Aerosol Forcing

… with the AERONET touch

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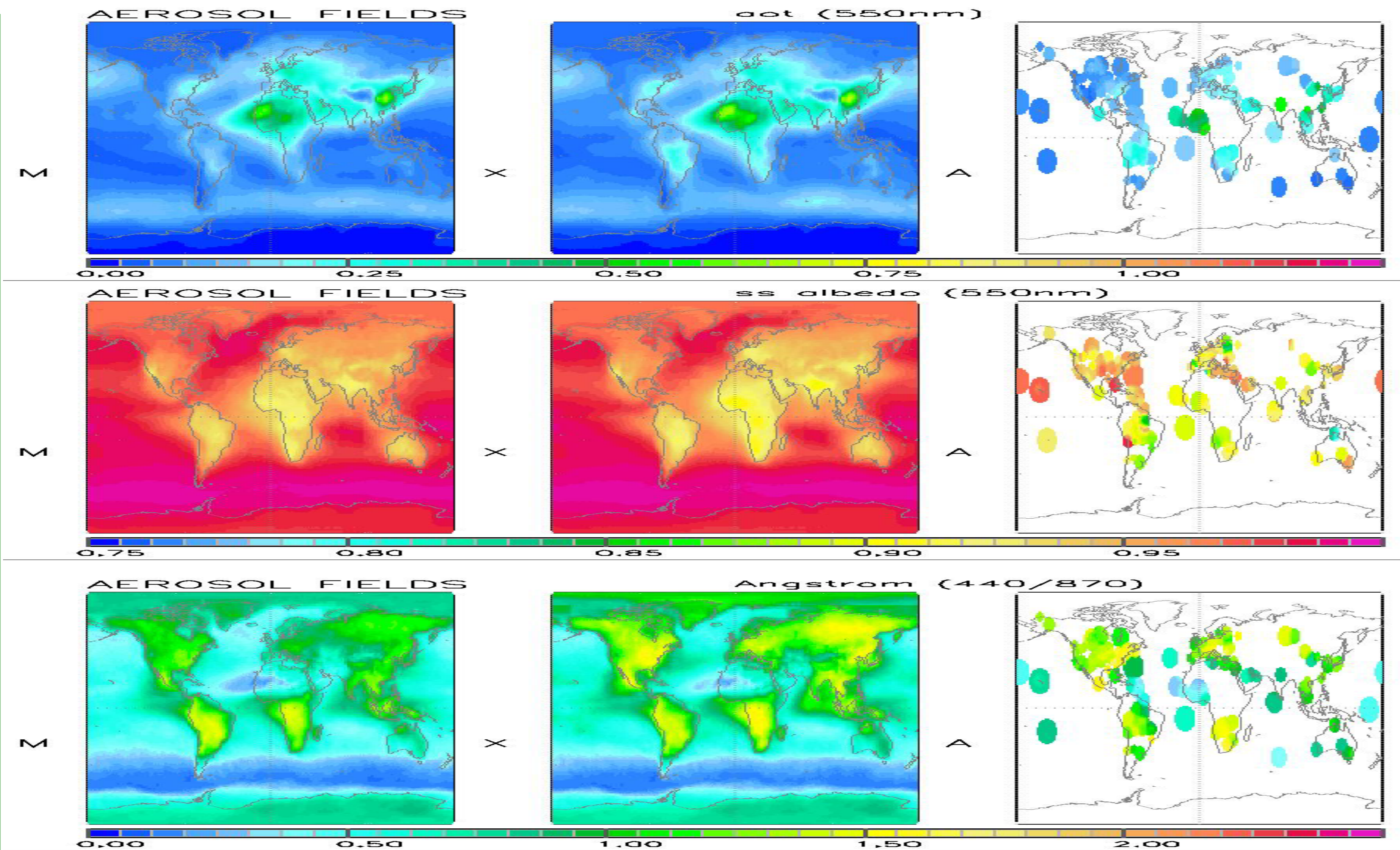
the concept

- **collect / create 1°x1° monthly global data sets**
- **impose AERONET statistics on model median**
  - amount ⇨ **aerosol optical depth (vis)**
  - size ⇨ **aerosol Angstrom parameter**
  - composition ⇨ **aerosol ss-albedo (vis)**
- **apply AERONET to establish spectral dependencies**
- **use MODIS data to prescribe the solar surface albedo**
- **use ISCCP data to include clouds for all-sky cases**
- **use ECHAM modeling to assign aerosol altitude**
- **determine aerosol forcing (F) and f-efficiency (F/aot)**

