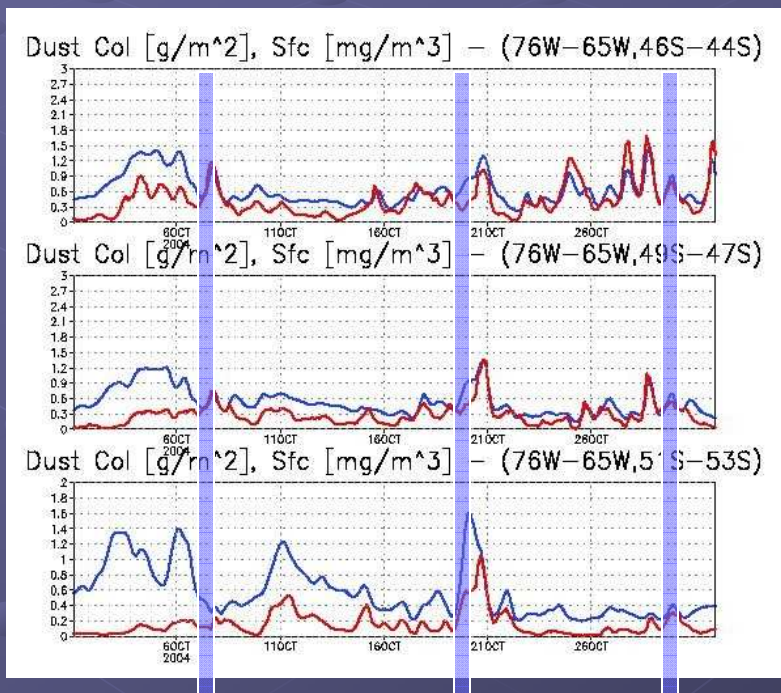
- Good spatial resolution
- No sensitivity to aerosol type

Models: Source Characterization is Problematic

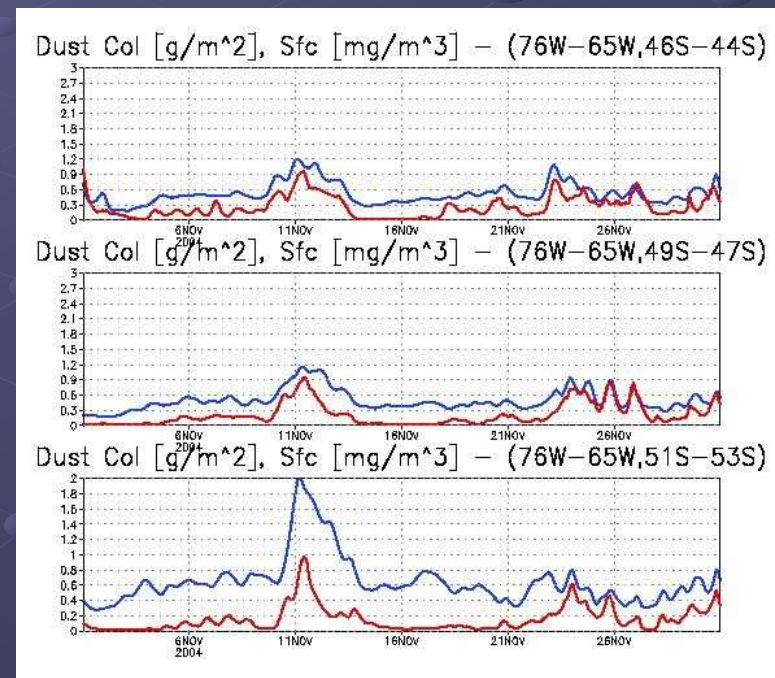
Modeled dust flow across the Patagonia Coastline

