AEROSOL

model vs data

ECWMF vs AERONET

mid-visible optical depth of aerosol > 1μm diameter

S. Kinne

Max Planck Institute
Hamburg, Germany

Overview

- **data-sets**
  - ECMWF simulations
  - aerosol ‘quality’ data reference
- **questions**
- **comparisons**
  - magnitude –matched ?
  - temporal phase matched ?
  - forcing efficiencies
- **first impressions**
- **outlook**

simulations ... and reference

- **ECMWF** **(2 averages each day 0-12, 12-24 UTC Jan-Jun 2003)**
  - **seasalt** and **dust** aerosol optical depth

  → **aot (coarse size mode)**

- **AERONET** **(robotic sun/sky-photometer ground network)**
  - **aot,s** – sun mode (based on direct attenuation)
  - **ff,s** - fraction of aot by particles < 1mm diameter
    - estimate based on Angstrom spectral change

  → **aot (coarse mode)** = aot,s * (1 -ff,s)

  - **aot,i** – sky mode (based on a all-data inversion)
  - **ff,i** - fraction of aot by particles < 1mm diameter
    - estimate based on retrieved size distribution

  → **aot (coarse mode)** = aot,i * (1 -ff,i)

Questions

- **How good are the AERONET data reference? Is there consistency?**

  assuming AERONET data are reliable and looking at time-series of temporal matches …

- **How good are initial ECMWF simulations for sea-salt and dust** (>1um in size) **aerosol ?**
  - phase?
  - absolute magnitude?

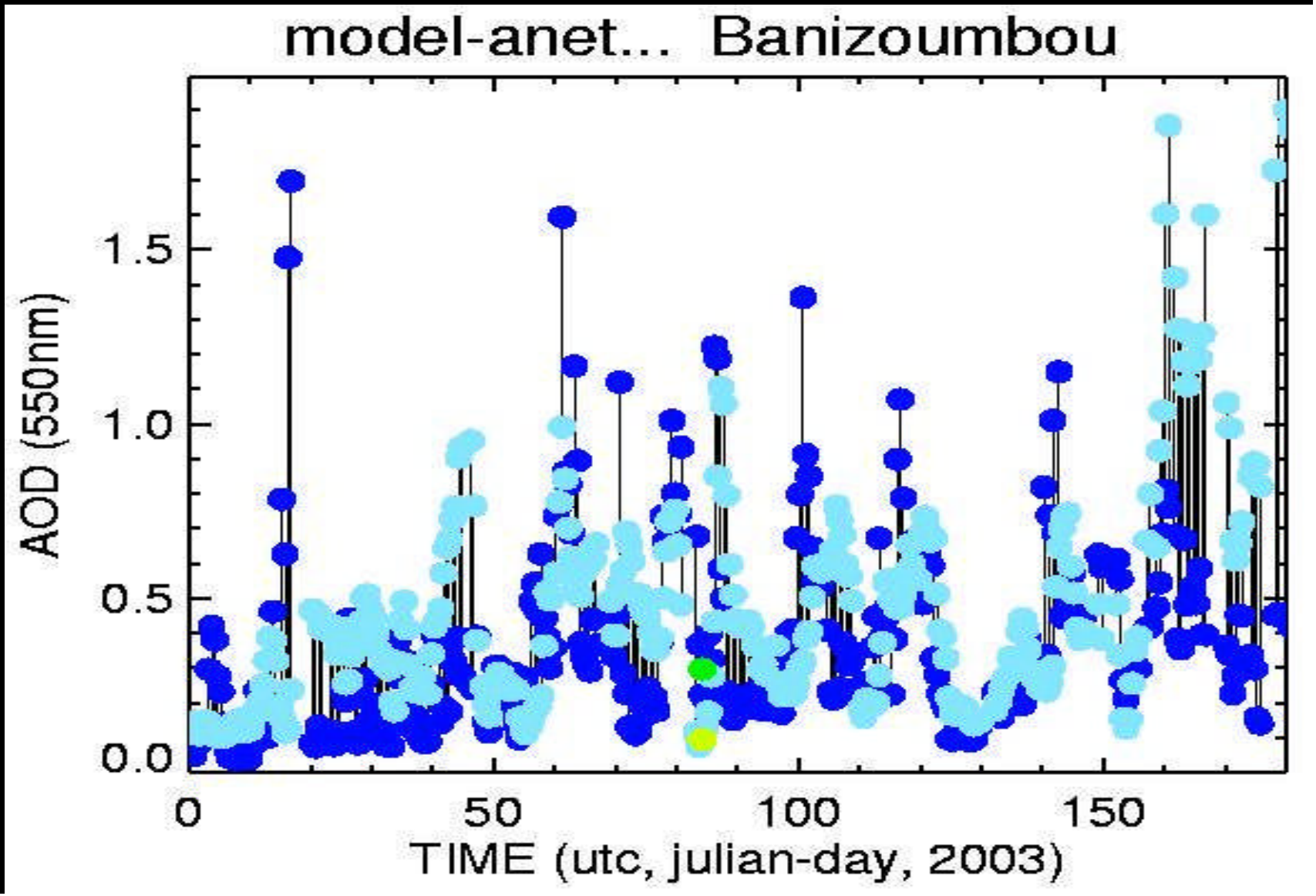
- **Can we identify events of high aerosol loads of coarse-mode for case studies?**

locations investigated

- **DUST**
  - western Africa
  - Mediterranean (2)
  - far East
  - central Asia
- **SEA-SALT**
  - Pacific (2)

