

ATS 421/521

Climate Modeling

Spring 2015

Mid-Term Review

April 29, 2015

Lecture 2

- Components of the Climate System
- Energy and Element Cycles
- Conservation Principles
- Earth's Energy Balance
- 0D-EBM
- Greenhouse Effect
- Ice-Albedo Feedback
- Hansen et al. (1981)

Lectures 3 & 4

- Radiative Forcing
- Feedbacks
- Climate Sensitivity

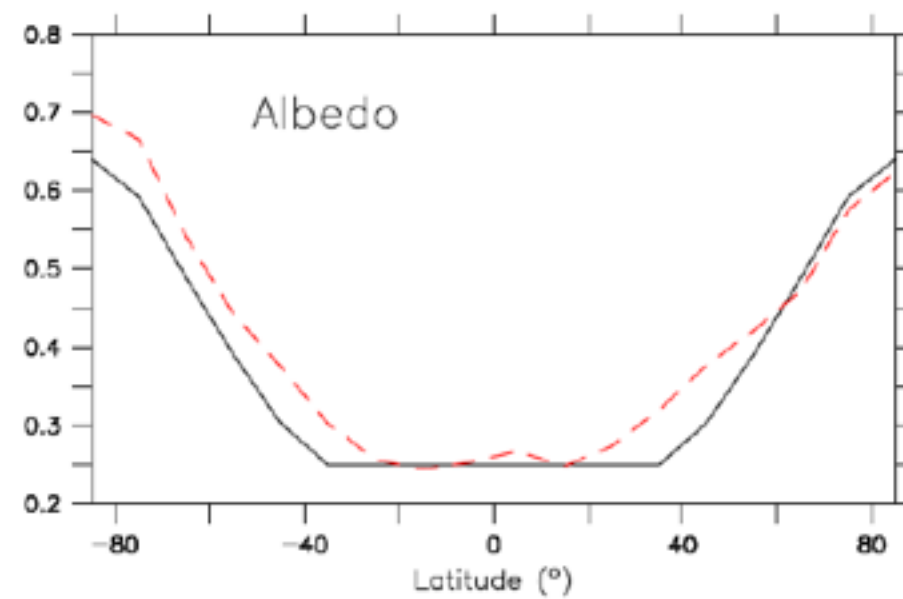
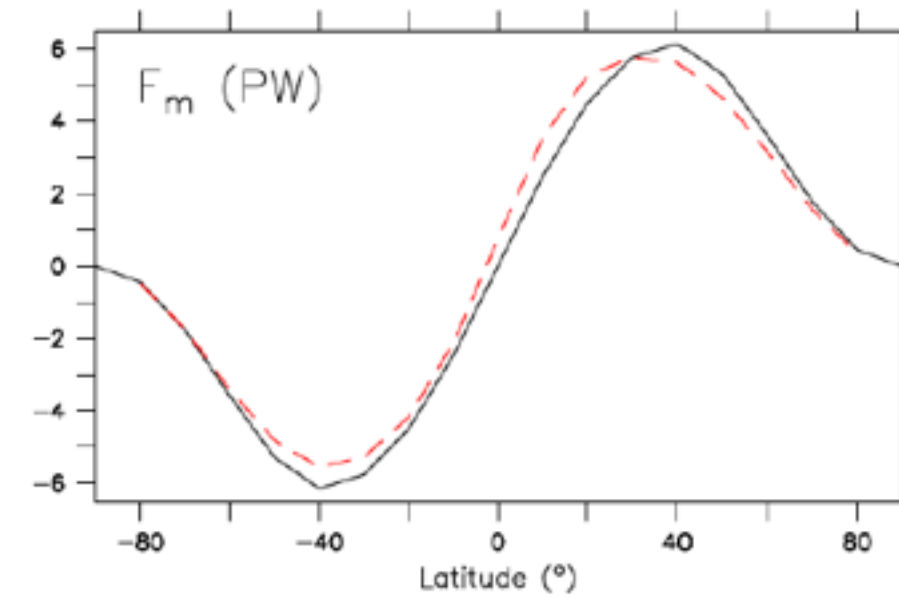
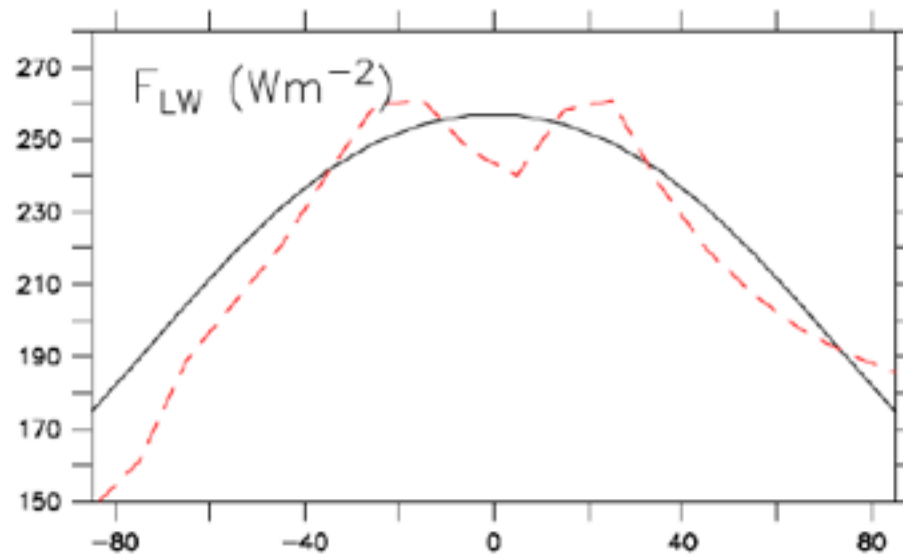
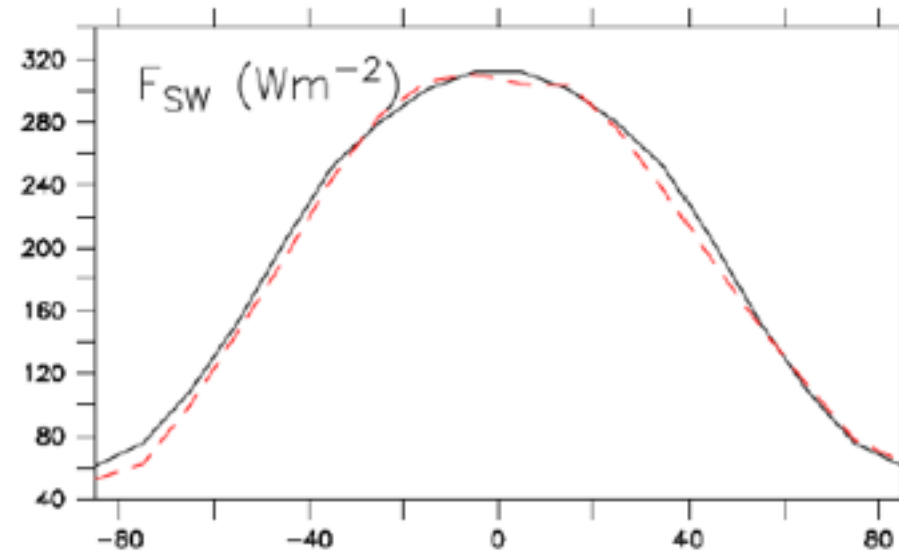
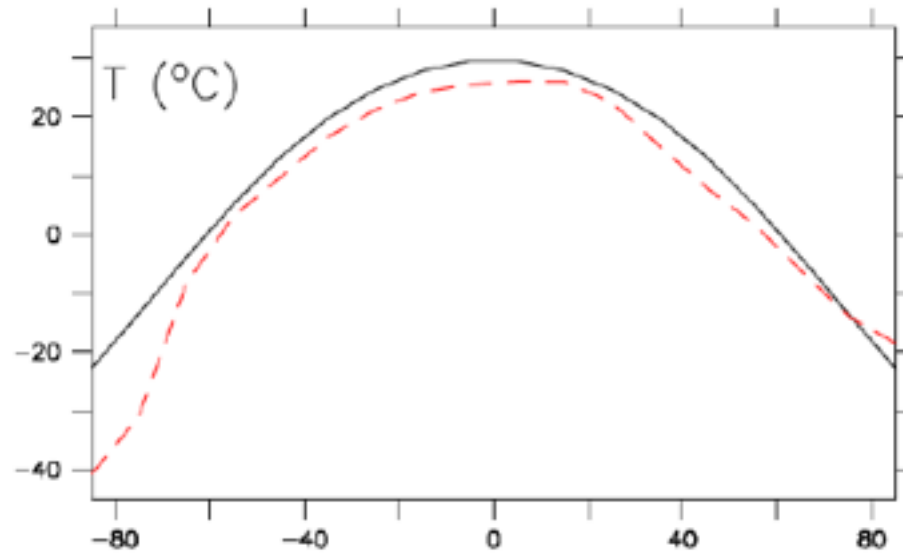
Lecture 5