the aerosol input

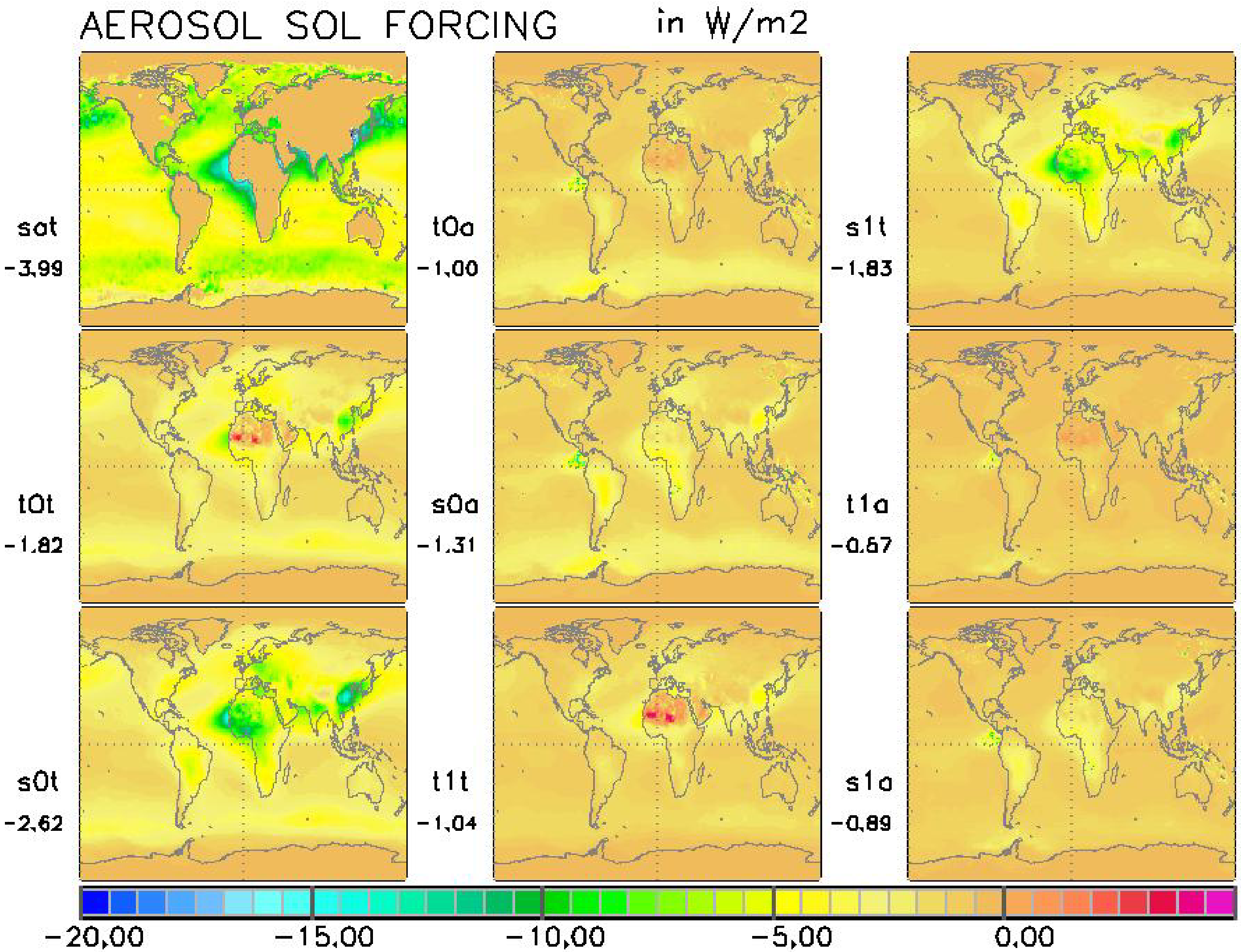


forcing *– a global overview*

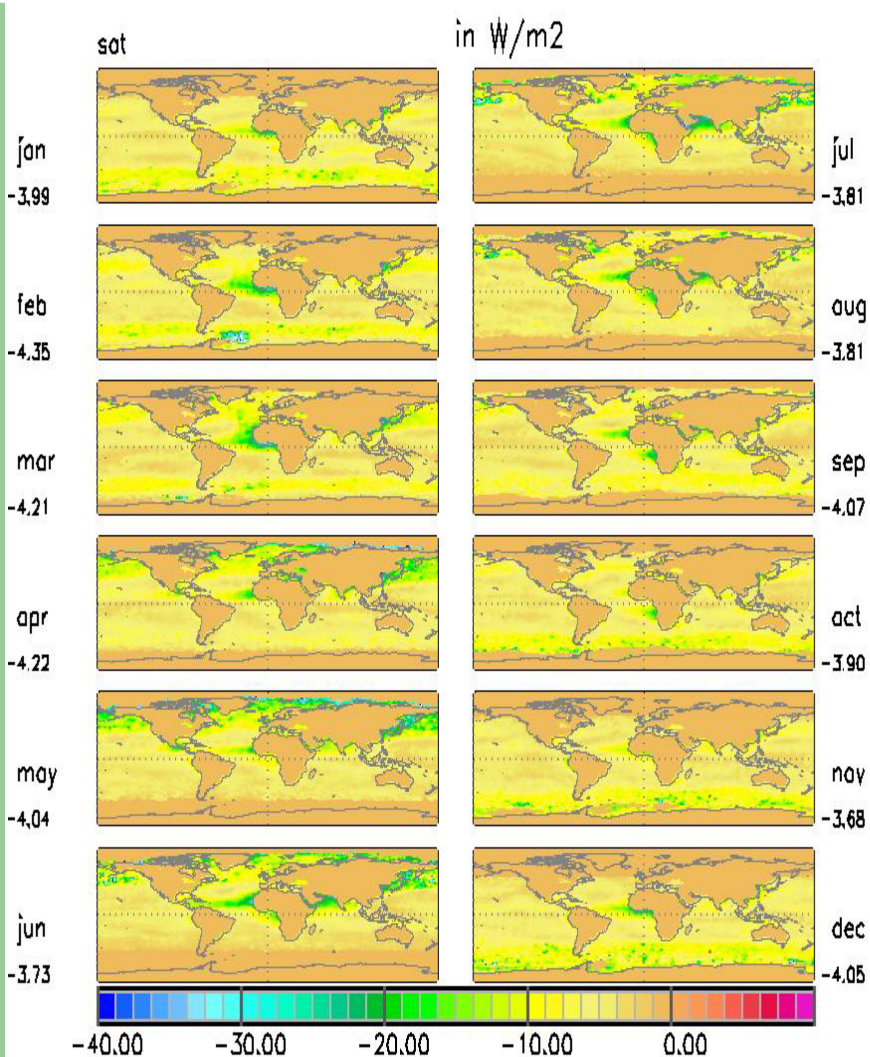
label – explanation

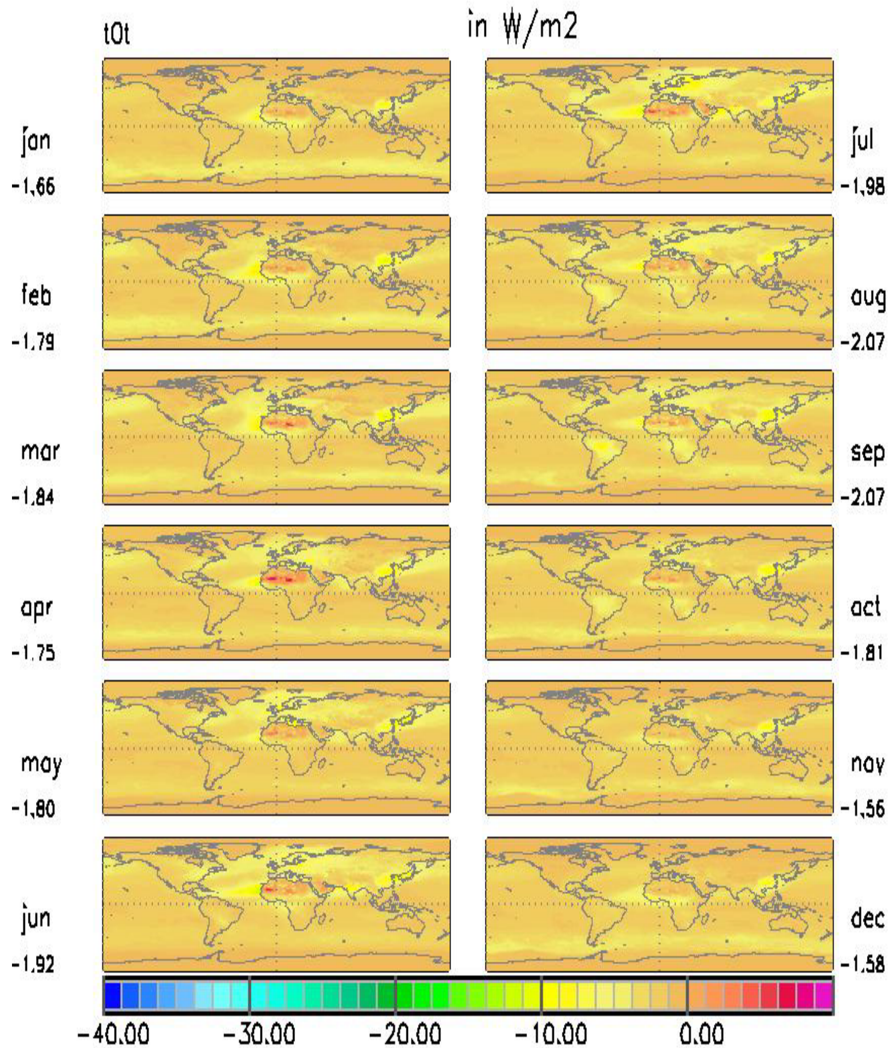
sat – CERES

t0t – ToA / cloud-free / total
s0t – surf / cloud-free / total
t0a – ToA / cloud-free / anthr
s0a – surf / cloud-free / anthr
t1t – ToA / all-sky / total
s1t – surf / all-sky / total
t1a – ToA / all-sky / anthrop.
s1a – surf / all-sky / anthrop.