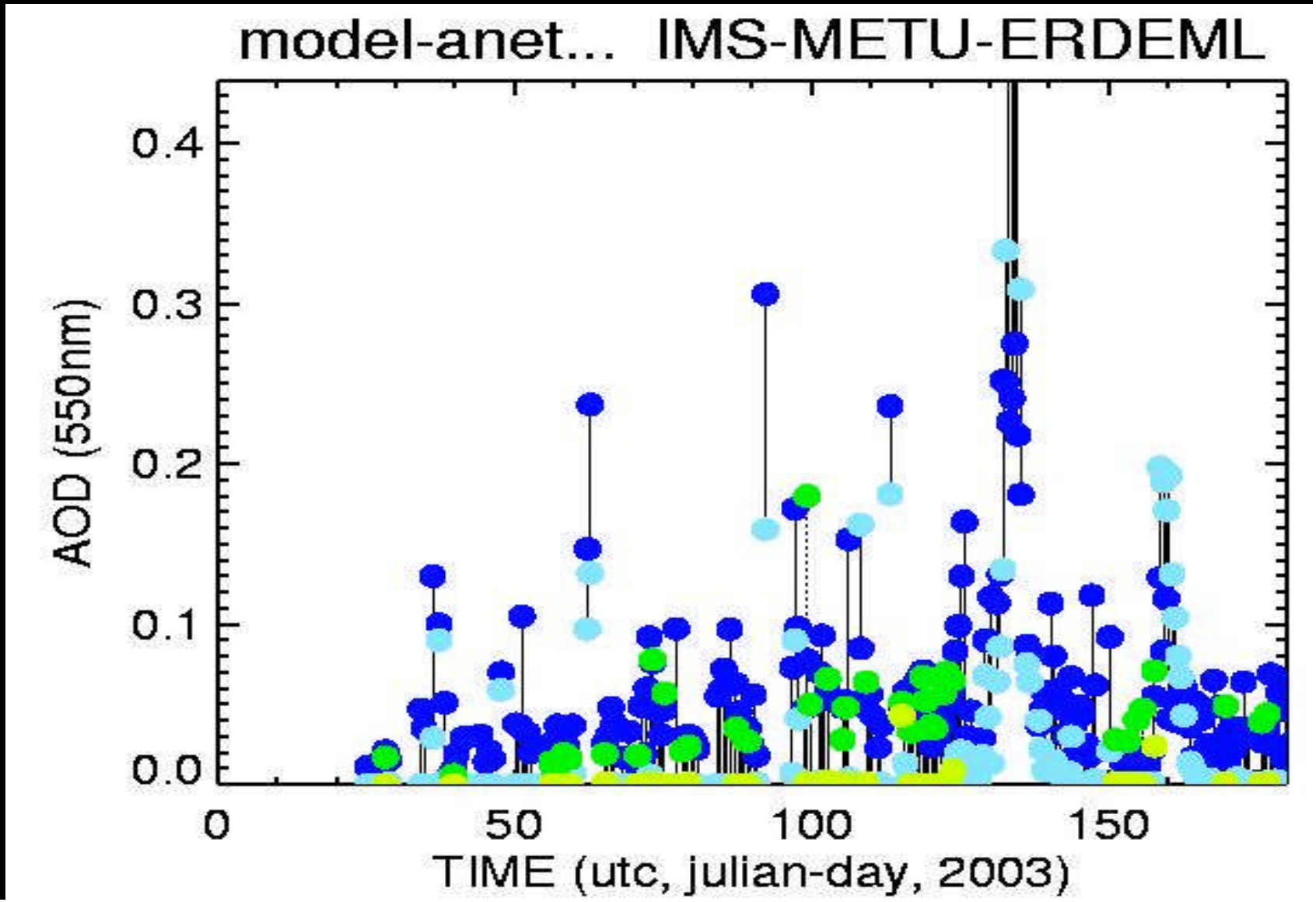
DUST – western Africa

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



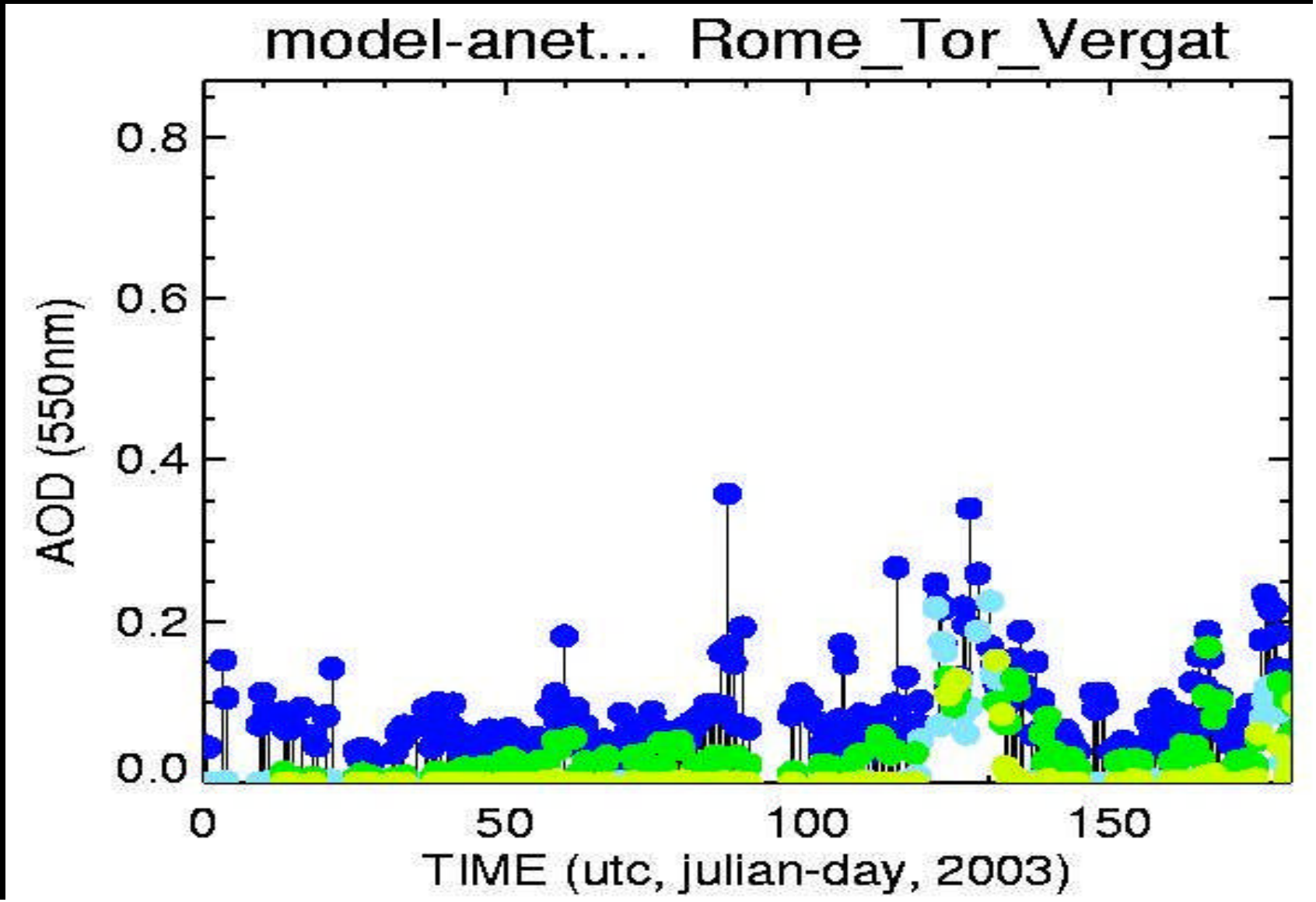
DUST – south Turkey

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



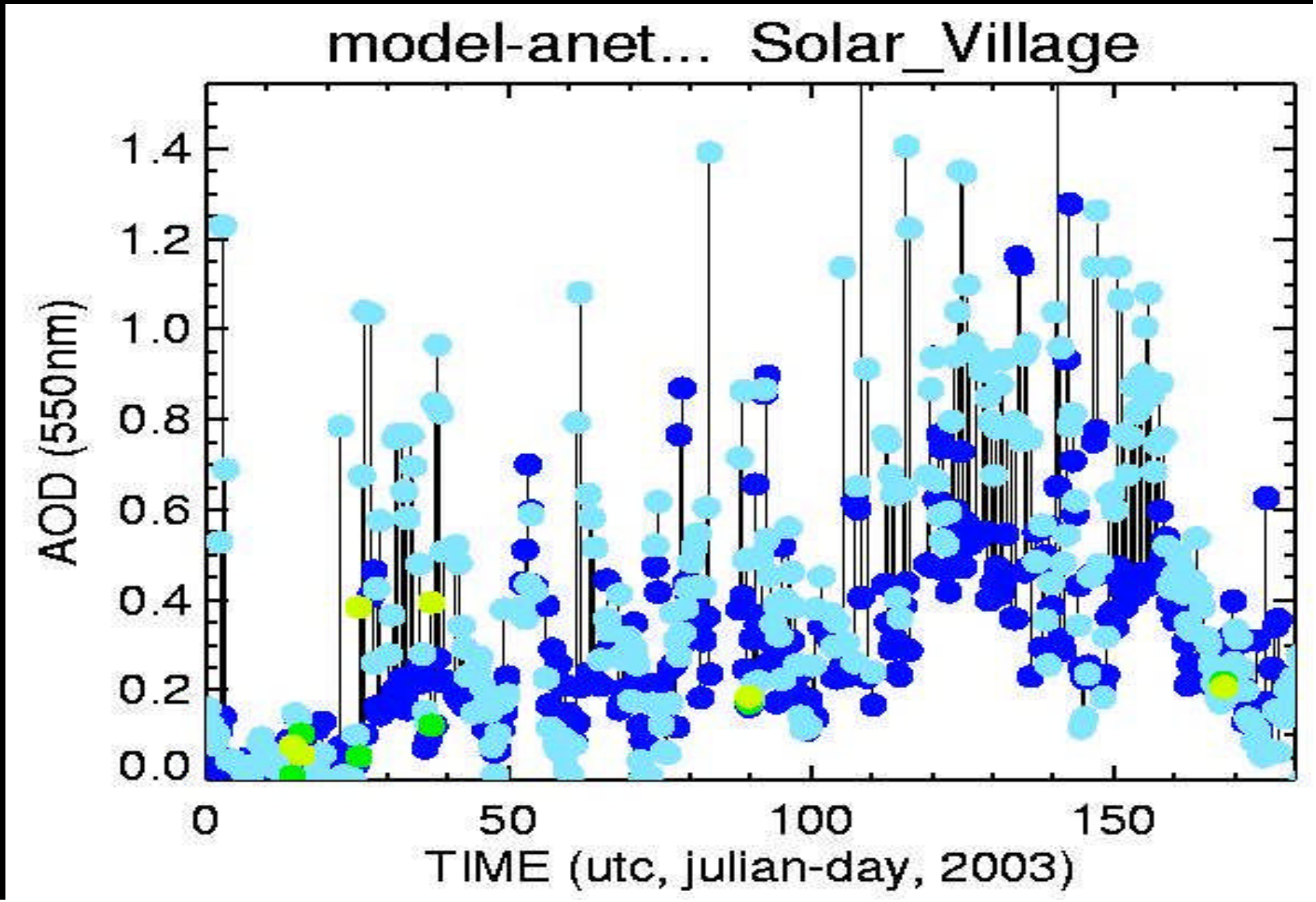
DUST – central Italy