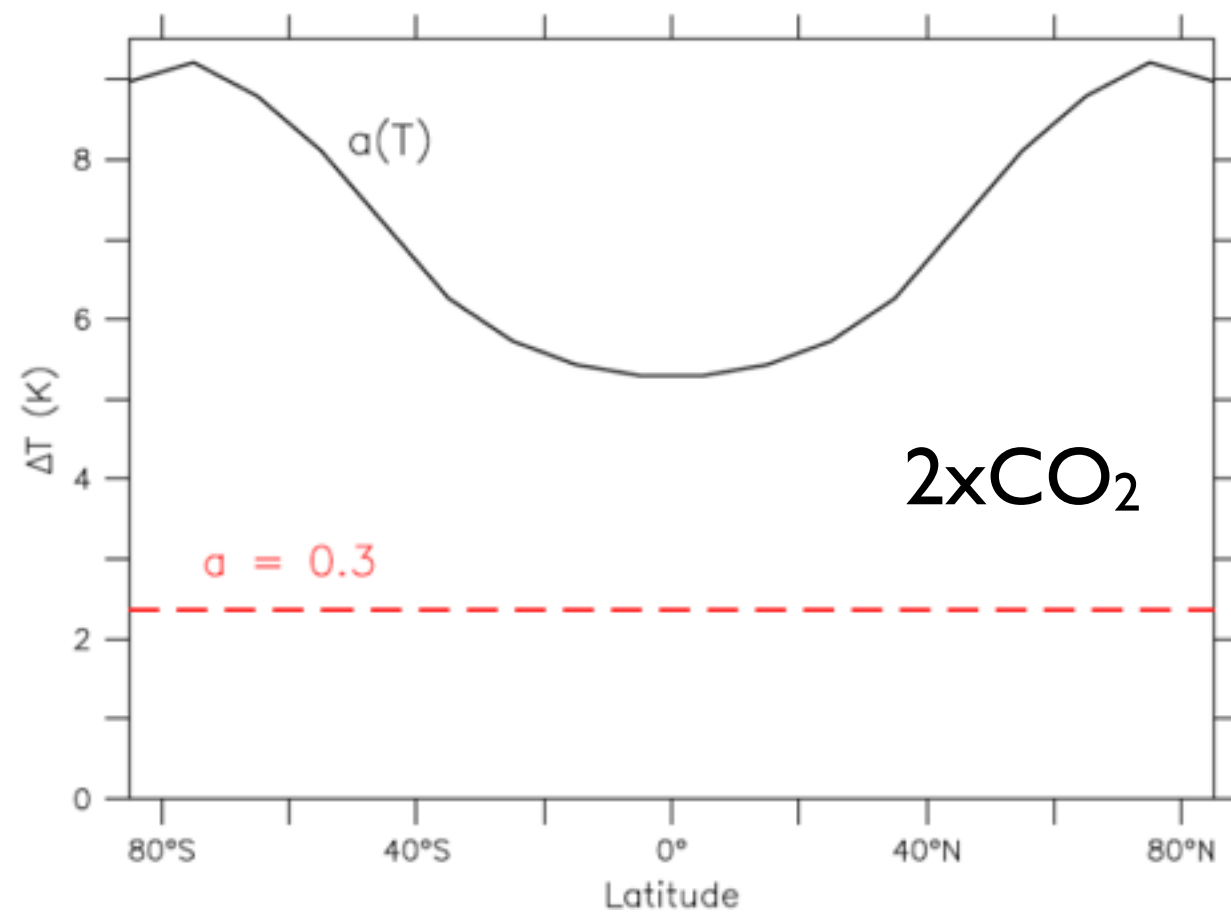
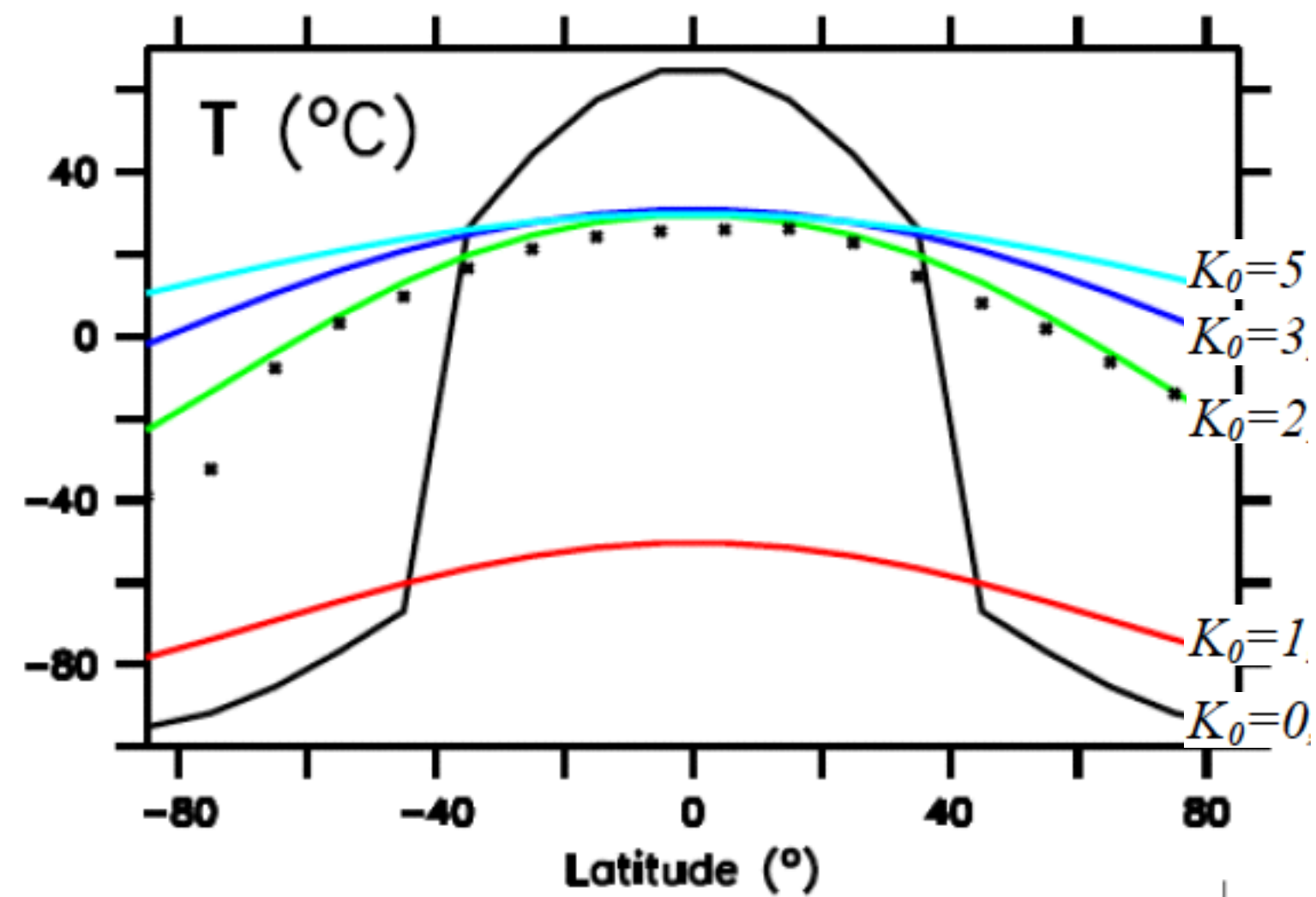
- Stochastic Climate Models
- Spectra
- Huybers and Curry (2006)

