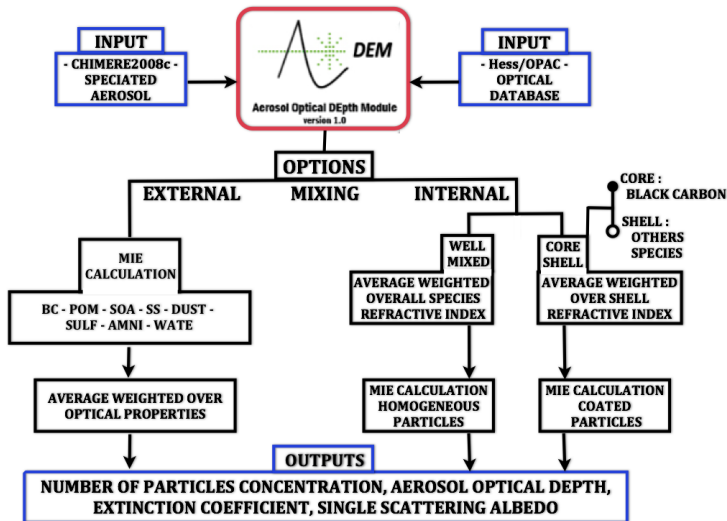


Modeling Aerosol Optical Properties with AODEM: accounting for non-sphericity of dust particles

Tony Christian Landi and Gabriele Curci

CETEMPS - Physics Department, University of Aquila

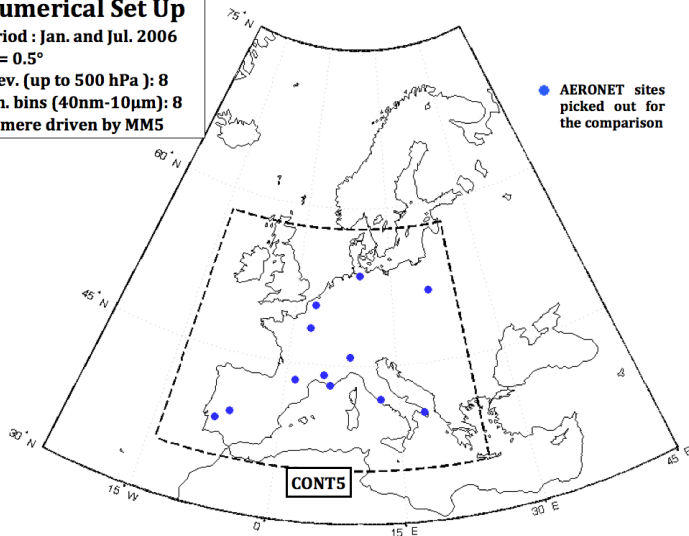
tony.landi@aquila.infn.it



CHIMERE : Coarse domain and numerical set up

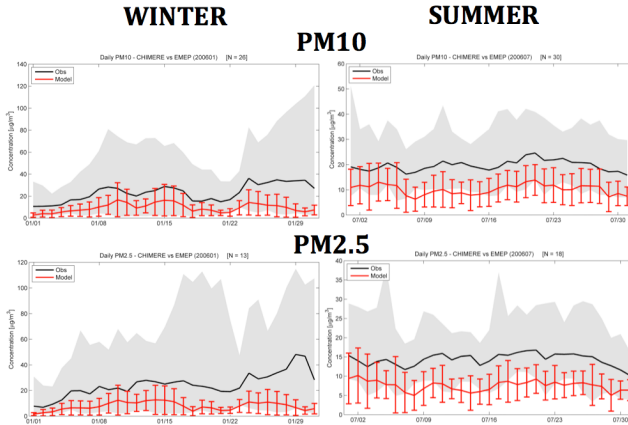
Numerical Set Up

- Period : Jan. and Jul. 2006
- $\Delta x = 0.5^\circ$
- v. lev. (up to 500 hPa) : 8
- dim. bins (40nm-10 μ m) : 8
- Chimere driven by MM5



