Aerosol Radiative Forcing

The AeroCom Prescribed Experiment: Towards the Quantification of Host Model Errors

AeroCom Meeting, Princeton, USA

06/10/2009

Philip Stier

Atmospheric, Oceanic and Planetary Physics

University of Oxford

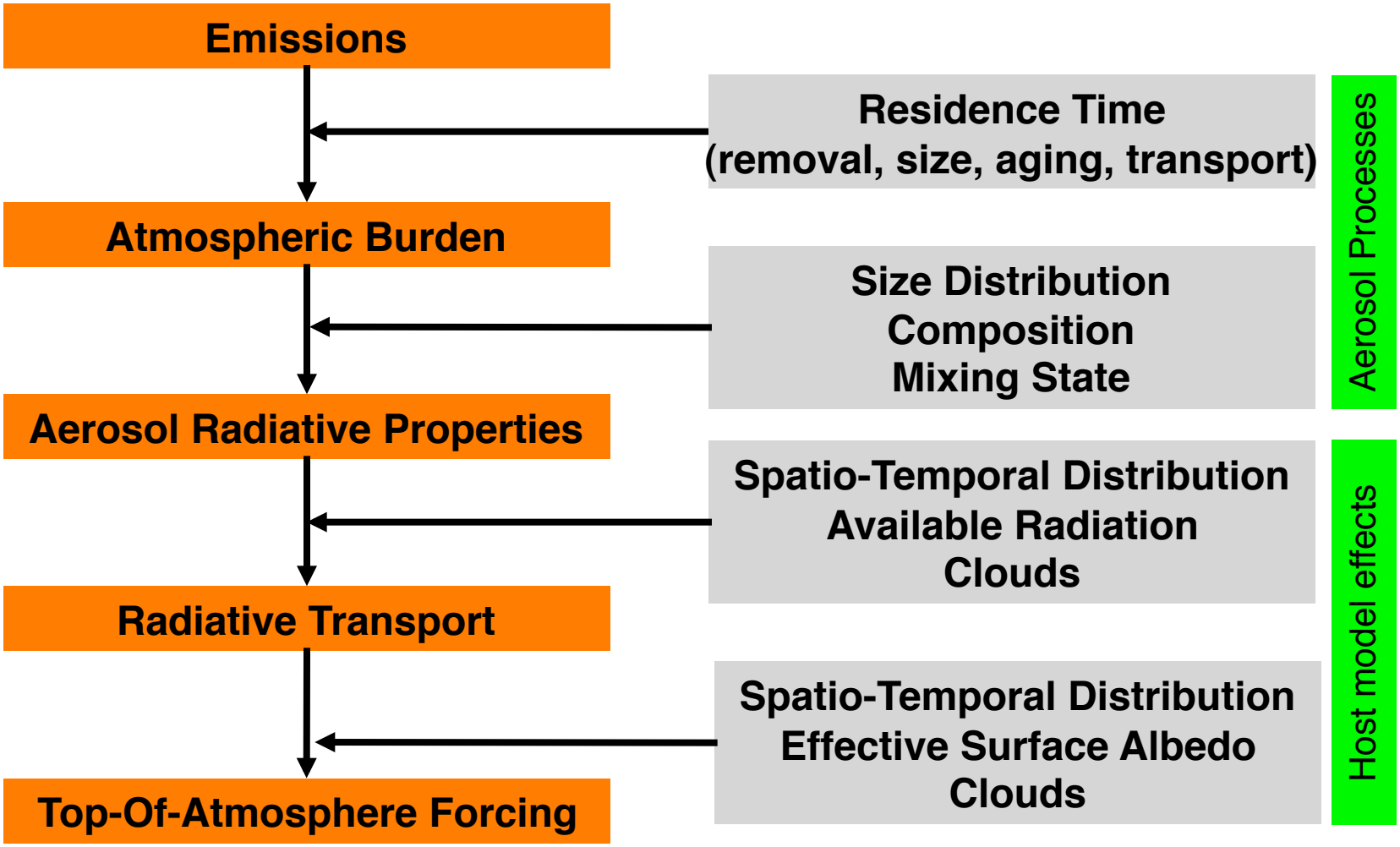
Stefan Kinne, Nicolas Bellouin, Michael Schulz, Gunnar Myhre, John Seinfeld

DEPARTMENT OF PHYSICS

UNIVERSITY OF OXFORD

Assessment of aerosol direct radiative forcing

AeroCom: Intercomparison and assessment of the underlying process representations