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



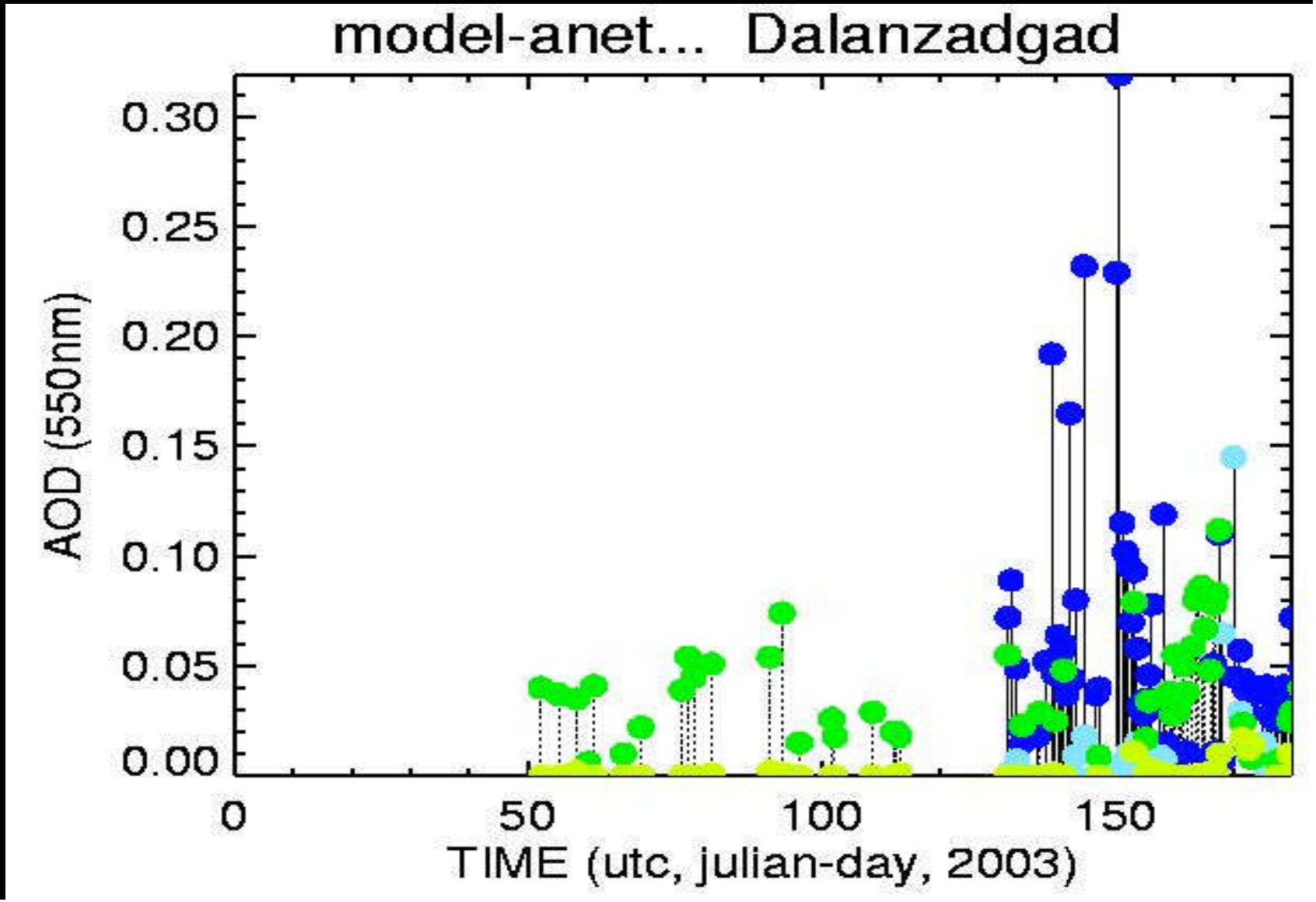
Dust – far East

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



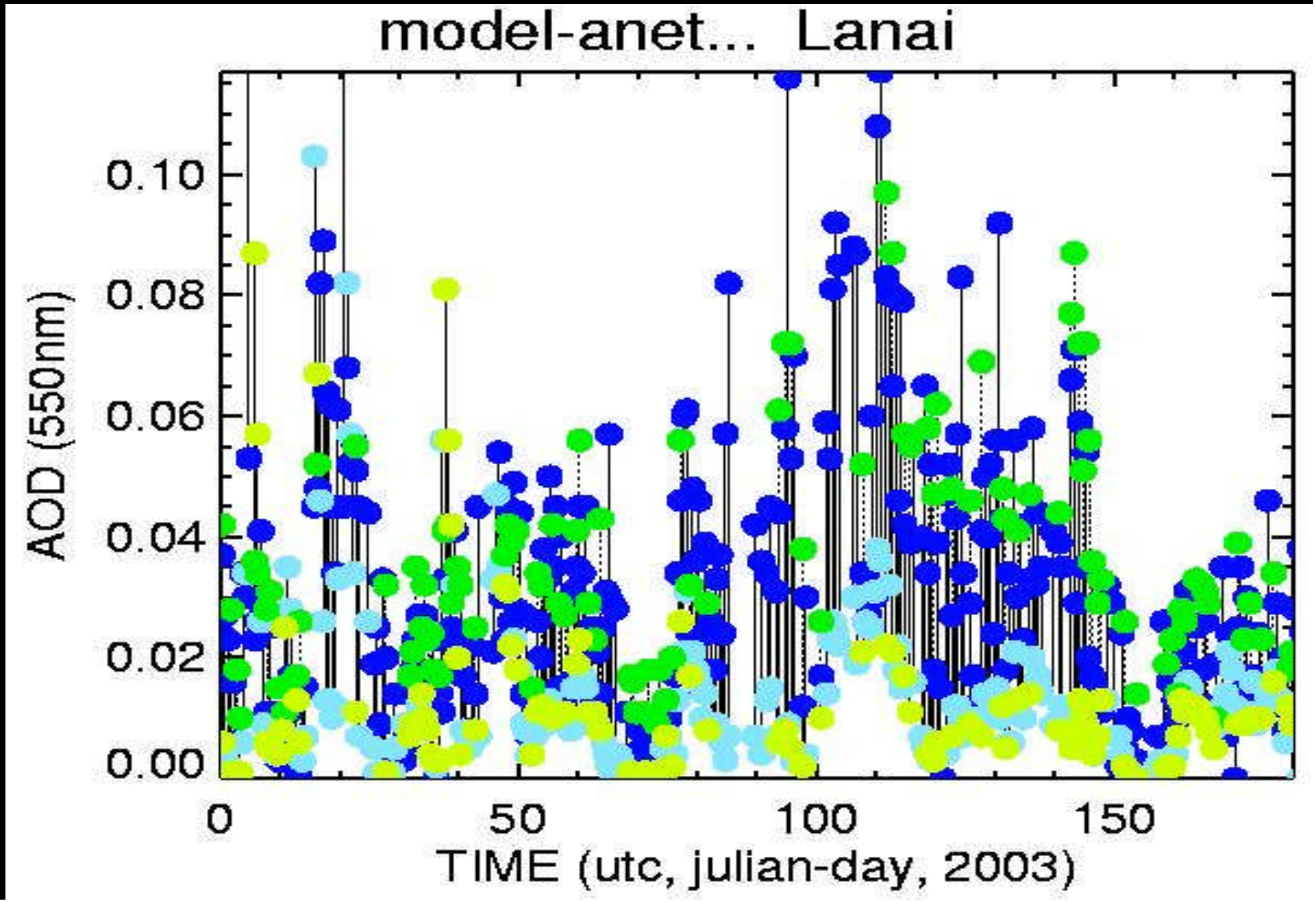
DUST – central Asia

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



