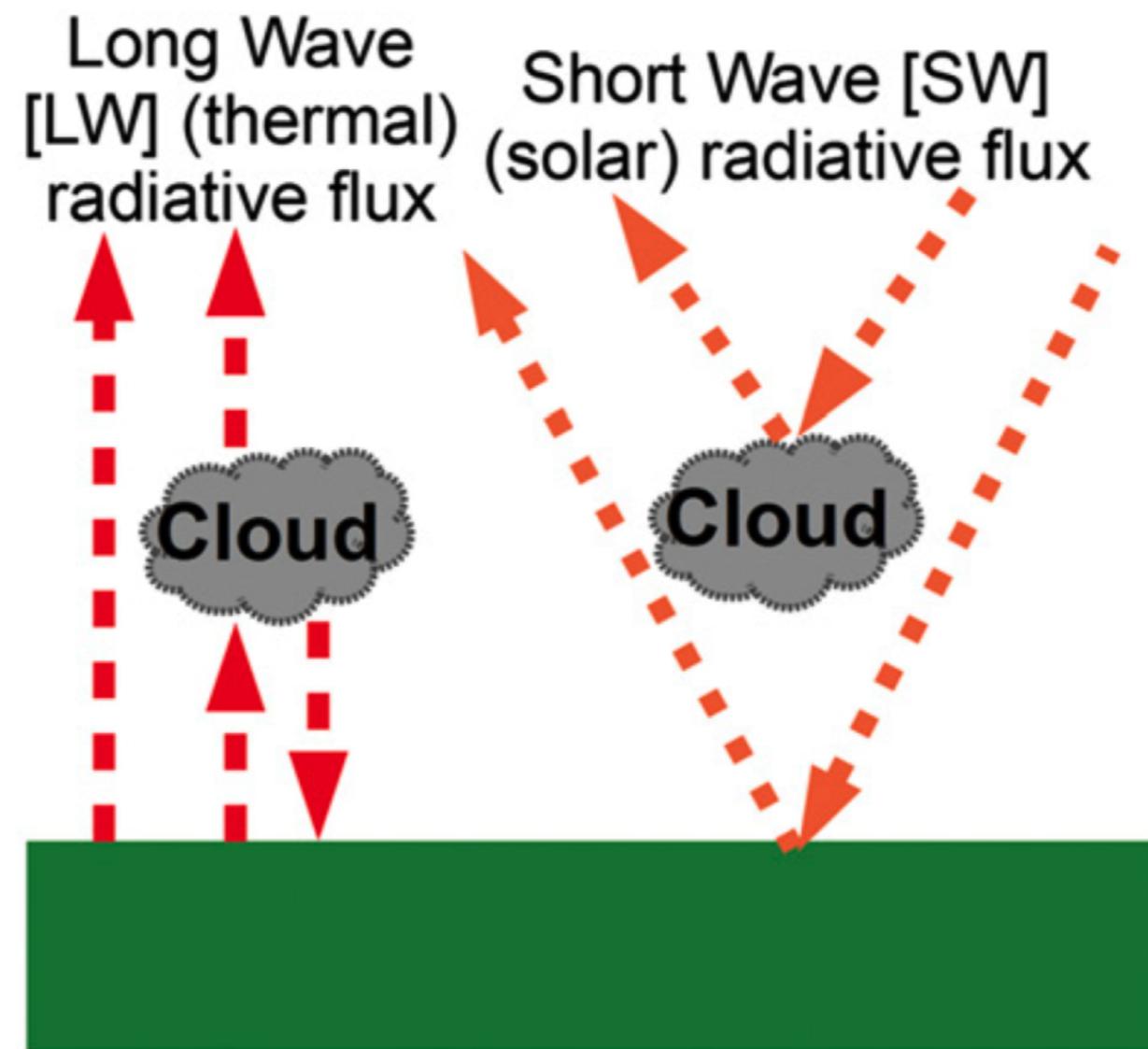




Global Warming
Lecture 4.6
Cloud Feedbacks

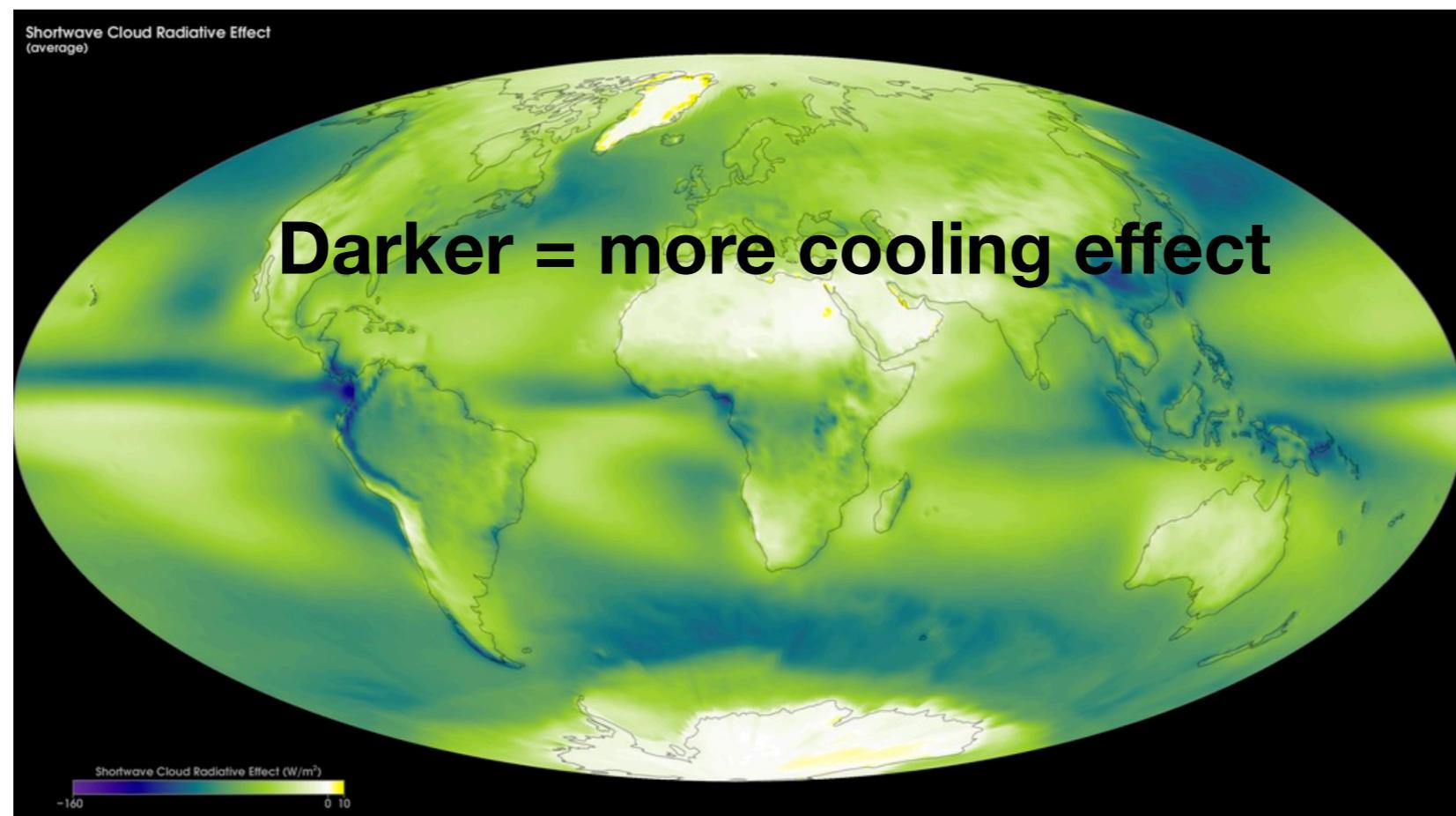
Overview

Incoming & Outgoing radiative fluxes