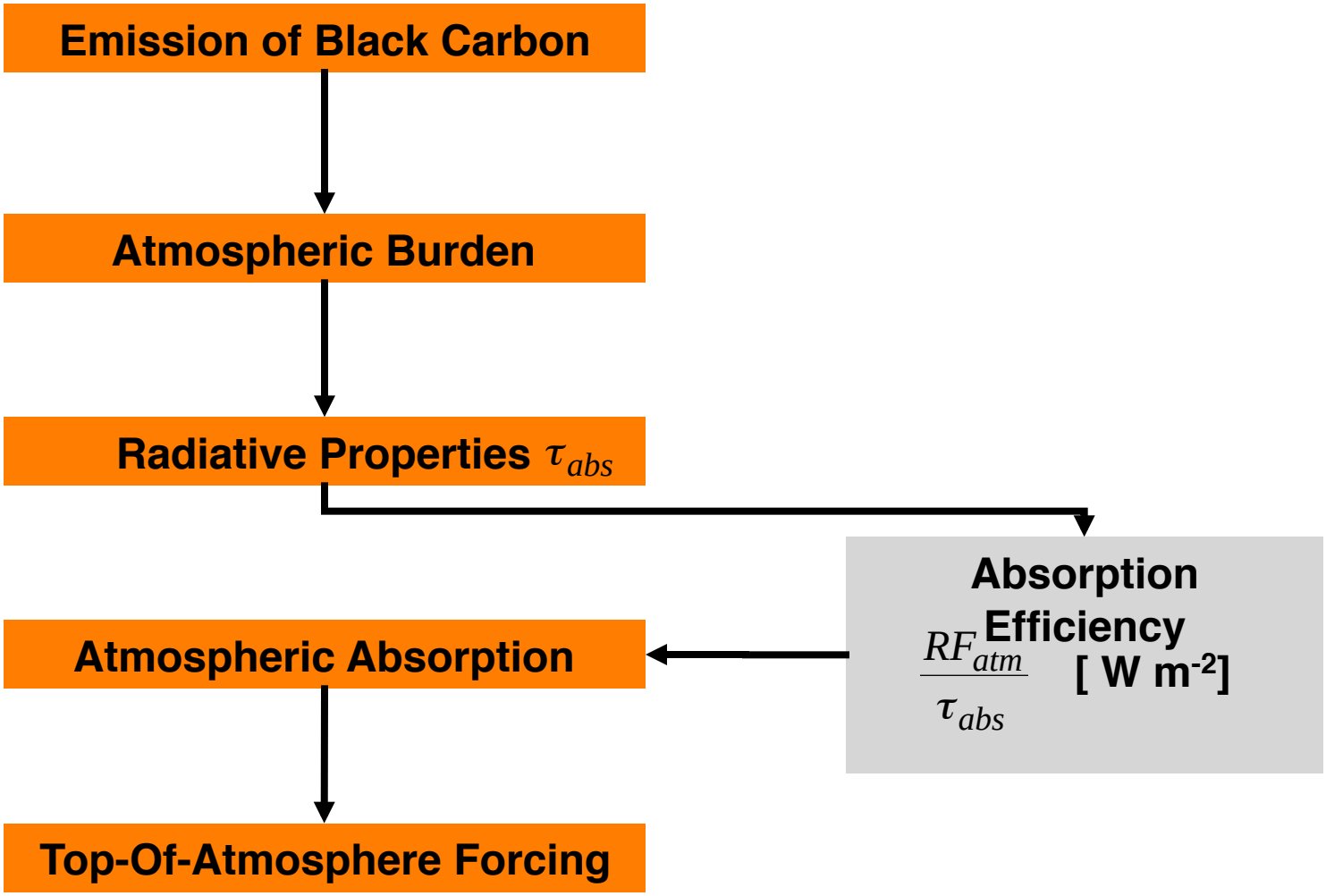
AeroCom Radiative Forcing

UNIVERSITY OF OXFORD

Assessment of aerosol direct radiative forcing

Analysis of AeroCom forcing experiment:

Large diversity in absorption efficiency from aerosol radiative properties:



Aerosol Processes

Host model effects

AeroCom Radiative Forcing

UNIVERSITY OF OXFORD

Analysis of AeroCom Forcing Experiment

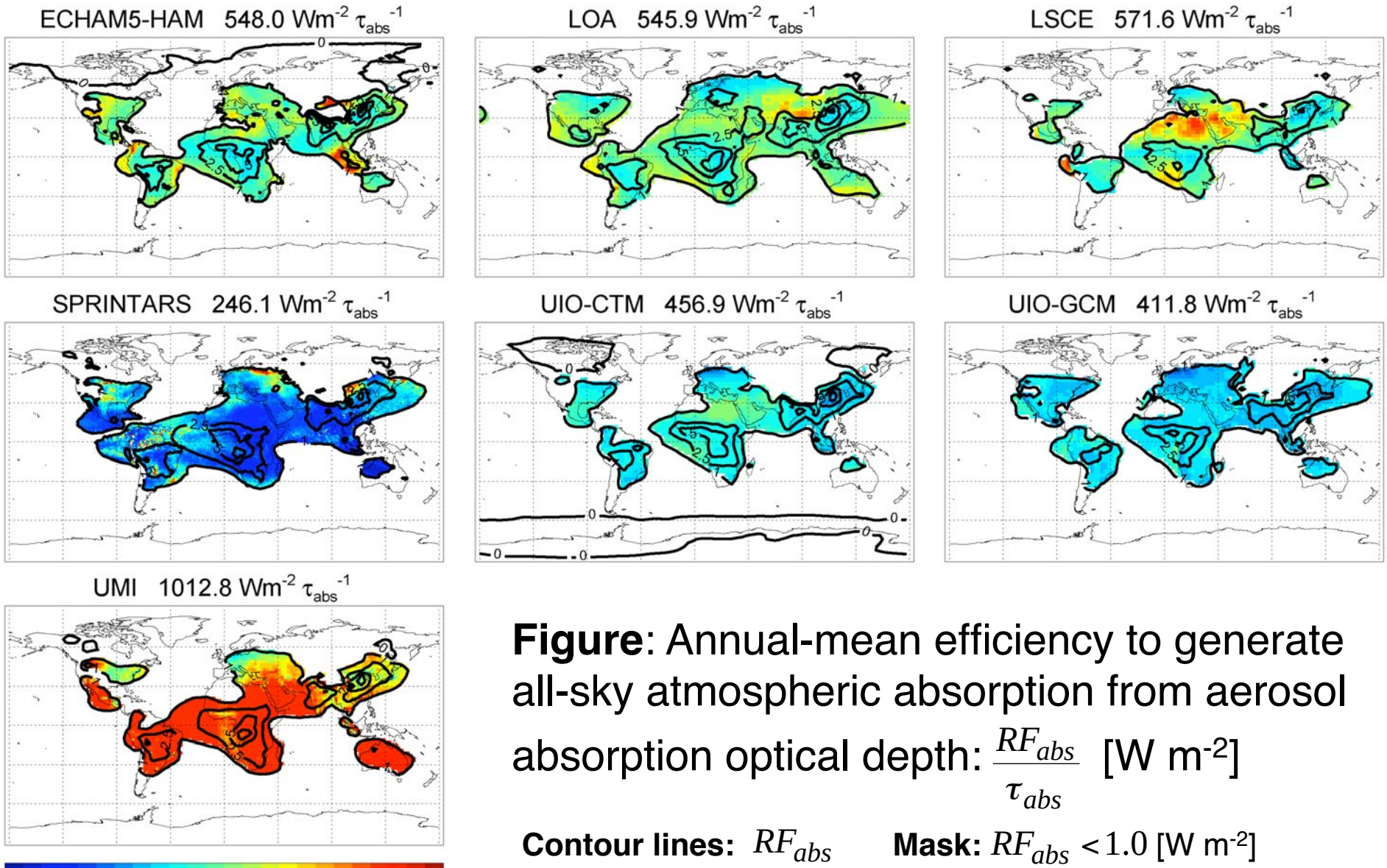
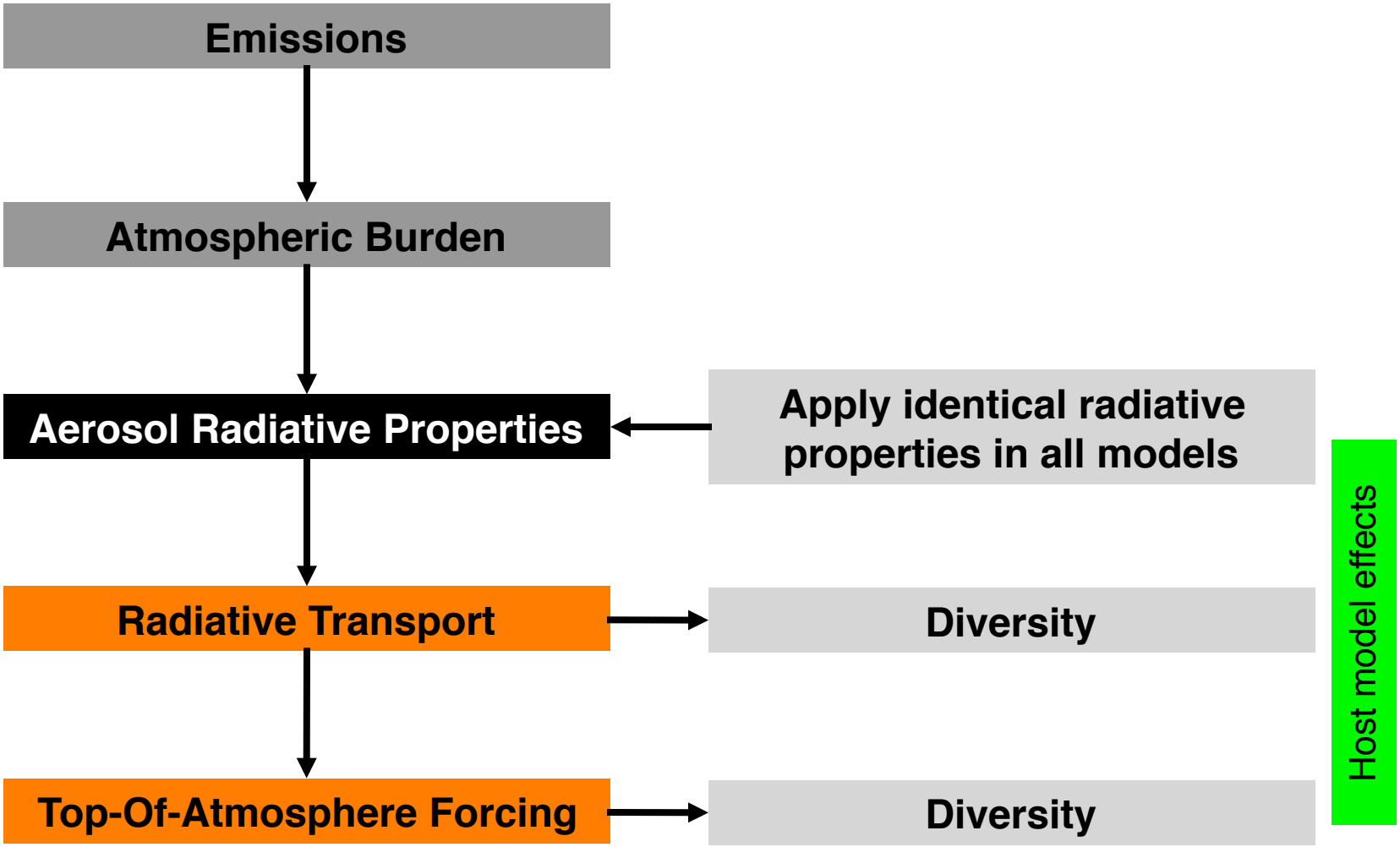