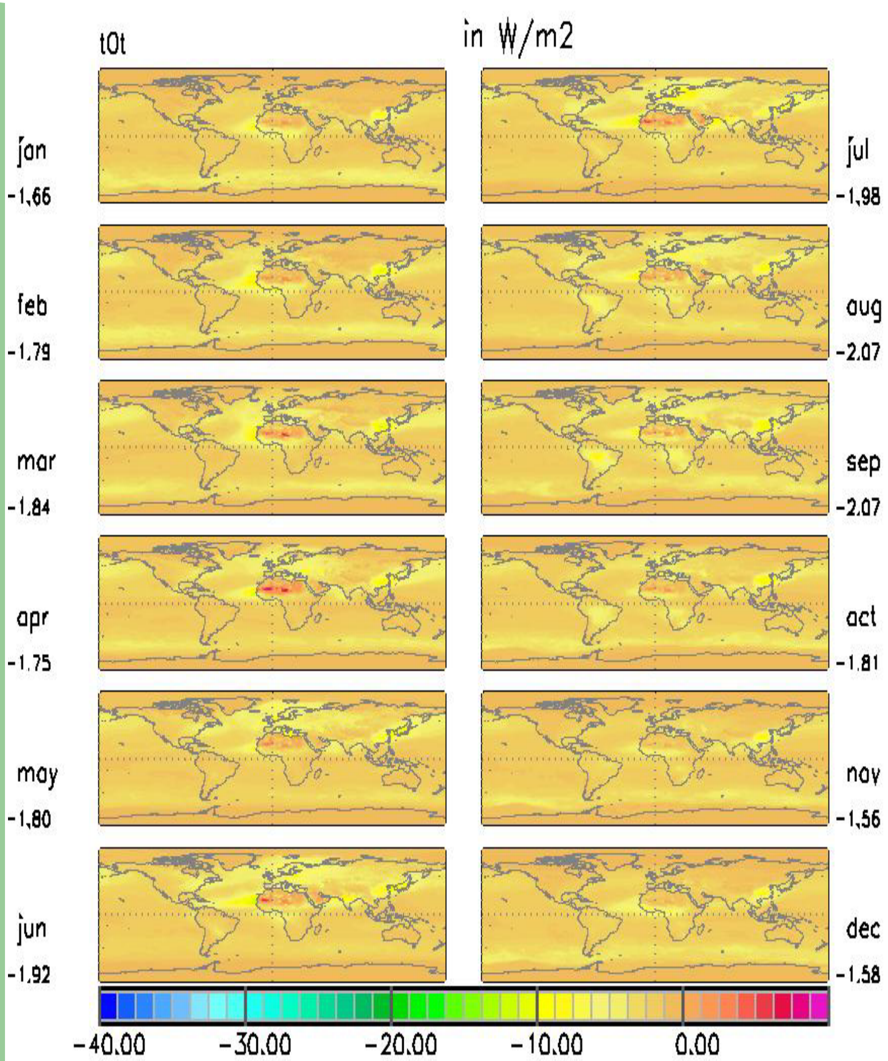


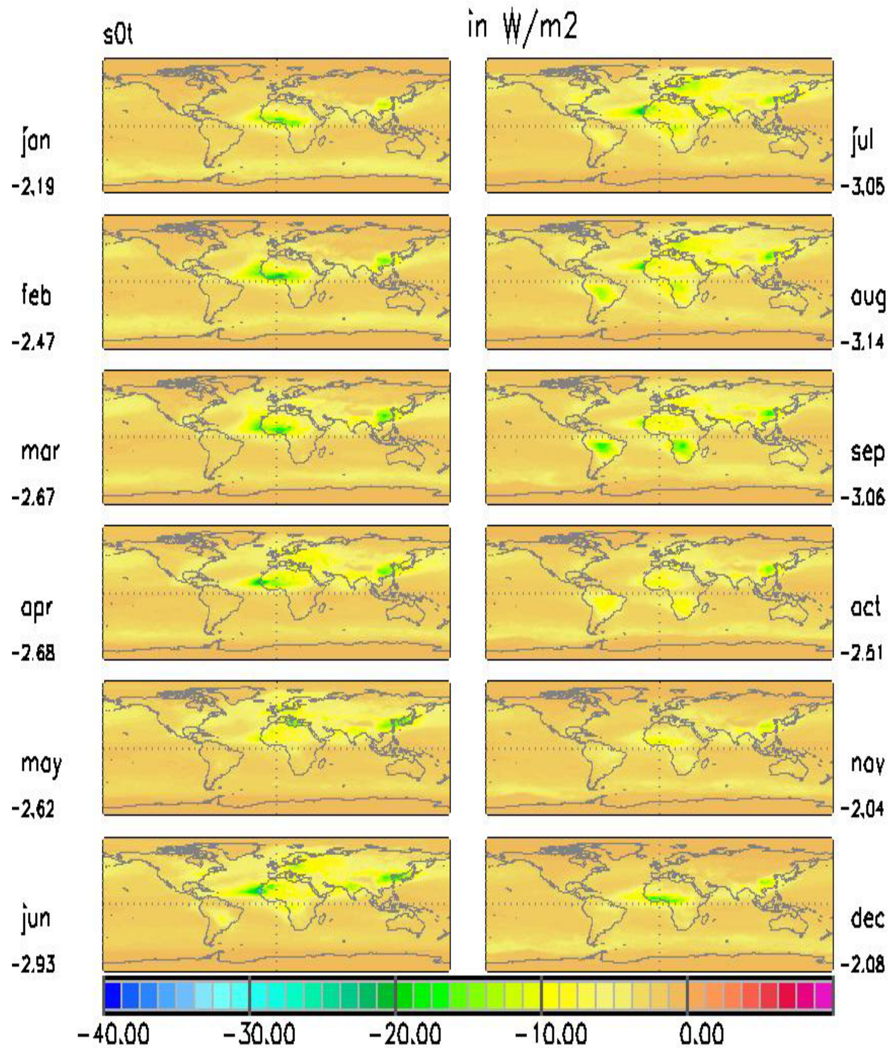
F,s-ToA – *CERES vs AERONET/Model*



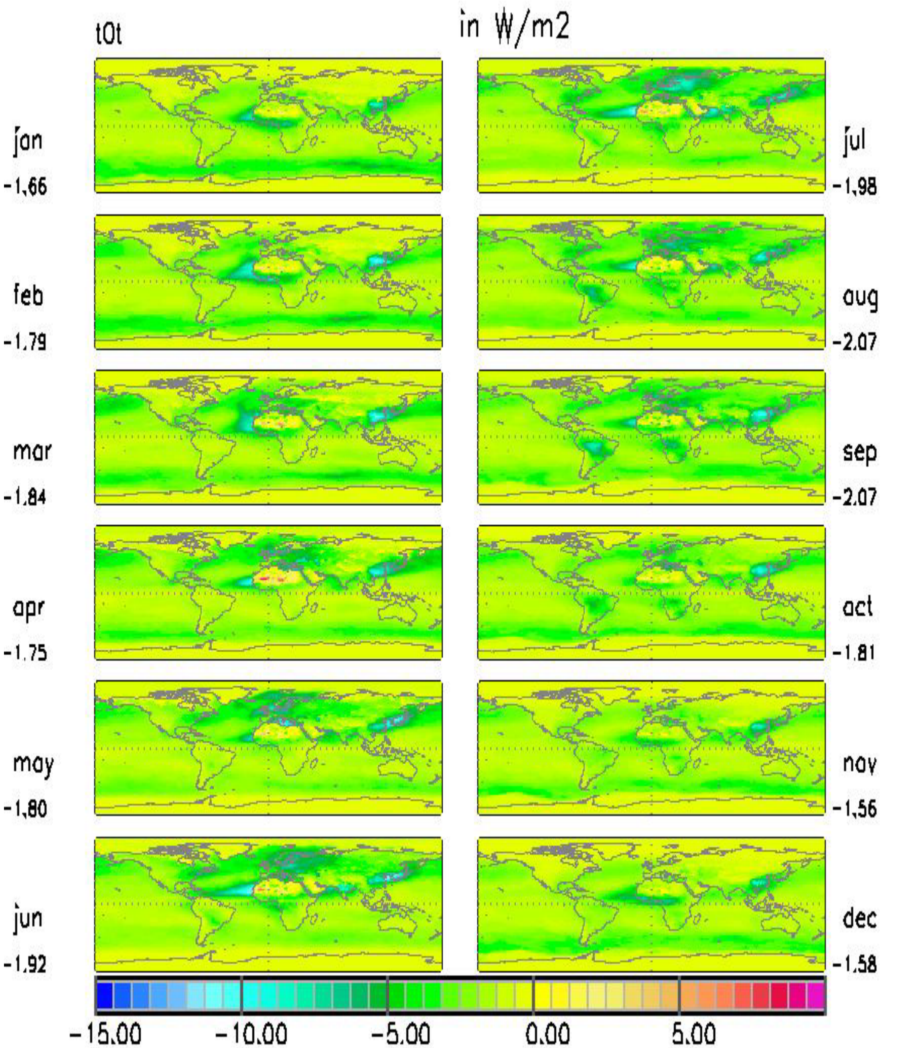


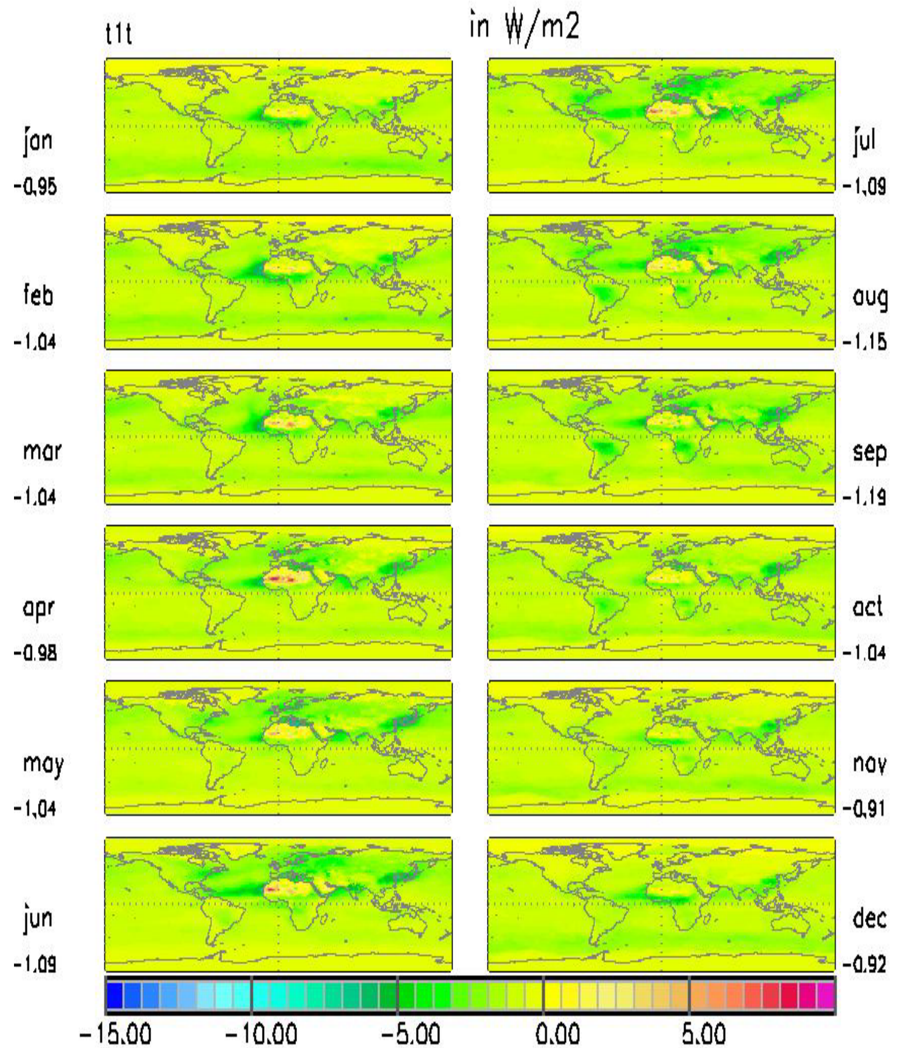
F,s – *ToA vs surface*



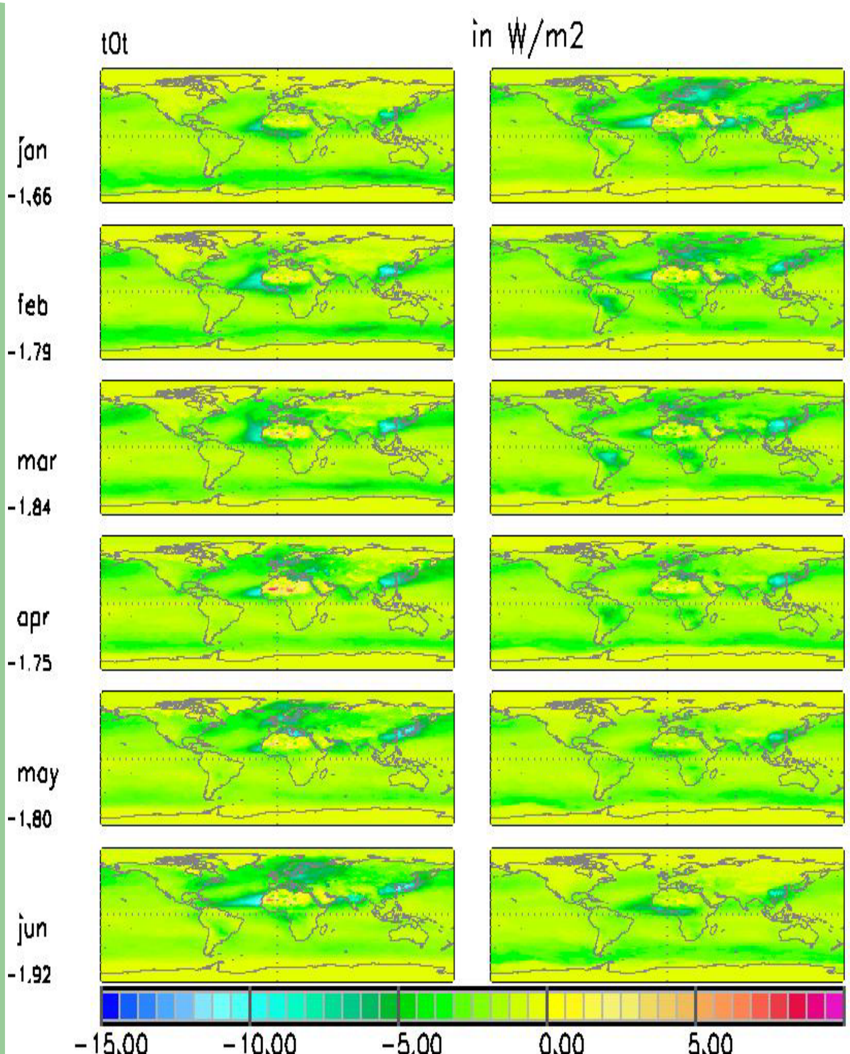