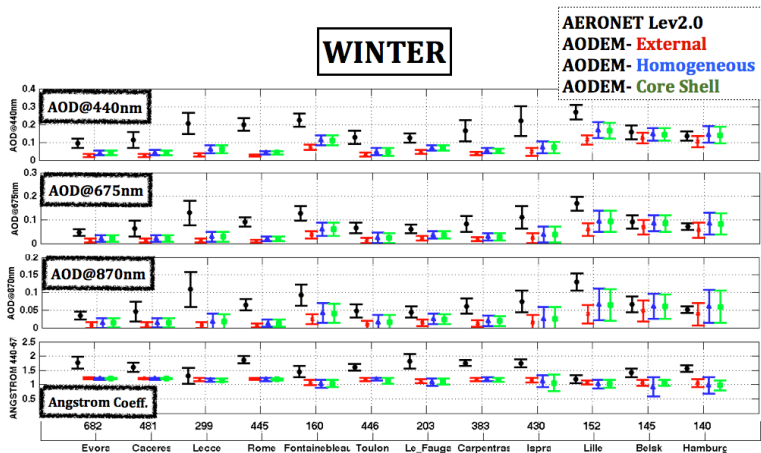
CHIMERE performances (PM)

Particulate matter levels are underestimated by the model by about —40%, both in winter and summer and both *PM*₁₀ and *PM*_{2.5} fractions. Extreme values are not captured by the model. Similar bias were previously reported for CHIMERE model (**Stern et al., 2008**).



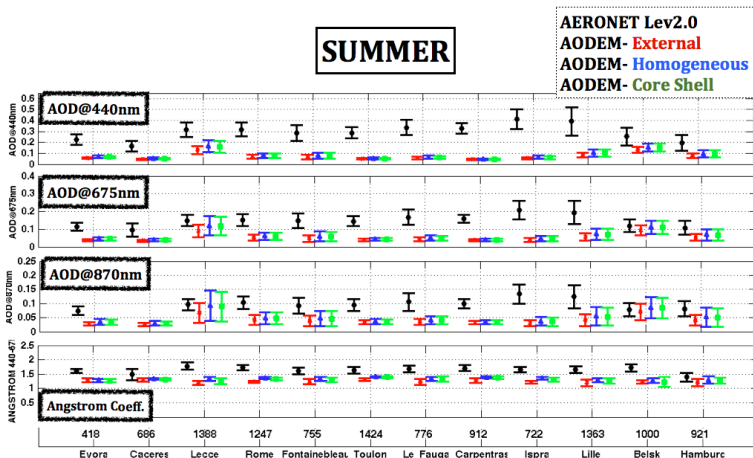
AODEM : AOD and ANGSTROM

Modeled AOD values differ by 15 – 20% among the three aerosol mixing these values are consistent with previous studies (Tombette et al., 2008; Pere et al., 2010). The relative bias ranges from 50% (@440nm) to 70% (@870nm)



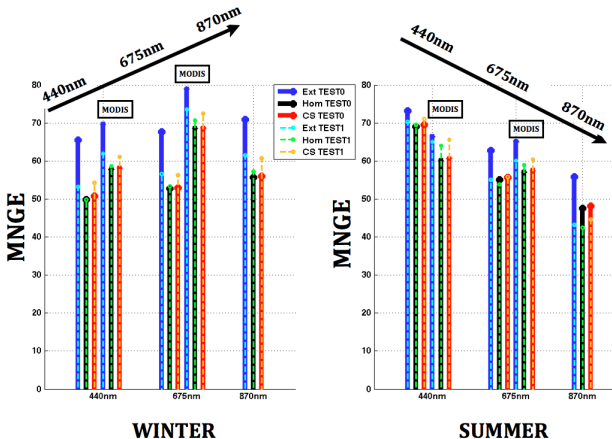
AODEM : AOD and ANGSTROM

Modeled AOD values differ by 15 – 20% among the three aerosol mixing these values are consistent with previous studies (Tombette et al., 2008; Pere et al., 2010). The relative bias ranges from 50% (@870nm) to 70% (@440nm)



AODEM : Finding potential sources of error

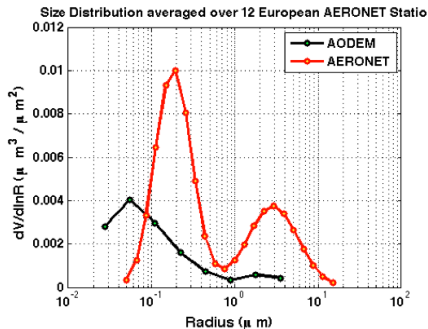
The study of spectral dependency of discrepancy can be considered as an interesting starting point to detect the potential sources of error in terms of module assumptions and measurements.