Figure: Annual-mean efficiency to generate all-sky atmospheric absorption from aerosol absorption optical depth: $\frac{RF_{abs}}{\tau_{abs}}$ [W m^{-2}]

Contour lines: RF_{abs} **Mask:** $RF_{abs} < 1.0$ [W m^{-2}]

The AeroCom Prescribed Experiment

Facilitate inter-comparability through fixing 3D aerosol radiative properties



AeroCom Prescribed

UNIVERSITY OF OXFORD

AeroCom Prescribed - Set-up

Prescribe aerosol radiative properties identically in all **"models"**:

- Extinction, Single Scattering Albedo, Asymmetry Factor:

  - 3D distributions

  - 24 SW wavelengths

  - "fool proof" offline mapping tools to model resolution and radiation bands

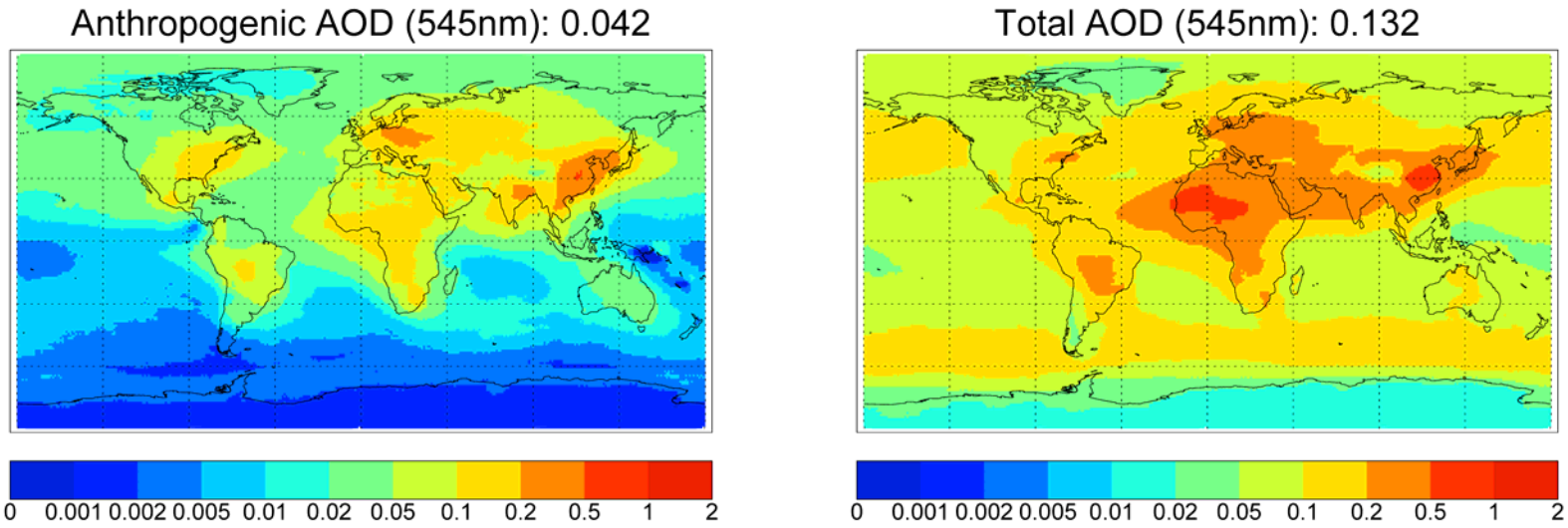


Figure: Annual-mean anthropogenic and total aerosol optical depth at 550 nm derived from AeroCom median model and AERONET.