Some events are well captured

but some events are not



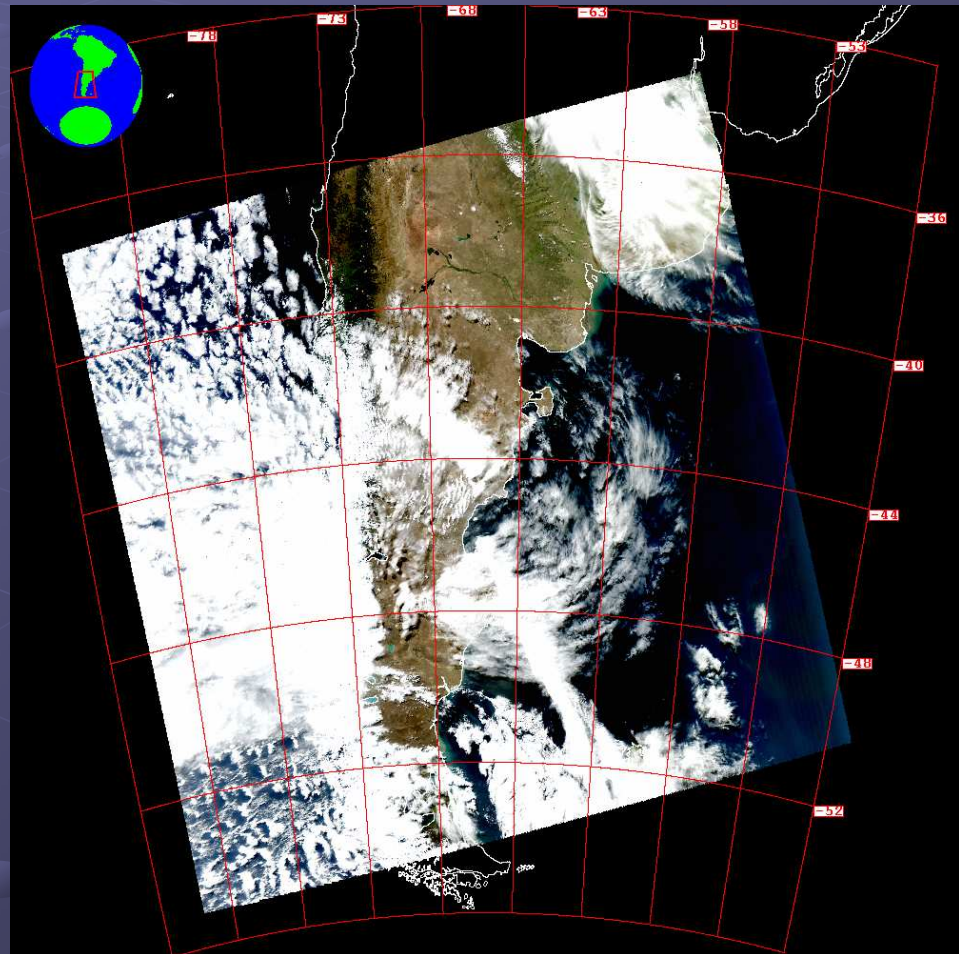
Dust events confirmed by satellite and/or surface obs