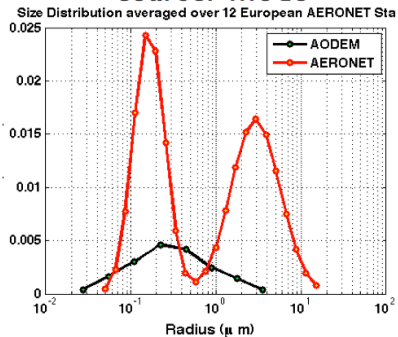
Aerosol Size Distributions

WINTER

Model shifts toward
finer mode

**SUMMER**

Model shifts toward
coarser mode



<http://www.bsc.es/projects/earthscience/DREAM>

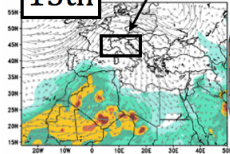
CASE STUDY OF JULY 2007 OVER PO VALLEY

13-14-15th NODUST

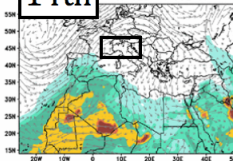
16-17th DUST

Nested domain
0.1 degree

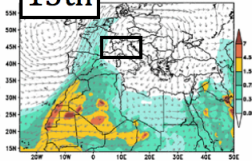
13th



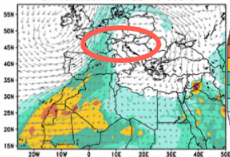
14th



15th

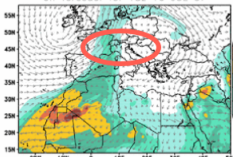


BSC/DREAM Dust Loading (g/m^2) and 3000m Wind
0h forecast for 12z 16 JUL 07



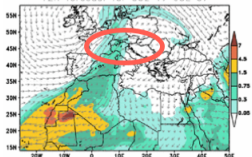
16th 12z

BSC/DREAM Dust Loading (g/m^2) and 3000m Wind
6h forecast for 18z 16 JUL 07



16th 18z

BSC/DREAM Dust Loading (g/m^2) and 3000m Wind
12h forecast for 00z 17 JUL 07



17 00z

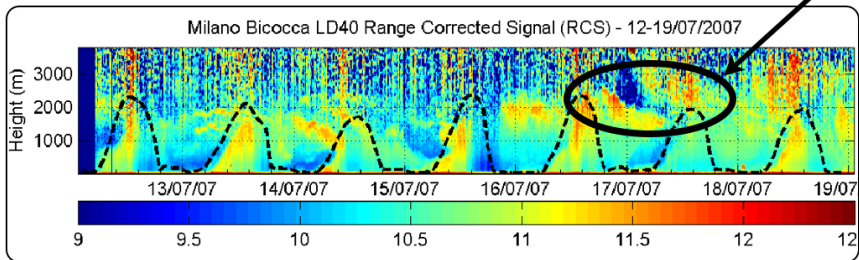
Lidar observation

CASE STUDY OF JULY 2007 OVER PO VALLEY

13-14-15th **NO DUST**

16-17th **DUST**

Saharan Dust

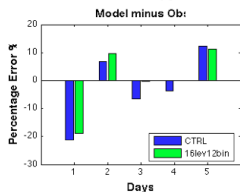
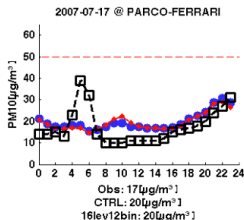
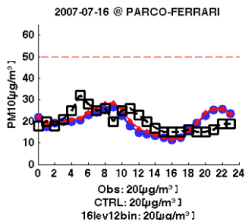
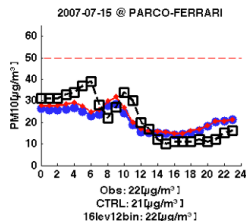
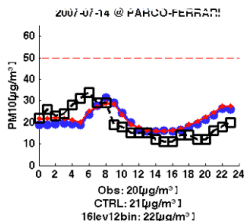
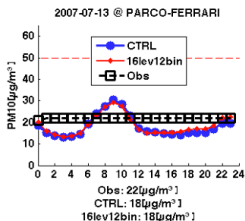