AeroCom Prescribed - First results

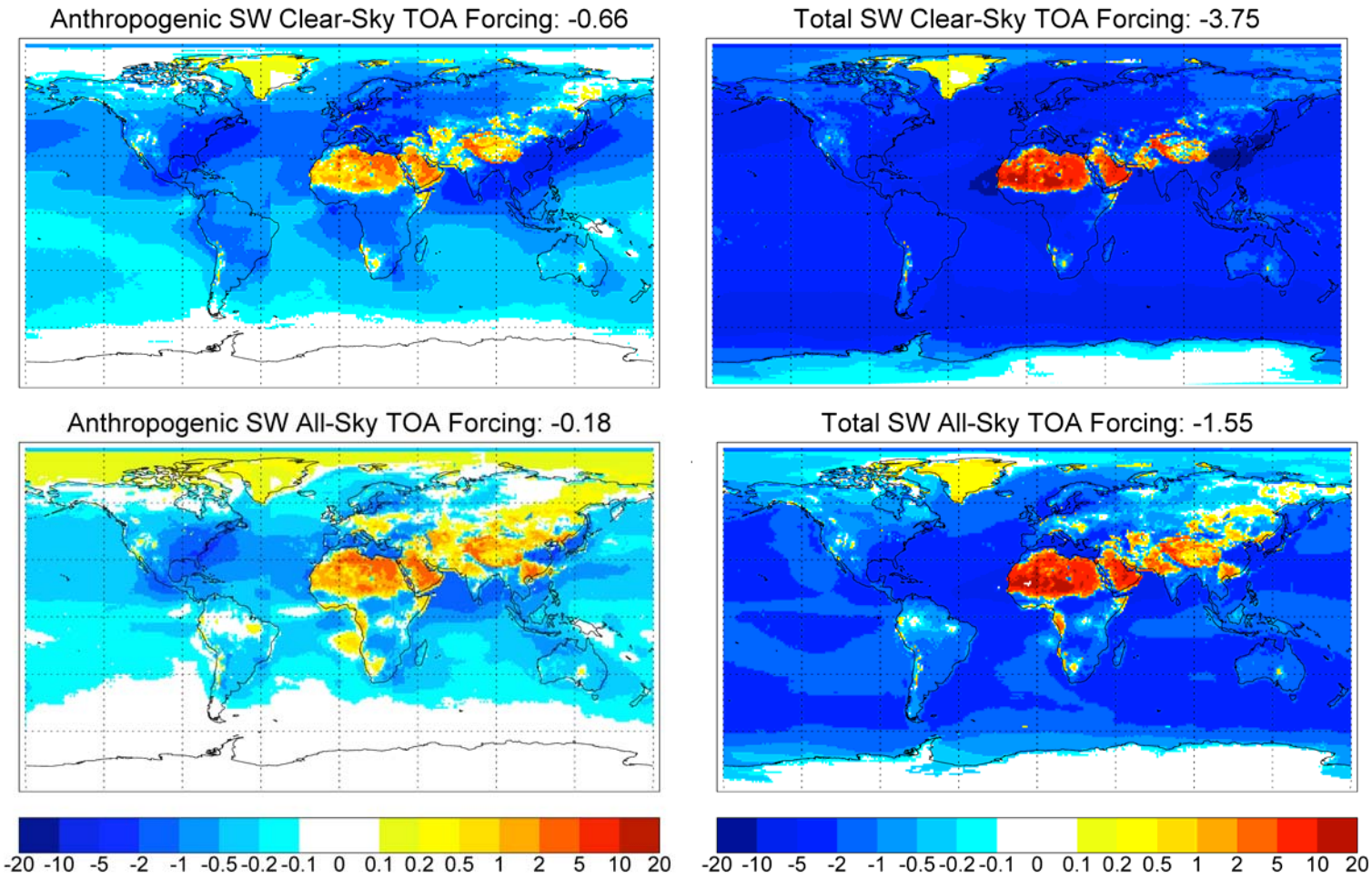
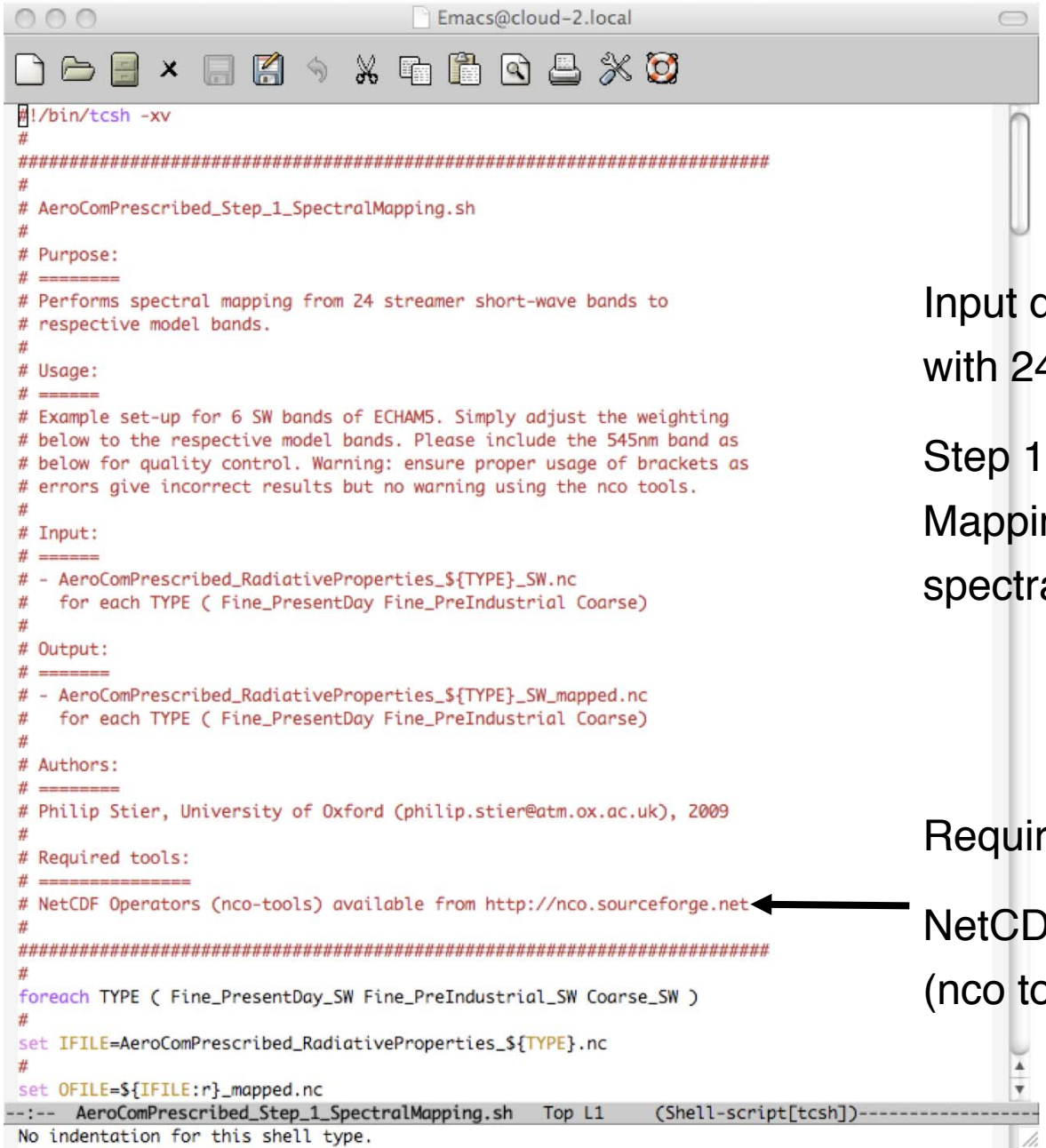


Figure: Annual-mean top-of-atmosphere anthropogenic and total aerosol direct aerosol radiative forcing [Wm^{-2}]. Offline model calculation by Stefan Kinne from the AeroCom Prescribed aerosol radiative properties.