No dust activity reported in observations

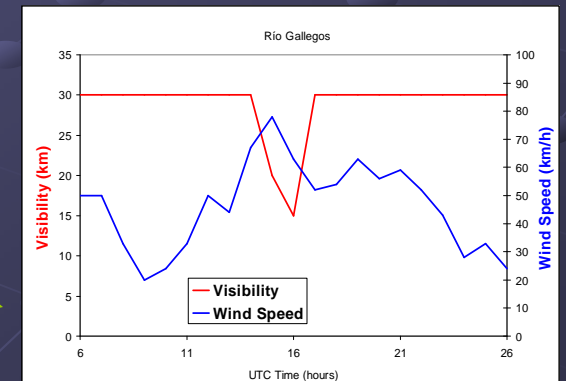
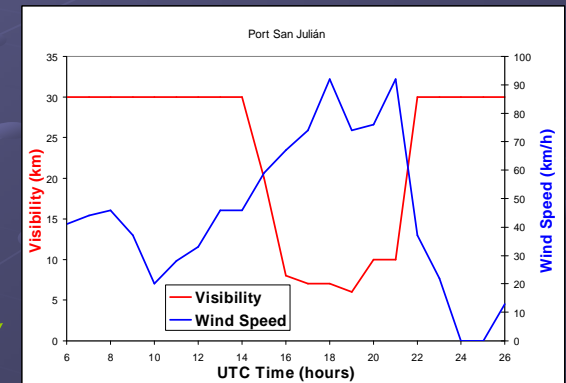
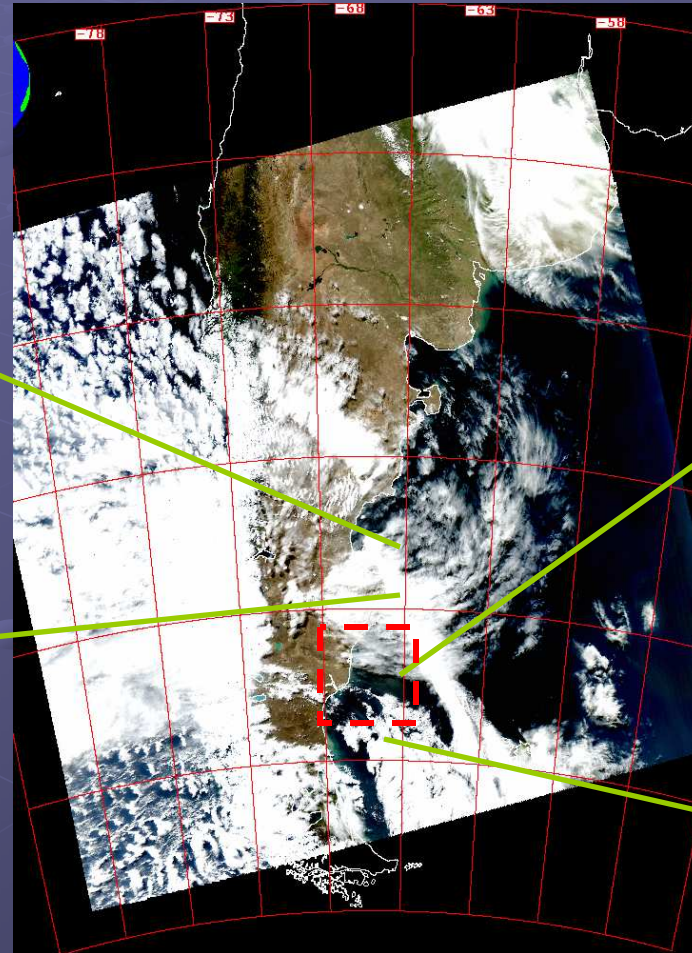
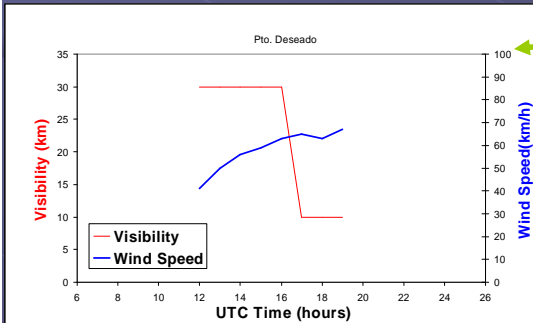
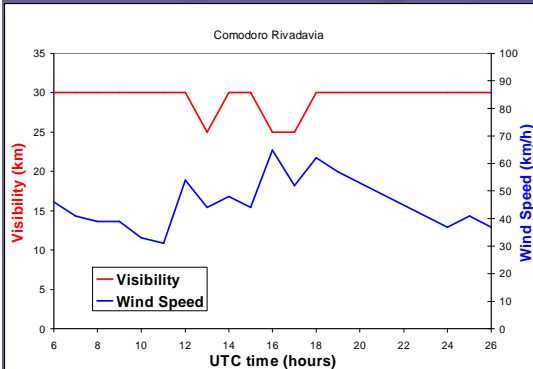
Case study: a Typical Dust Event in Patagonia

- Wind storms are typically accompanied by abundant cloudiness
- Sustained winds above 60 km/h (~7-10 hours)
- Gusts reach 120-140 km/h