Lidar Observations : P.I. Gian Paolo Gobbi, g.gobbi@isac.cnr.it

Obs vs CHIMERE : PM10 @ ground level

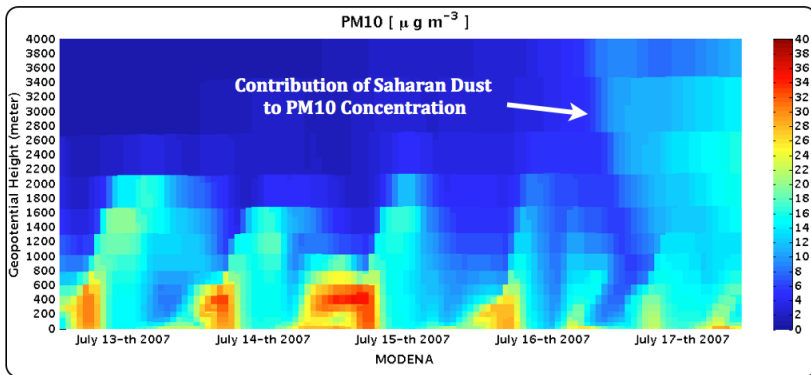
<http://www.brace.sinanet.apat.it>

CASE STUDY OF JULY 2007 OVER PO VALLEY on July 13th - 17th @ Modena

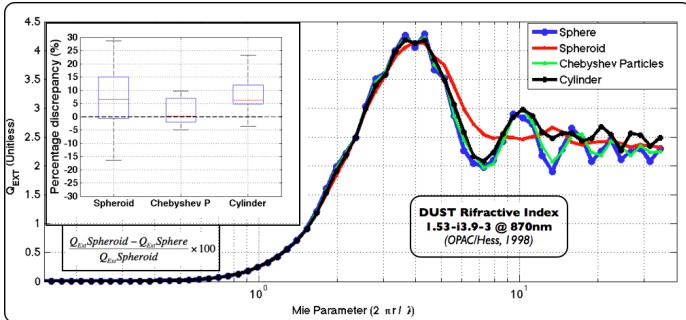
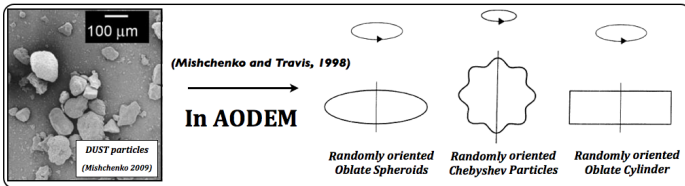


CHIMERE : Time series of PM10 vertical profile

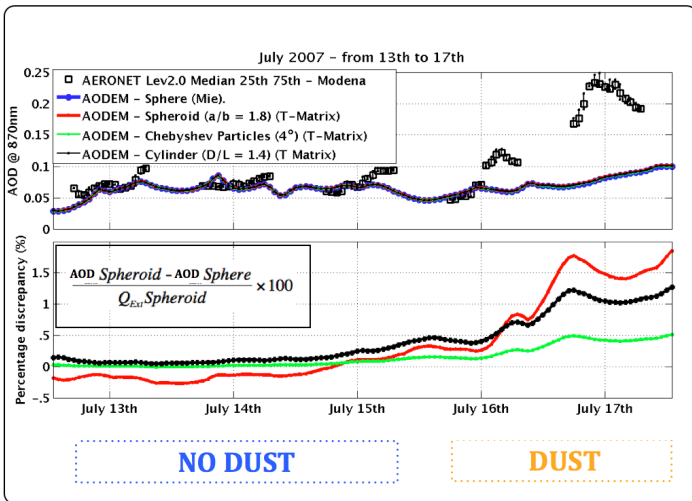
CASE SUDY OF JULY 2007 OVER PO VALLEY on July 13th - 17th @ Modena



Dust Particles modeling in AODEM



Dust Particles modeling in AODEM



Conclusions and Future Outlook

- In the coarse resolution model we find an underestimation of -50% to -70% of AOD with respect to AERONET and MODIS observations. We explain the bias considering a -40% bias in surface particulate levels (PM_{10} and $PM_{2.5}$) and a shift in the fine mode peak of the simulated aerosol size distribution.
- Using higher spatial resolution, in no-dust conditions the model well reproduces both hourly particulate matter and AOD.
- The optical calculation assuming non-spherical particles in dust conditions slightly increases the AOD, but it doesn't fill the gap with observations.
- Future outlook
 - 1) test higher degree of asphericity (high CPU cost)
 - 2) extend the simulated size range to 40 microns (dust particles)