Lecture 6

- Meridional Energy Transport
- 1D-EBM

HW3



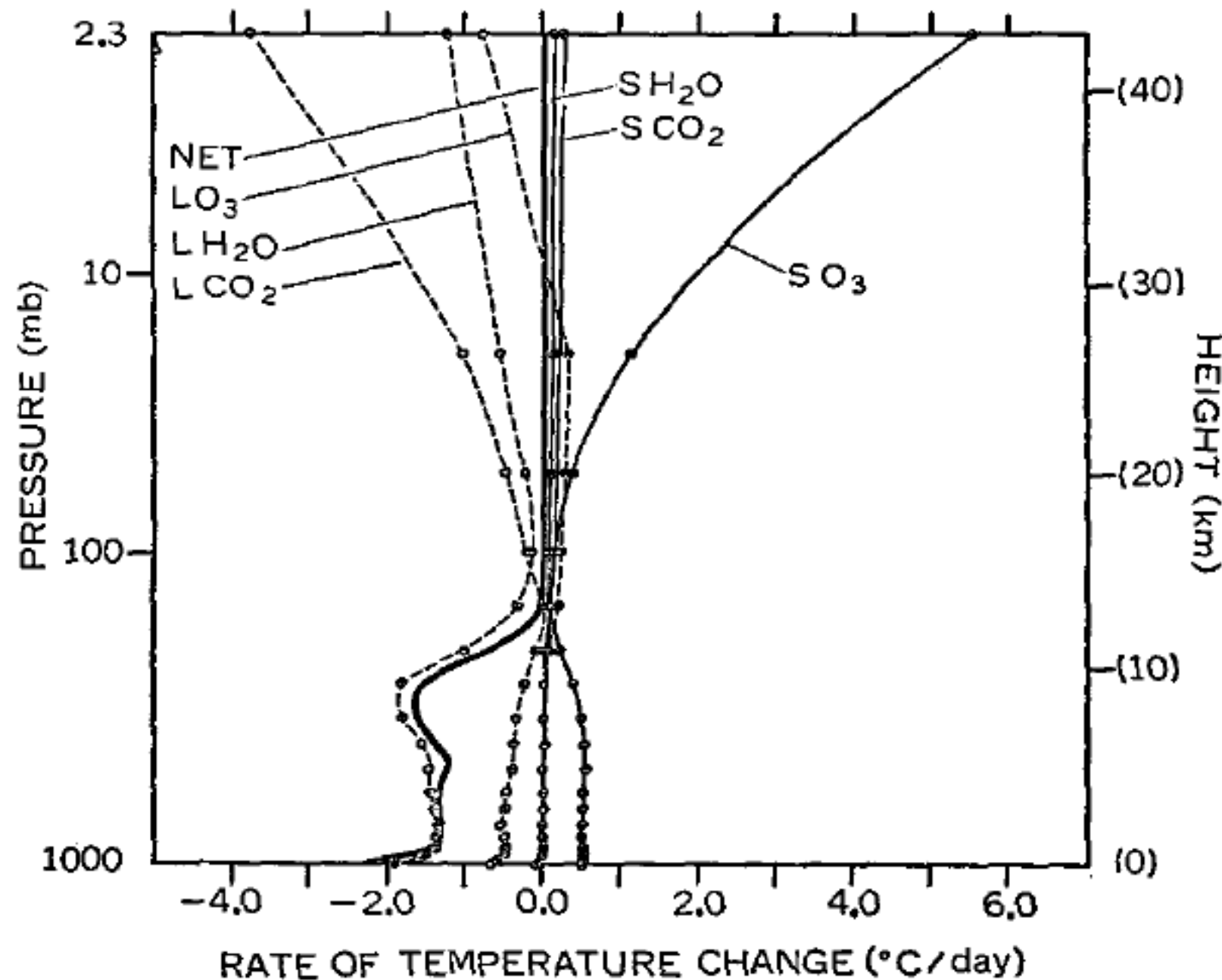


Lecture 7

- Numerics
- Boundary Conditions
- Initial Conditions
- Convergence
- Accuracy (von Neuman Stability Analysis)
- Advection Equation:
 - FTCS
 - Upwind
 - Leapfrog
 - CFL Criterion
- Diffusion Equation

Lecture 8

- Radiative Convective Models
- Vertical Temperature Structure in Atmosphere
- Effects of H₂O, CO₂, O₃
- Effects of Clouds
- Manabe and Strickler (1964)
- Pierrehumbert (2011)



Ozone absorbs sunlight in stratosphere, which leads to warming.

Stratosphere is cooled mainly by long wave radiation due to CO₂.

Long wave radiation by H₂O and CO₂ cool the troposphere.

Convective fluxes heat the troposphere by transporting heat from the ground upwards.