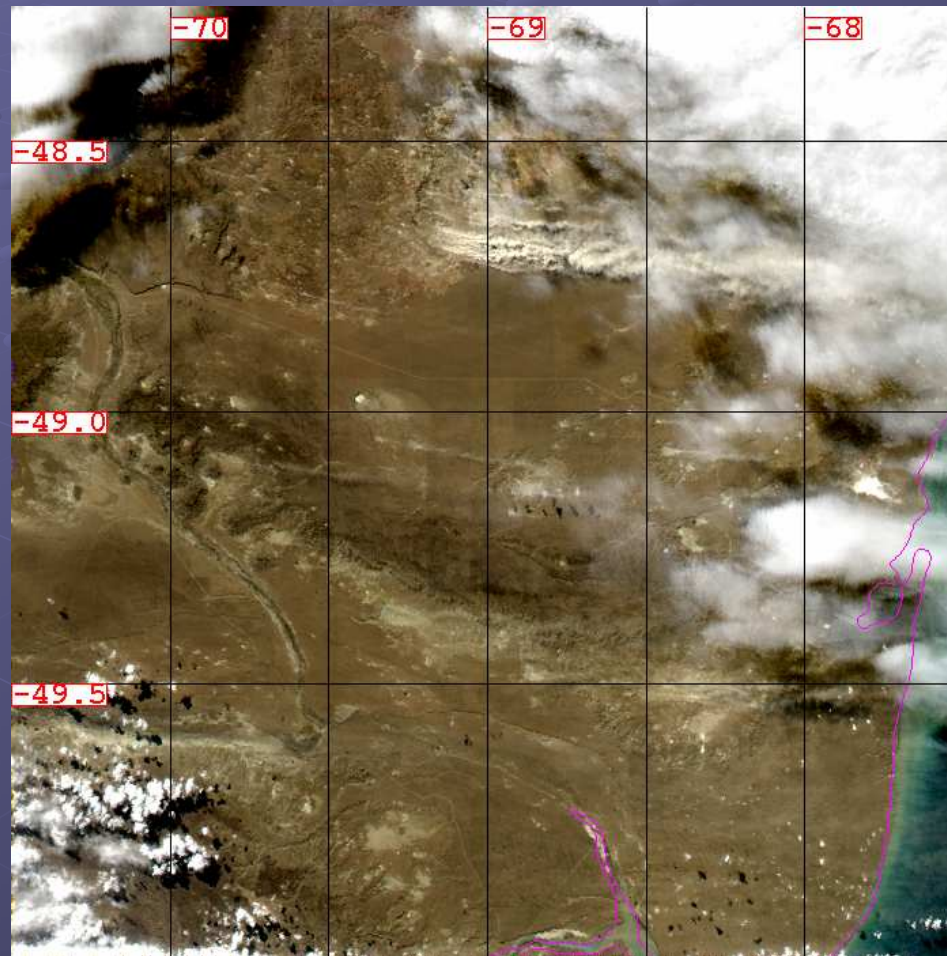
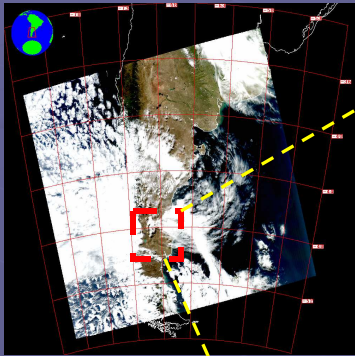
Surface Observations Confirm Dust Activity