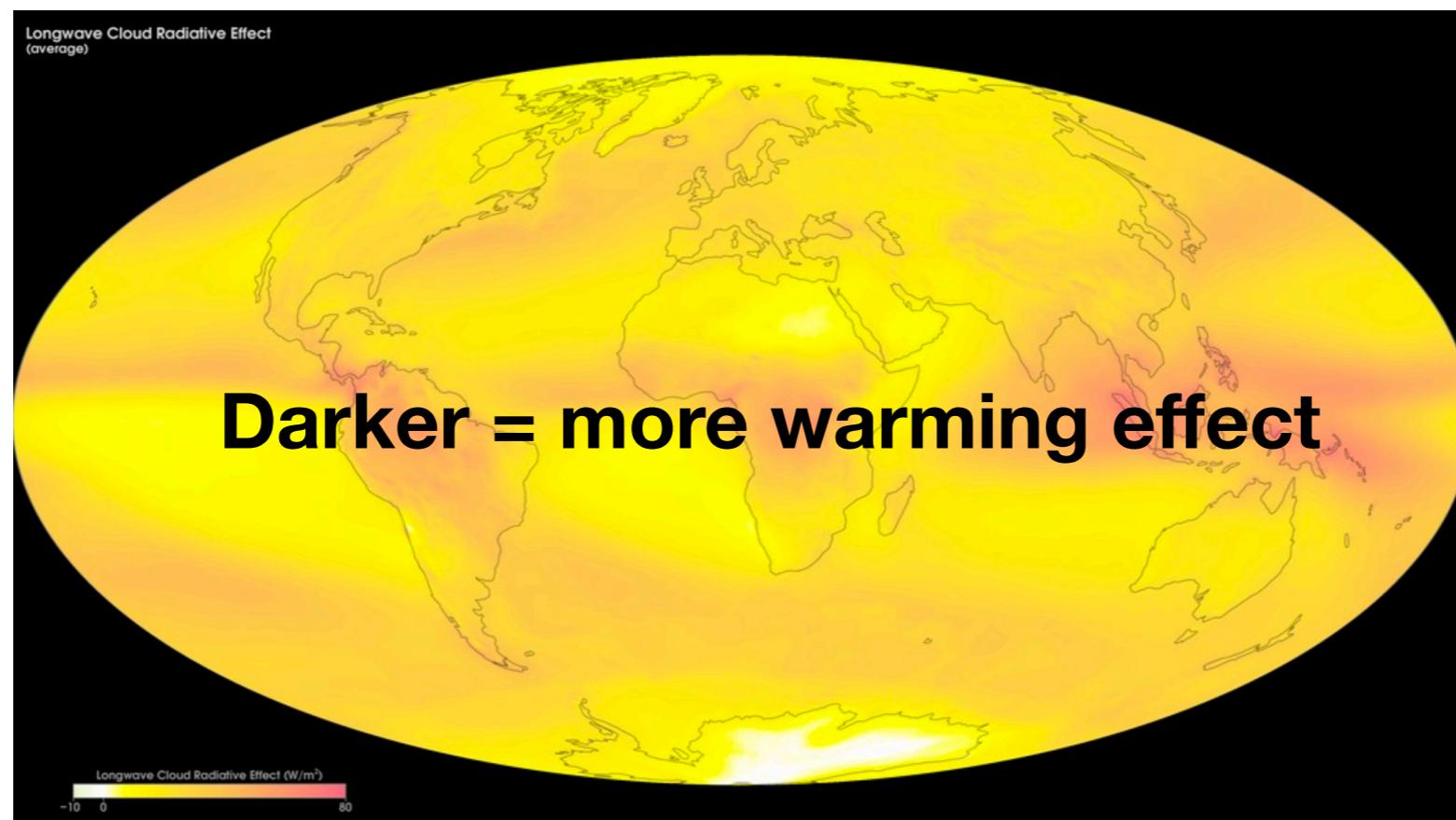
Shortwave cloud radiative effect (SW CRE)

- Difference in shortwave radiative flux at the top of the atmosphere when clouds are present vs. when they are not
- Usually negative: Helps cool the Earth because makes it more reflective
- Low and High Clouds can have a strong shortwave CRE.