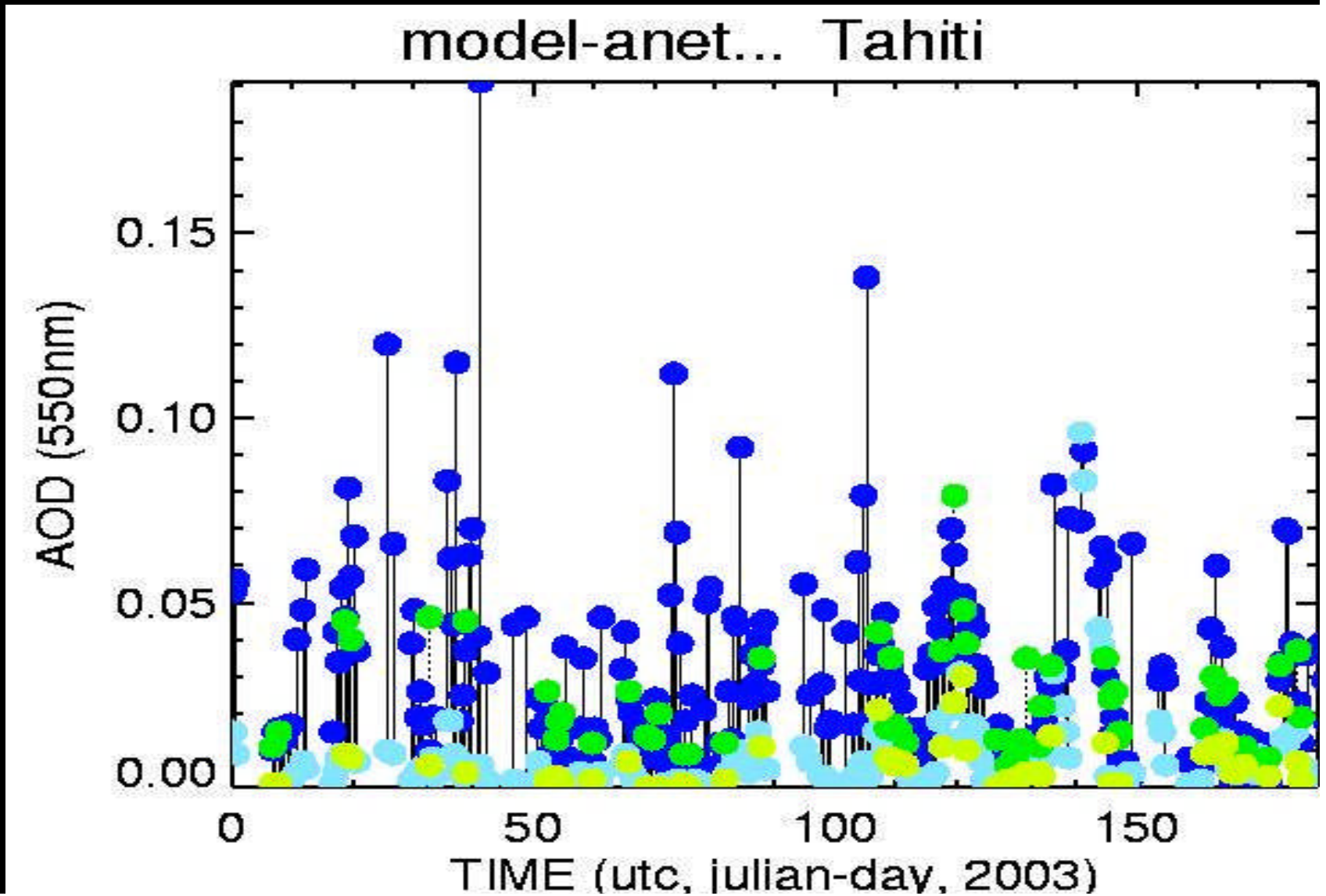
Sea Salt, DUST - Pacific

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



Sea-salt – south Pacific

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



first impressions

- **dust**
  - major events simulated (“in phase”)
  - peak values: too large
  - background / off-source regions: too low
- **seasalt**
  - too low *(…as in many other models)*
- **interesting dust events:**
  - julian days 120-140 over Mediterranean
    - seen at Italy, Turkey and Israel
  - julian days 150-170 over the western Africa
  - julian days 100-120 over Hawaii