Visibility and Wind Speed



All stations reported partially or totally cloudy conditions

Sources have different scales

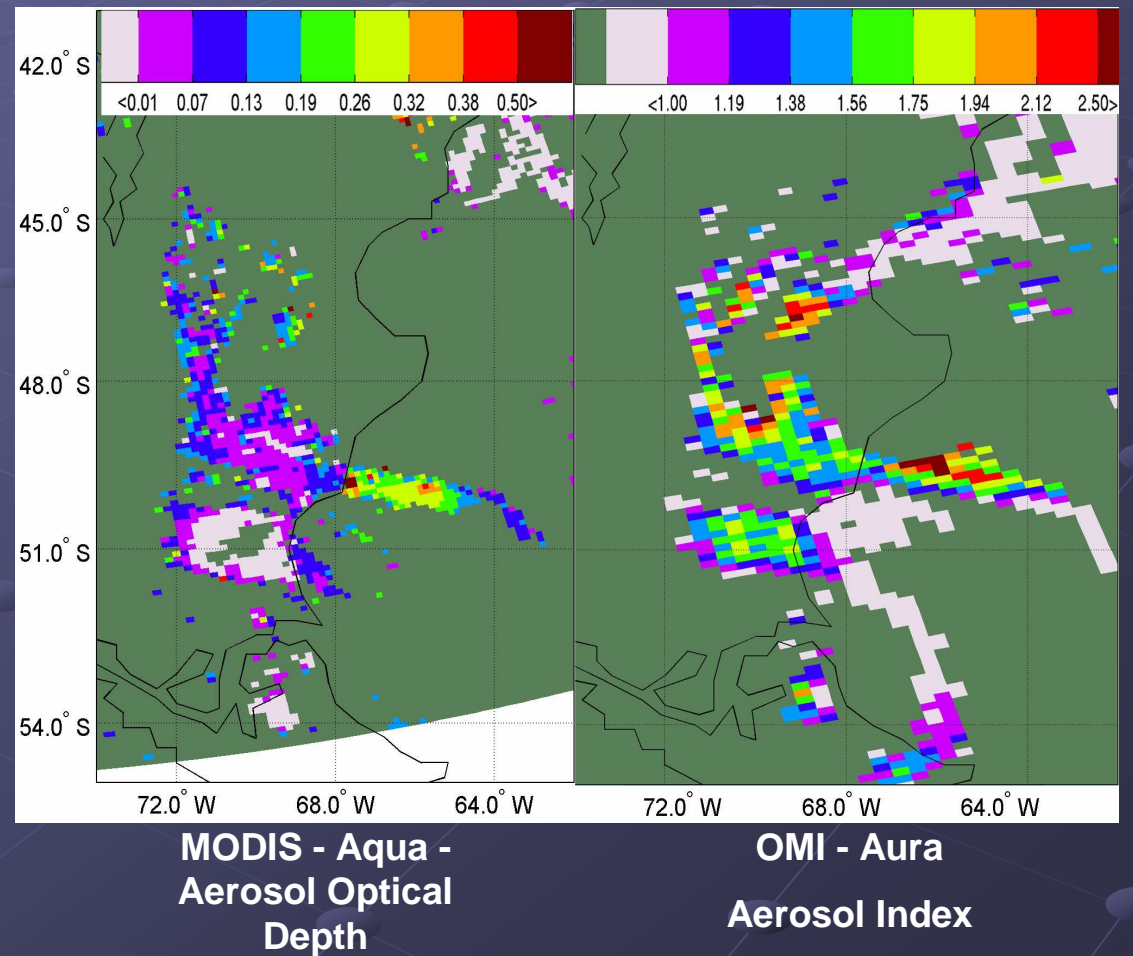


sources
range from
10s-100s
meters
diameter

Detection by MODIS and OMI