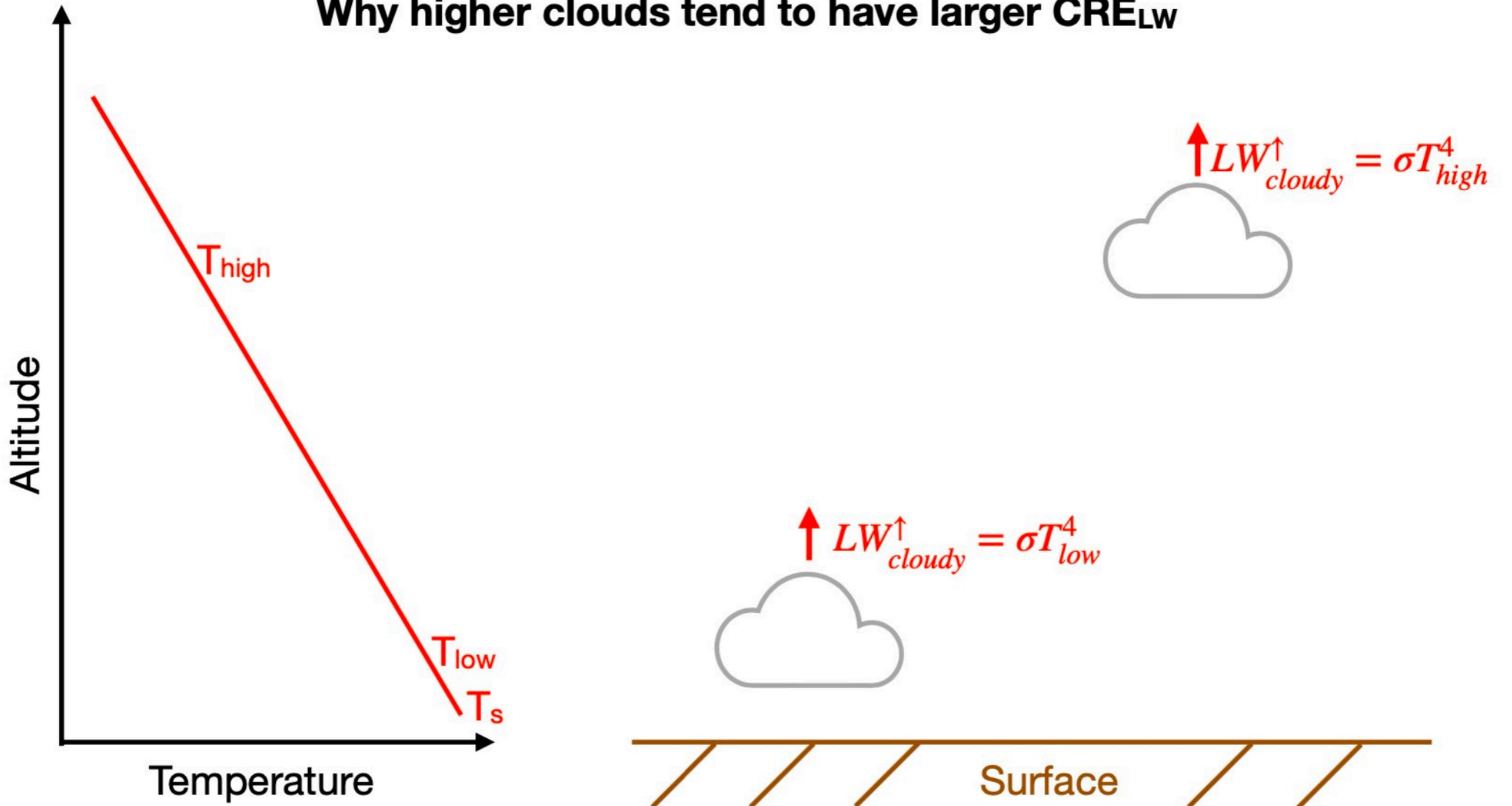


Longwave cloud radiative effect (LW CRE)

- Difference in longwave radiative flux at the top of the atmosphere when clouds are present vs. when they are not
- Usually positive: Warms the Earth because heat is trapped and reemitted at cooler temperature
- Only High Clouds can have a strong longwave CRE (emitting at low T because high up)