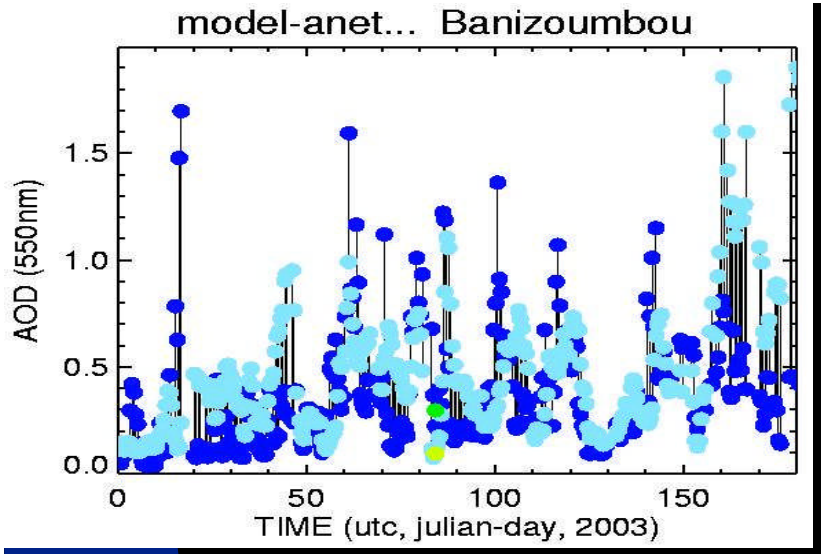
next

- implement aerosol data into AeroCom
  - netcdf (or ascii, if small), what tem. resolution ?
- **ground data (quality)**
  - AERONET (all data, daily, monthly) …next month
    - *data at anon. ftp:* **ftp.zmaw.de/aerocom/grd_aeronet601**
  - your data ? (contact me for coordination: kinne@dkrz.de)
- **satellite data (pattern)**
  - satellite composite (monthly averages)
  - best regional satellite product on a daily basis
- **other data**
  - in-situ, lidar….

next

- **SCORING**
  - add and implement scoring scenes (new ideas?)
  - establish local, seasonal scores
    - average normalized deviation, (rank-) correlation
  - combine score regionally, globally, annually
    - weighting (site quality, orography, sparseness)

- **EMISSIONS**
  - update AEROCOM with GFED-2, daily cycle?
  - data for 2003 (dust and sea-salt (LSCE?))
  - growth factors / year? for other species ?
  - include future scenarios in emission



example ... on 'scoring'

- **SCORES are needed to quantify the overall model performance with 1 value**

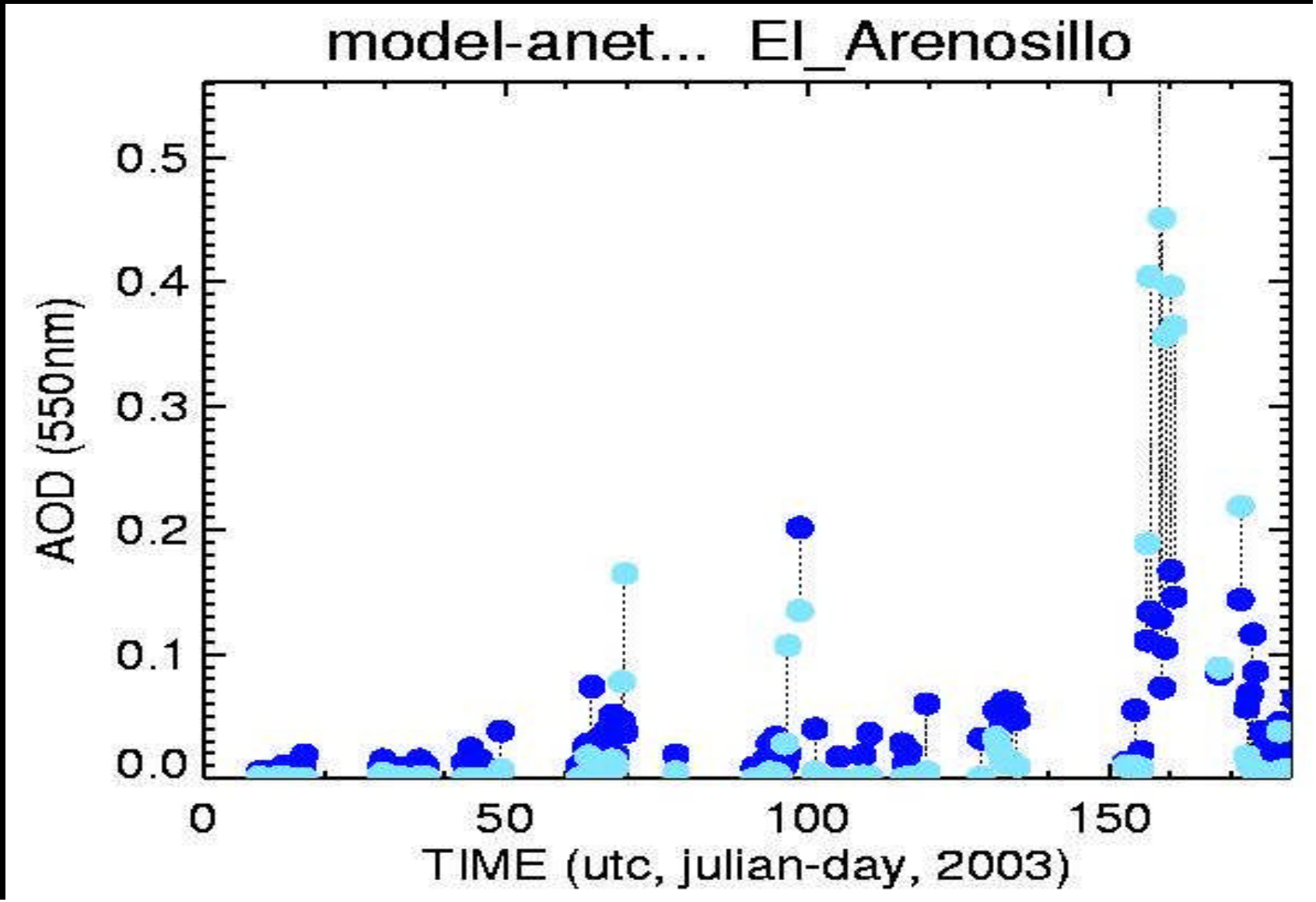
- **sample model-data to match local measurements**
- **determine each site's normalized average deviation**
  - ★ DEV = sum (|MODEL-DATA|) / sum (DATA)
    - *(.10 to .60 for first coarse-mode simulations)*
- **assign site specific weights (and combine)**
  - ★ regional coverage (e.g. only site in a region)
  - ★ site quality (e.g. instrument issues…)
  - ★ site region representation (e.g. orography, pollution)