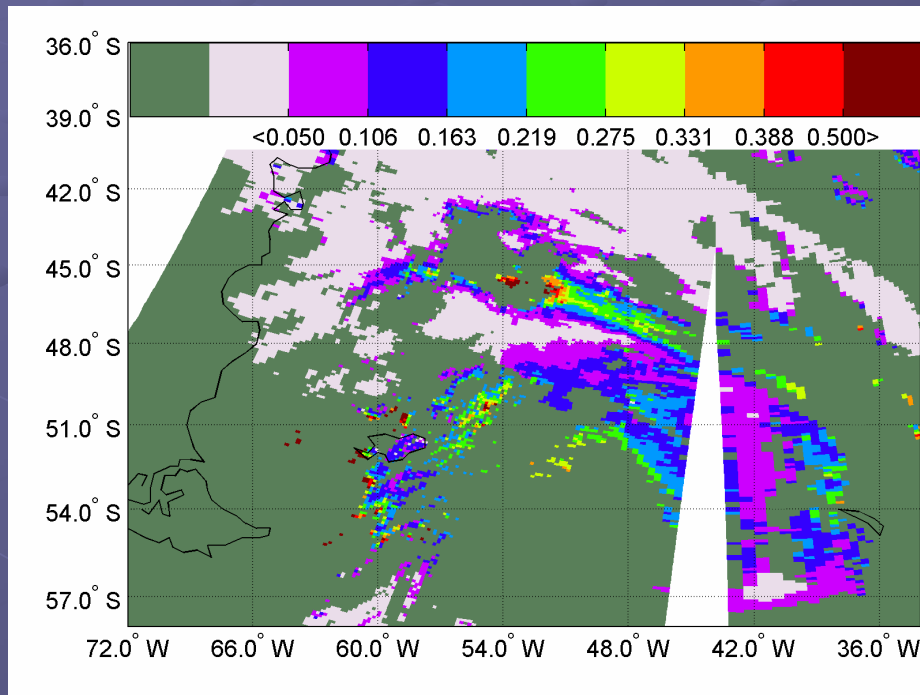
On the day of the event...

- Both detectors agree over ocean
- Confirm an intense and localized event

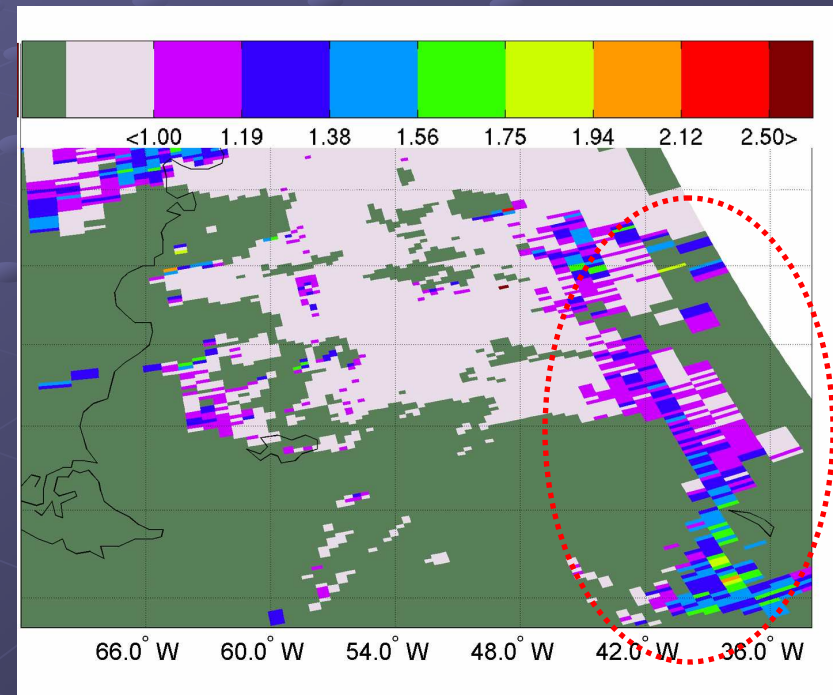


A day after emission...