Input Data Set-up - Step 1 out of 3



Input data on 2D 1x1 degree with 24 spectral bands

Step 1:
Mapping to model specific spectral bands.

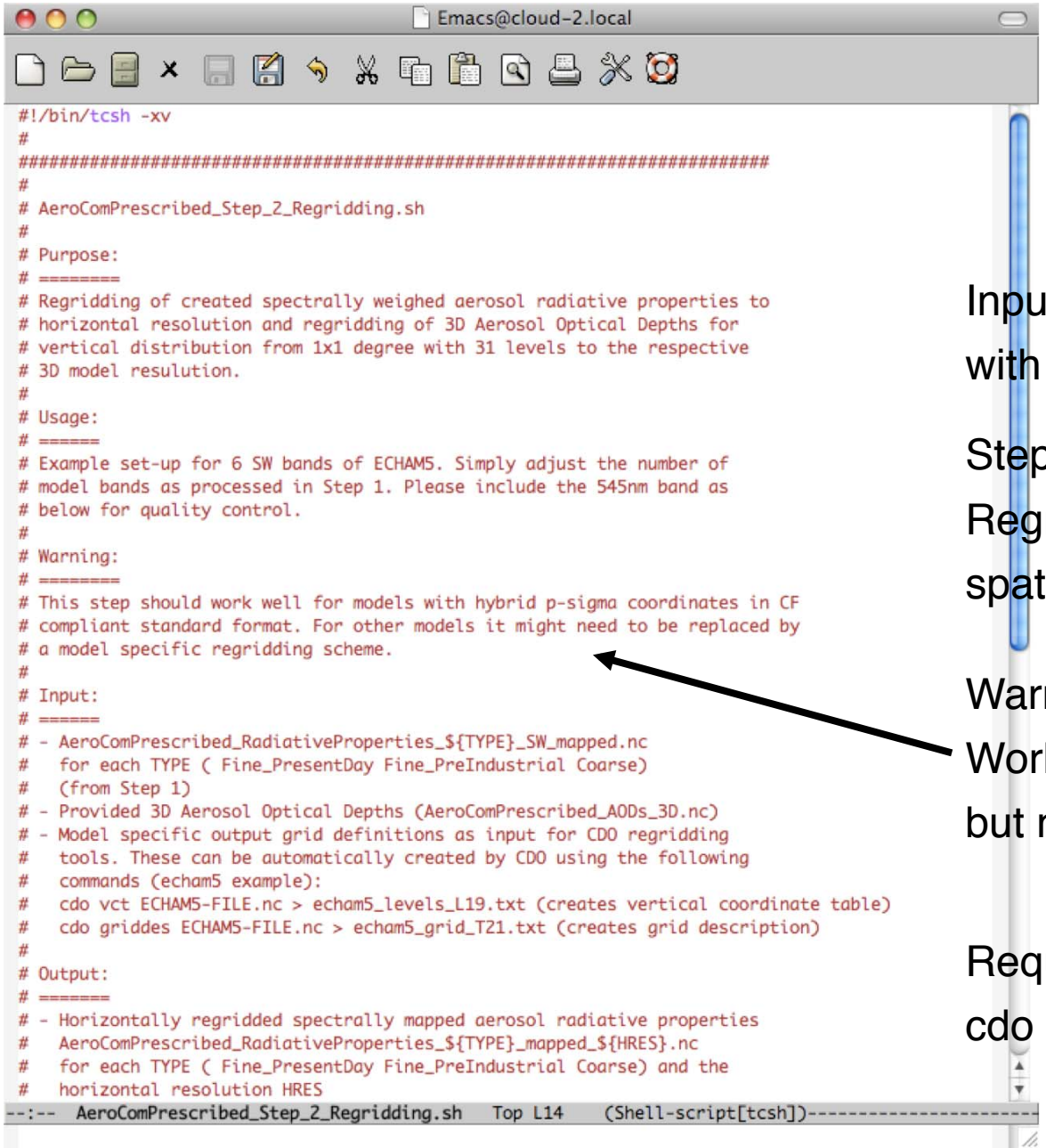
Required:

NetCDF operators (nco tools)

AeroCom Prescribed

UNIVERSITY OF OXFORD

Input Data Set-up - Step 2 out of 3



Input data on 2D 1x1 degree with 24 spectral bands

Step 2:
Regridding to respective spatial model resolution.