→ **one score !** *(repeat with diff. temp resolution or time-offsets)*

extra slides

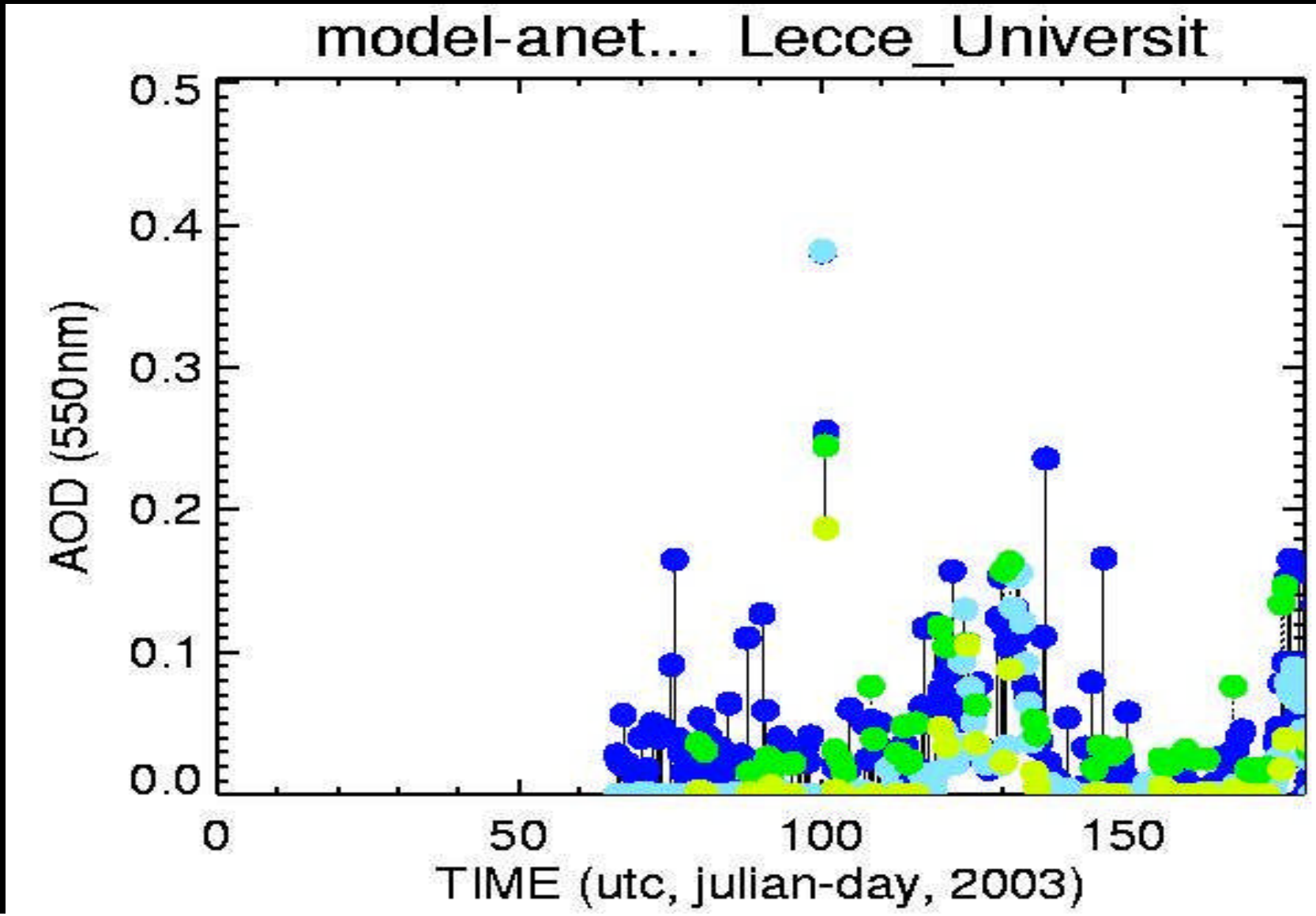
DUST – south Turkey

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



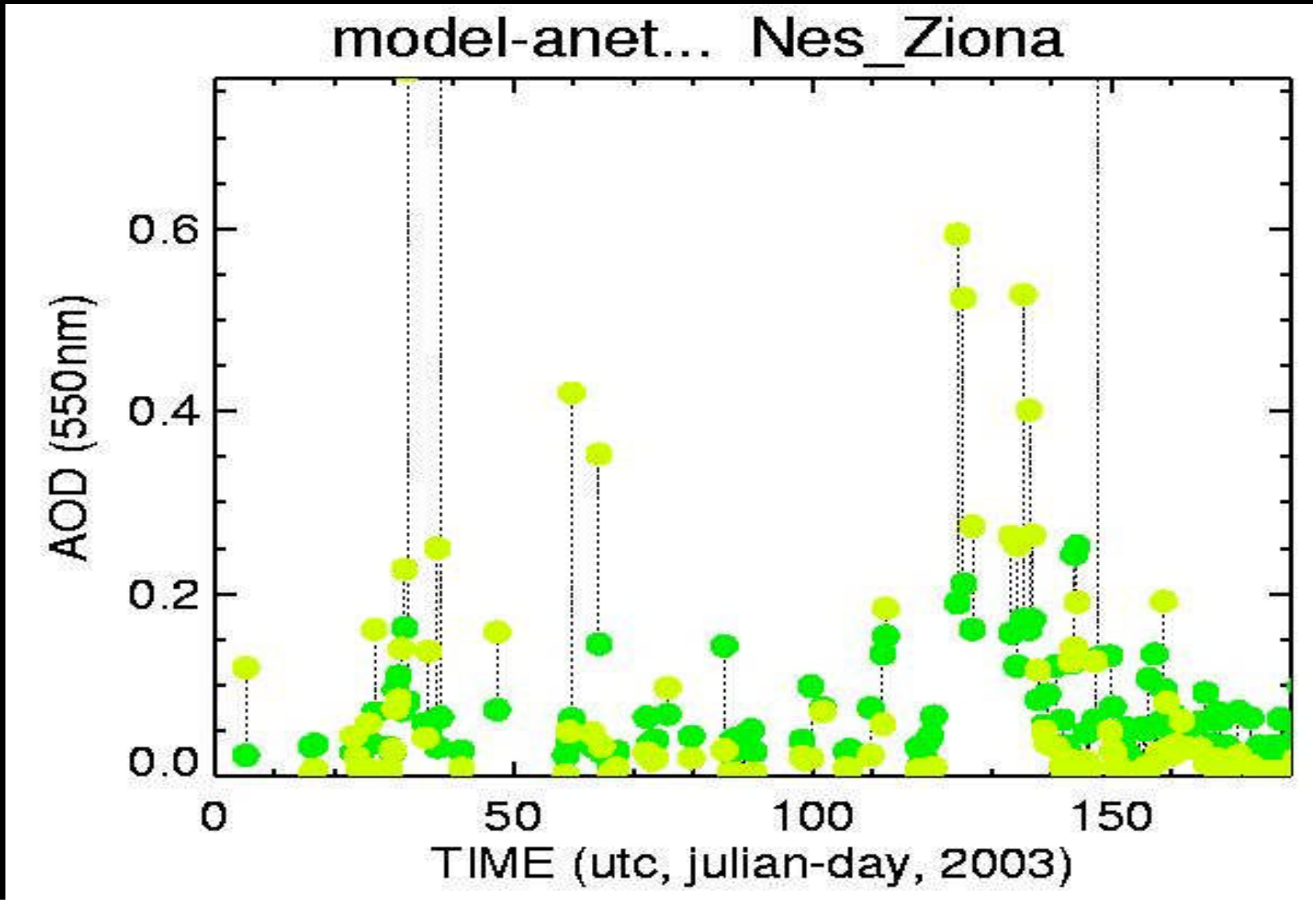
DUST – south Italy

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