MODIS - AOD



OMI - Aerosol Index



- AI consistent with absorbing aerosol



near the edge of scan and over clouds

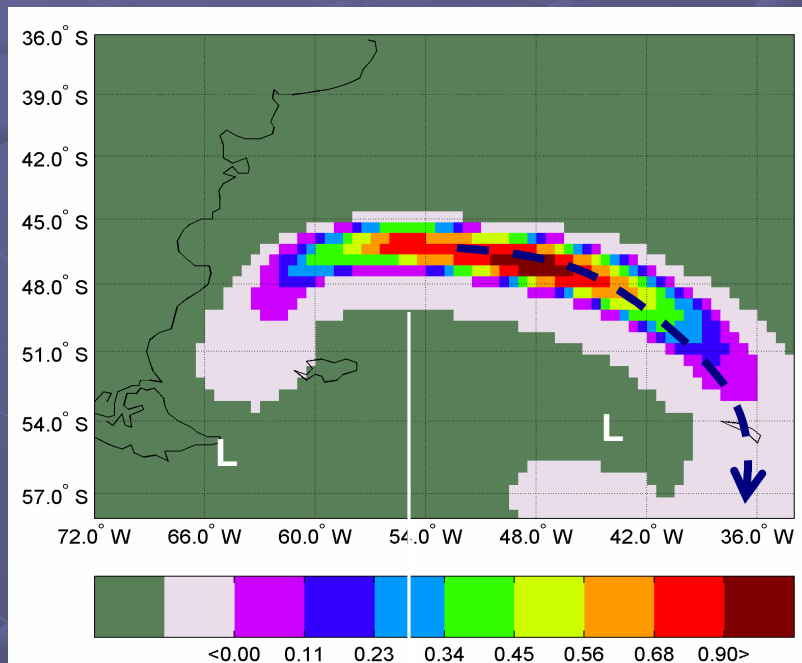
- Moderate levels of AOD



not clear if dust or seasalt

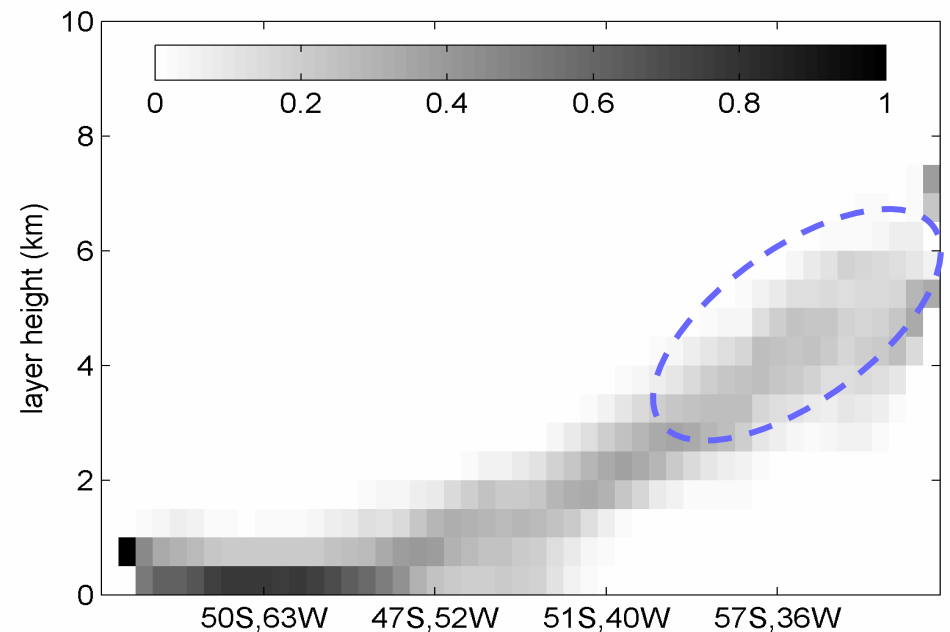
Dust model simulation : Day after of emission