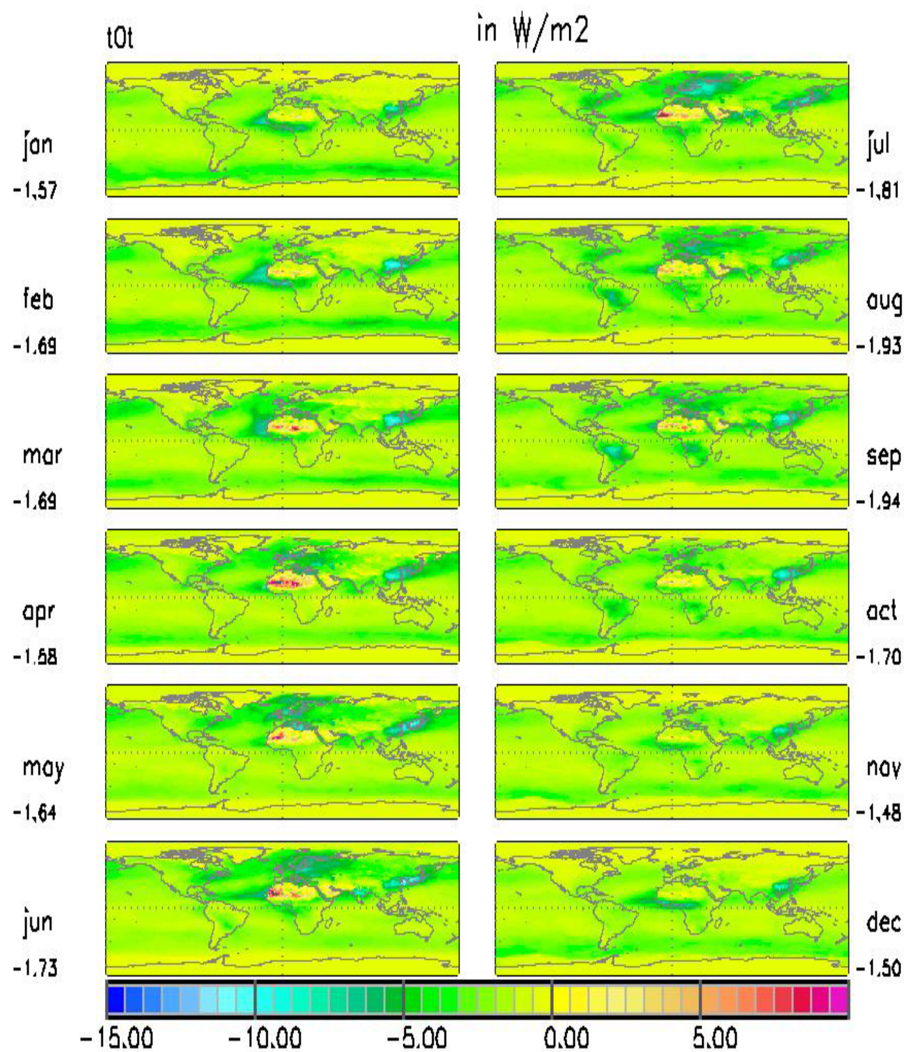
F,s ToA – *clear-sky vs all-sky*



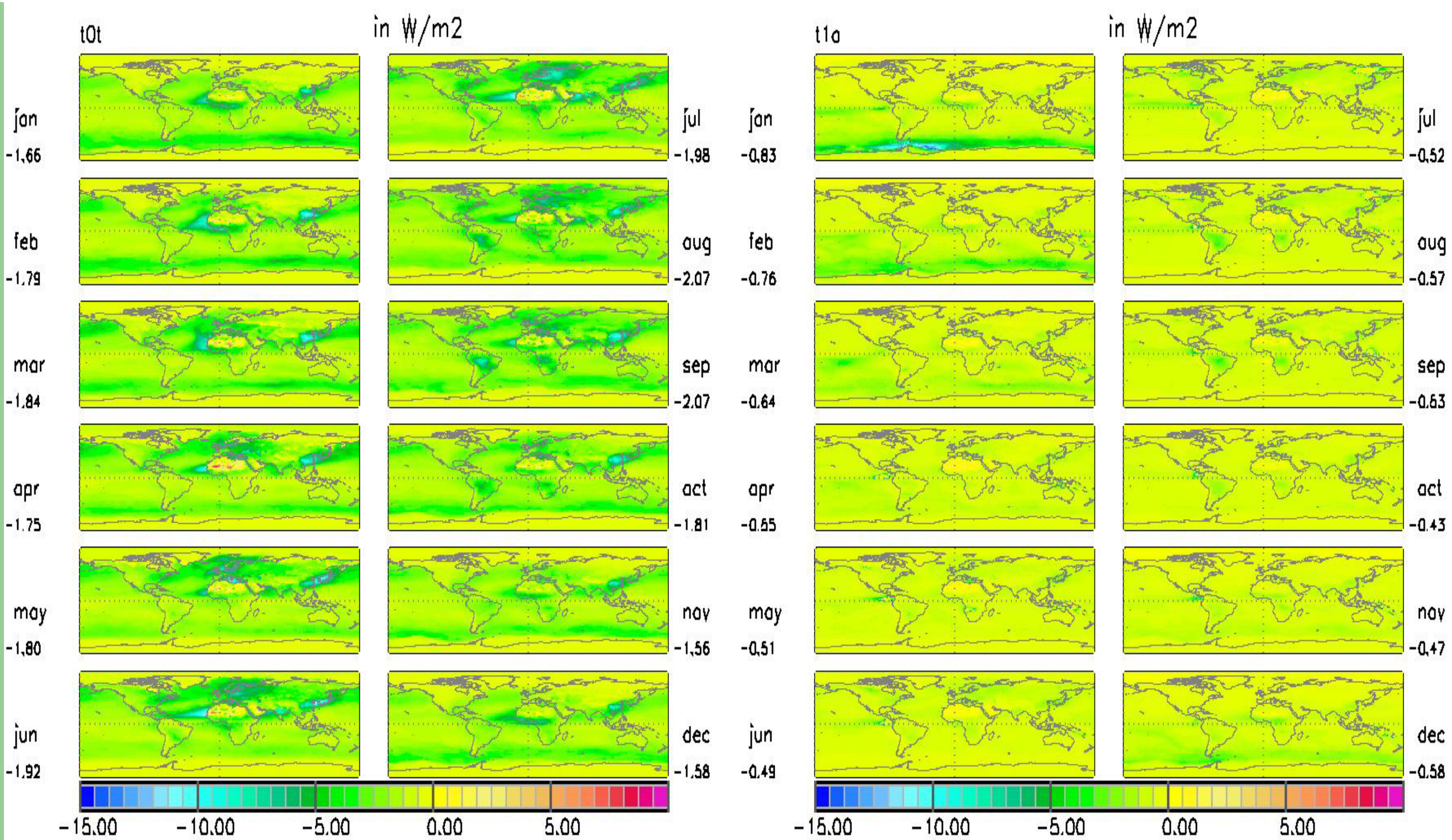


F ToA – *solar vs total*





F,s ToA – *clear-sky vs all-sky anthr.*



first impression

- relative tendencies of local studies confirmed
  - **ca. 70% of ToA cooling is anthropogenic**
  - **ca. 70% of clear-sky forcing is all-sky forcing**

    ⇨ the anthropogenic all-sky forcing is about half of the clear-sky forcing
  - **atmospheric forcing amounts to ca 30% of the ToA cooling (aerosol cools globally)**
  - **ca 35% of the solar forcing is anthropogenic**
  - **solar surface forcing is ca 60% larger than ToA forcing**

- absolute differences to data-derived estimates
  - **compare ToA clear-sky of -1.8W/m2 to -5.7W/m2 of CERES and to -5.1W/m2 at local AERONET sites**
  - **better agreement to estimates from modeling** (no surprise)

    ⇨ further tests/sensitivity studies should clarify these discrepancies

extras

climatology – AERONET support

- Model / (satellite- /) AERONET composites at 550nm
- AERONET Angstrom relationships
  - the asymmetry-factor, in the **UV**, **VIS**, **n-IR**
  - the aot **fraction f** in accu-mode [f=.19+.687*ln(An+1)]