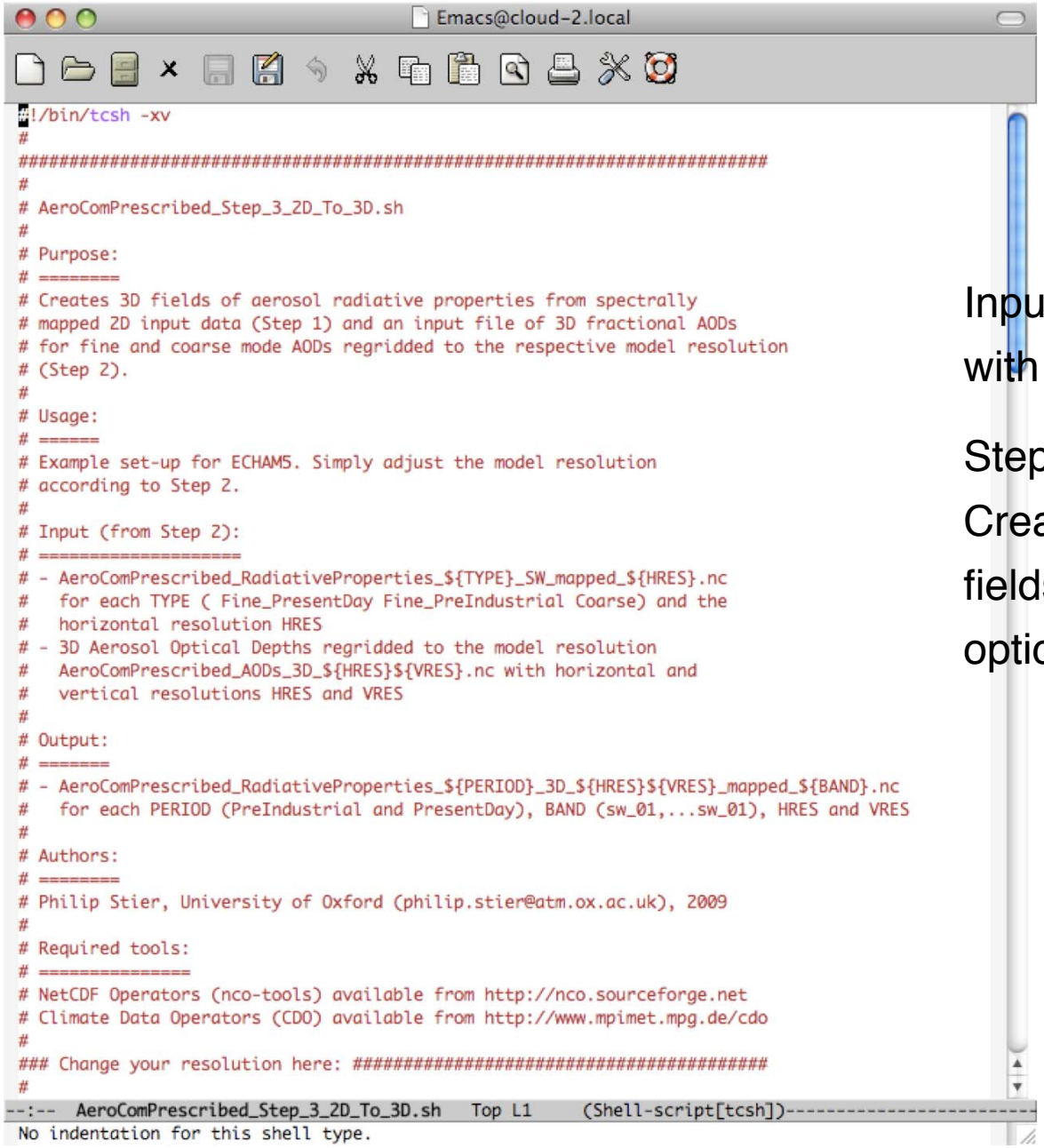
Warning:
Works with hybrid p-sigma but not all grids

Required:
cdo climate data operators

AeroCom Prescribed

UNIVERSITY OF OXFORD

Input Data Set-up - Step 3 out of 3



Input data on 2D 1x1 degree with 24 spectral bands

Step 3:

Creation of 3D files from 2D fields using 3D fractional optical depth input file.

AeroCom Prescribed

UNIVERSITY OF OXFORD

Diagnostics

Incorporated in AeroCom Protocol

Aerosols

- 3D aerosol radiative properties as implemented (545nm for quality control)
- Separate diagnostics for in-cloud and clear-sky radiative properties

Clouds

- 3D fractional cloud cover
- 3D cloud optical depth

Link to data and scripts on:

- http://wiki.esipfed.org/index.php/AeroCom_Prescribed

AeroCom Prescribed

UNIVERSITY OF OXFORD