Distribution of normalized concentrations



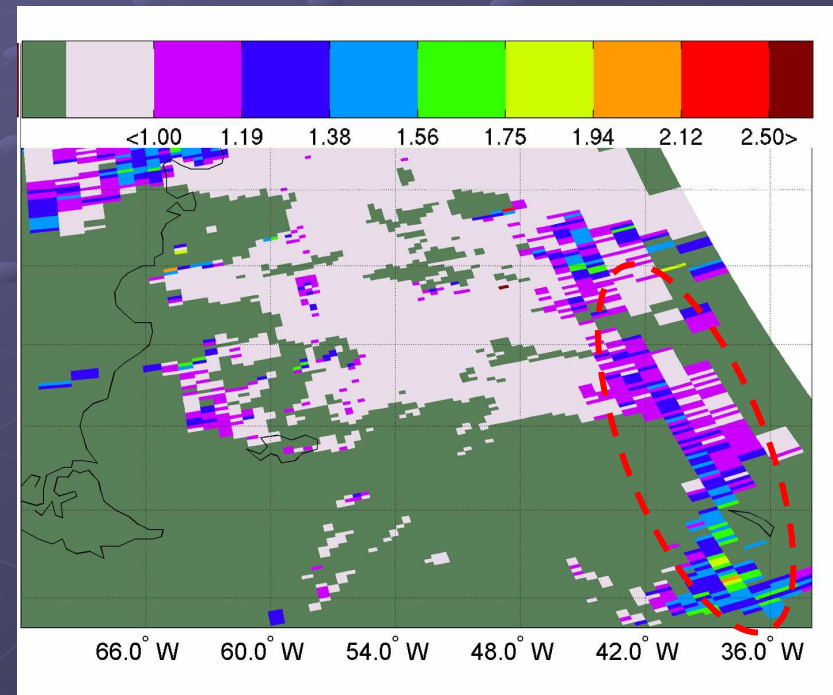
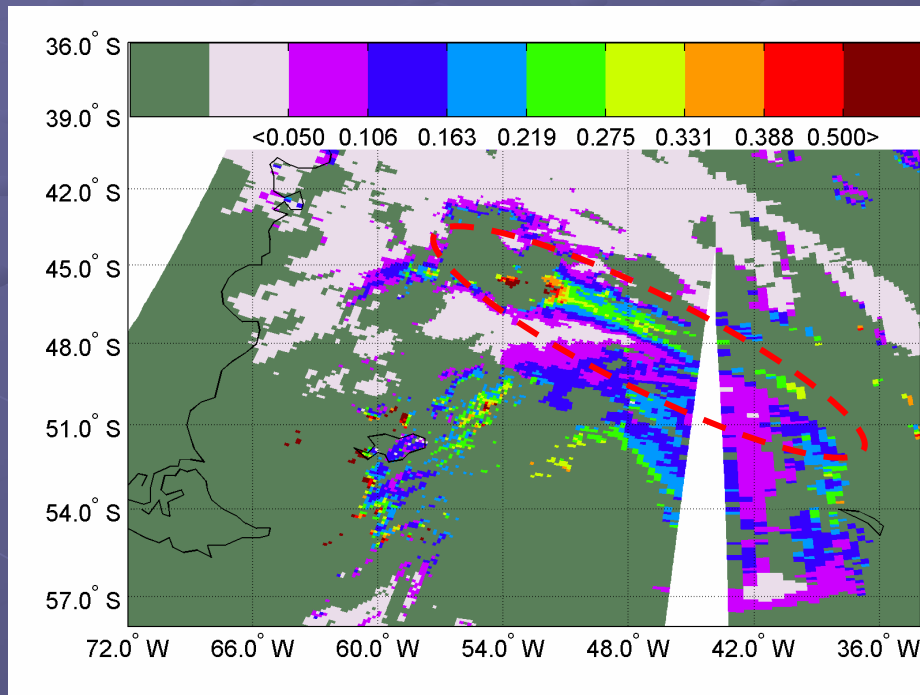
Agreement with MODIS

Dust is lifted



Agreement with OMI

So, mostly likely this is dust...



Gasso, S., and A. F. Stein (2007),
Does dust from Patagonia reach the sub-Antarctic Atlantic Ocean?,
Geophys. Res. Lett., 34, L01801, doi:10.1029/2006GL027693.

We established the fact that.....

- There is observable dust activity in the South Atlantic Ocean
- South American dust reaches the biologically important Sub-Antarctic Ocean

So, what's next?

Now we can address the following questions....

- Does the dust reach Antarctica?
- Is there an observable biological response to the input of dust?

(Proposal Submitted to Ocean Biology and Biogeochemistry Program)