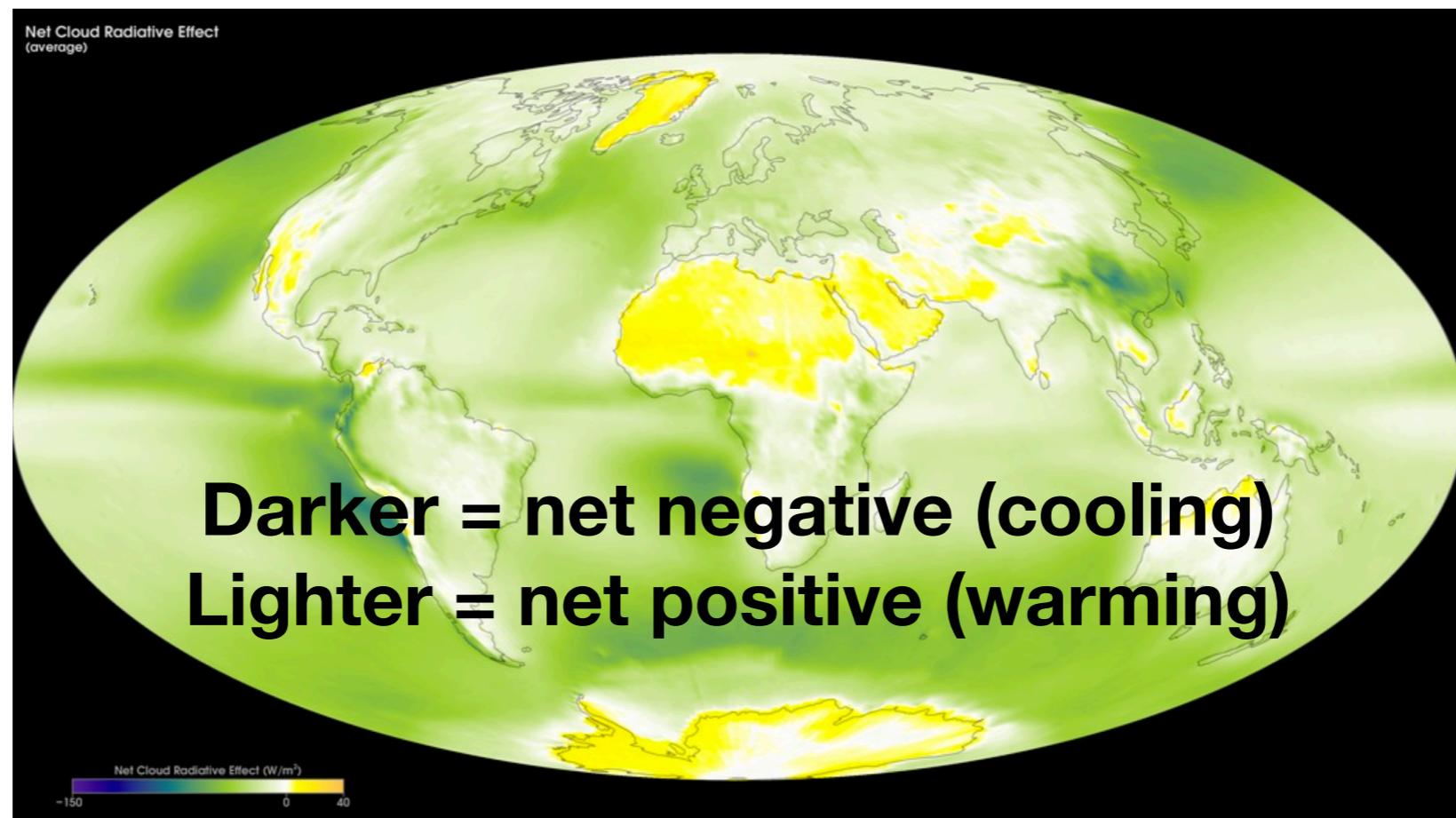


Why higher clouds tend to have larger CRE_{LW}



Net cloud radiative effect (Net CRE)

- Sum of the shortwave and longwave CREs
- Depending on geographic location, the net CRE can be either positive or negative.
- The global average net CRE is negative, so clouds help cool the Earth overall.