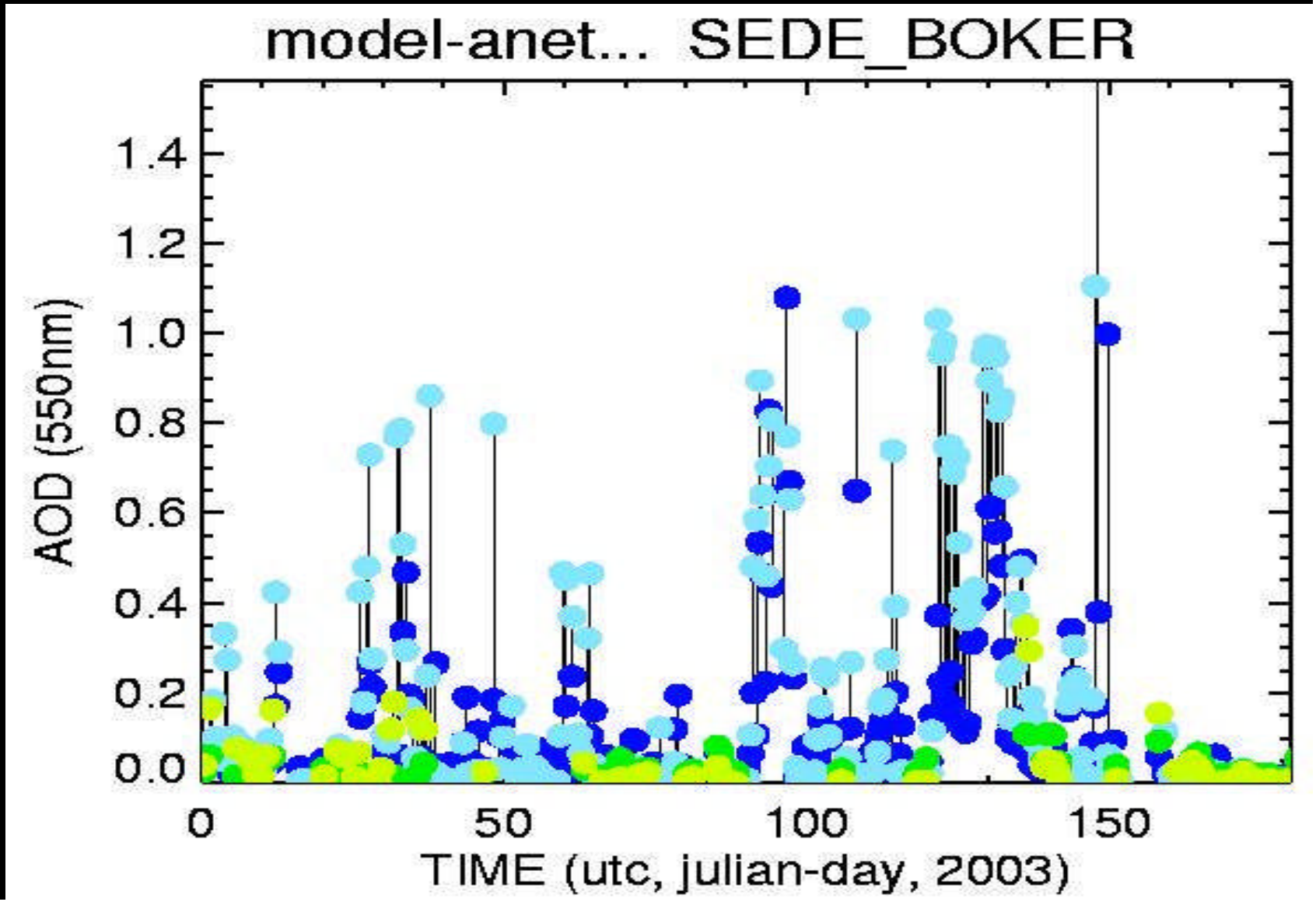
DUST – mid East

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



DUST – mid East

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF



high altitude - Pacific

AERONET sun-mode
… matching ECMWF
AERONET sky-mode
… matching ECMWF