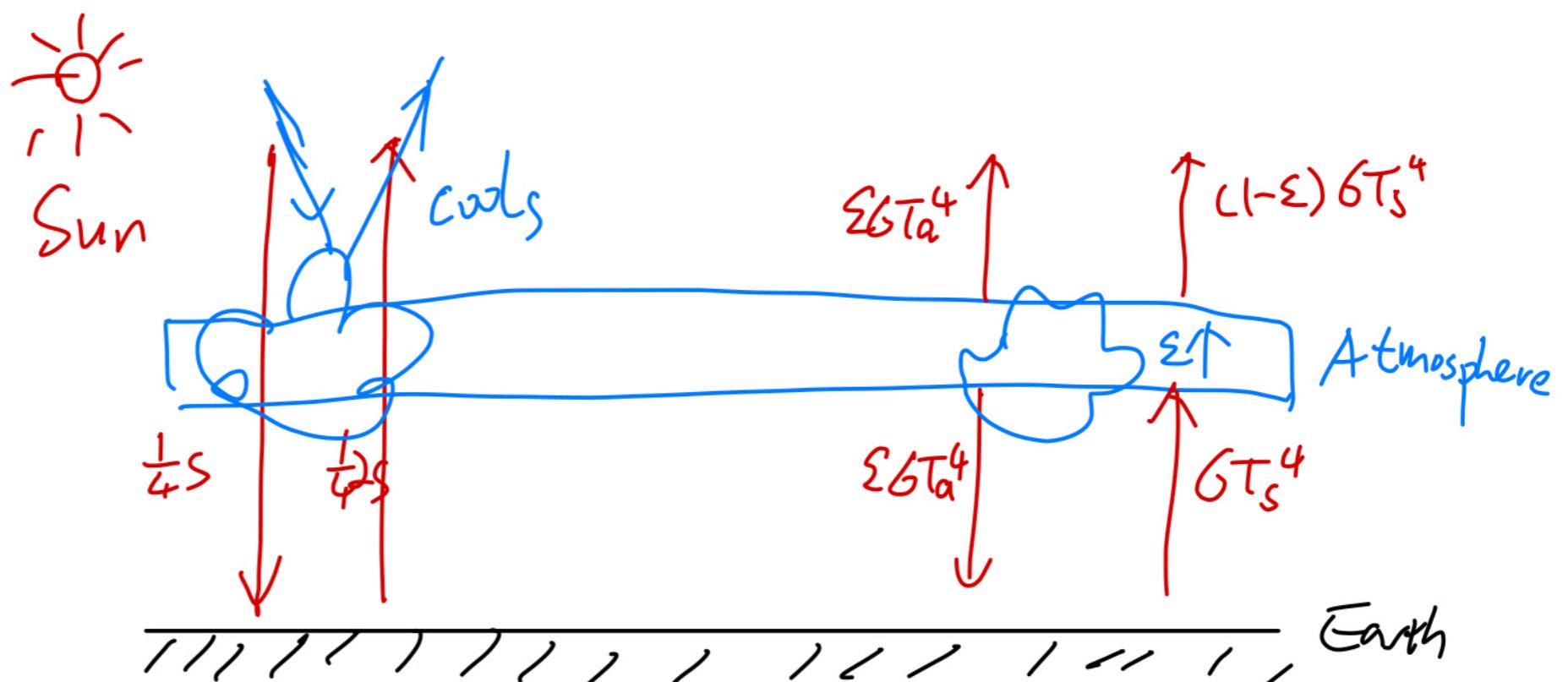


**High clouds: longwave cloud
radiative effect dominates,
increasing T (positive)**

**Low clouds: shortwave cloud
radiative effect dominates,
decreasing T (negative)**

**Net radiative effect: either
positive or negative locally,
global-mean is negative**

Notes on board:



SW CRE: negative

LW CRE : positive.

Net CRE = SW + LW: different in regions, net is negative

