SAG 4 – the science
Short update

= Science questions

= team members

= open questions

Lisa Kaltenegger, MPIA/CfA

ExoPAG, June 2 2011

Signs Of Life On An Earth-like Planet

Ozone
Oxygen
& Methane (or other reducing gas) — Biomarker

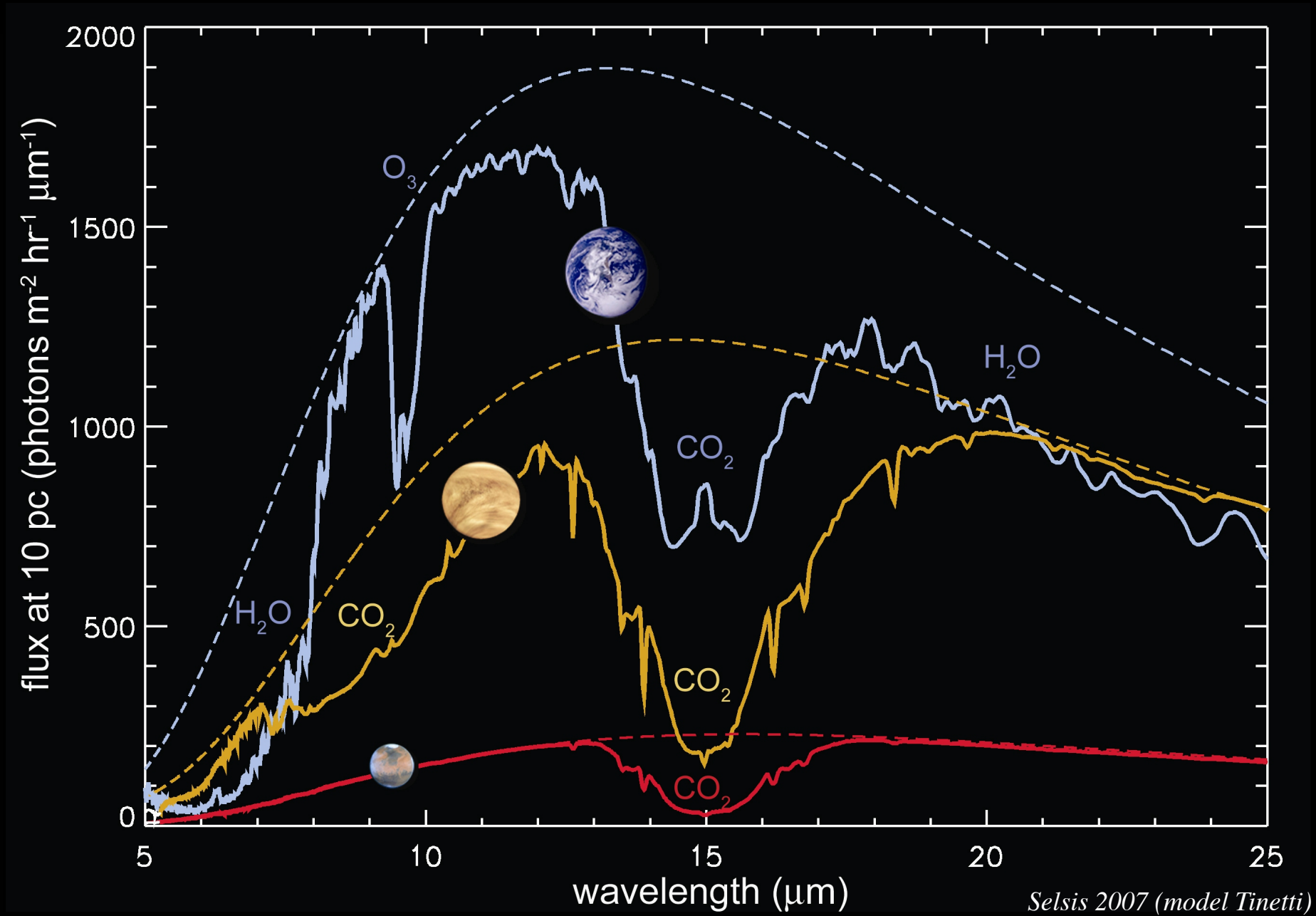
Nitrous oxide

Water makes Oxygen – WITHOUT life — Bio-indicators

Carbon dioxide - greenhouse & HZ extend

Surface/Vegetation – good enough SNR per 1/20 of planet's rotation to detect surface feature

Features: 1) observables & 2) unique ?



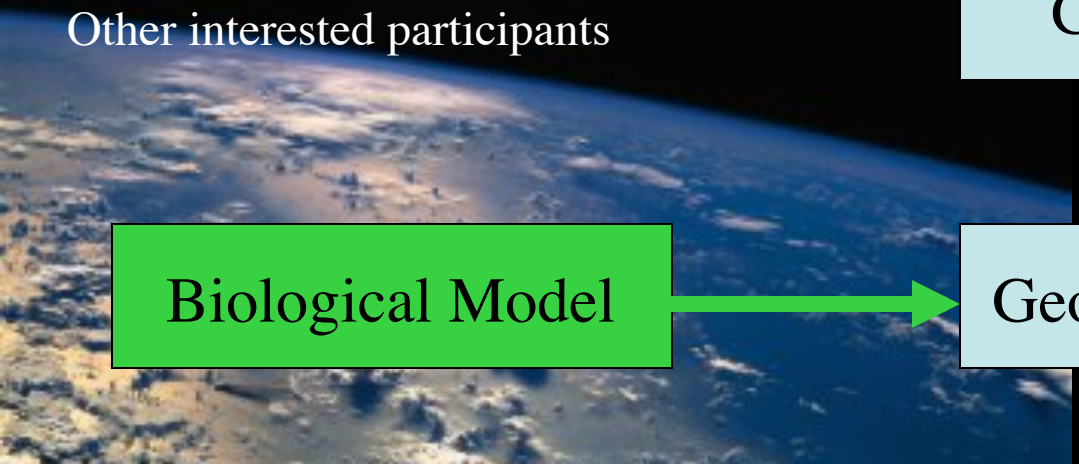
Selsis 2007 (model Tinetti)

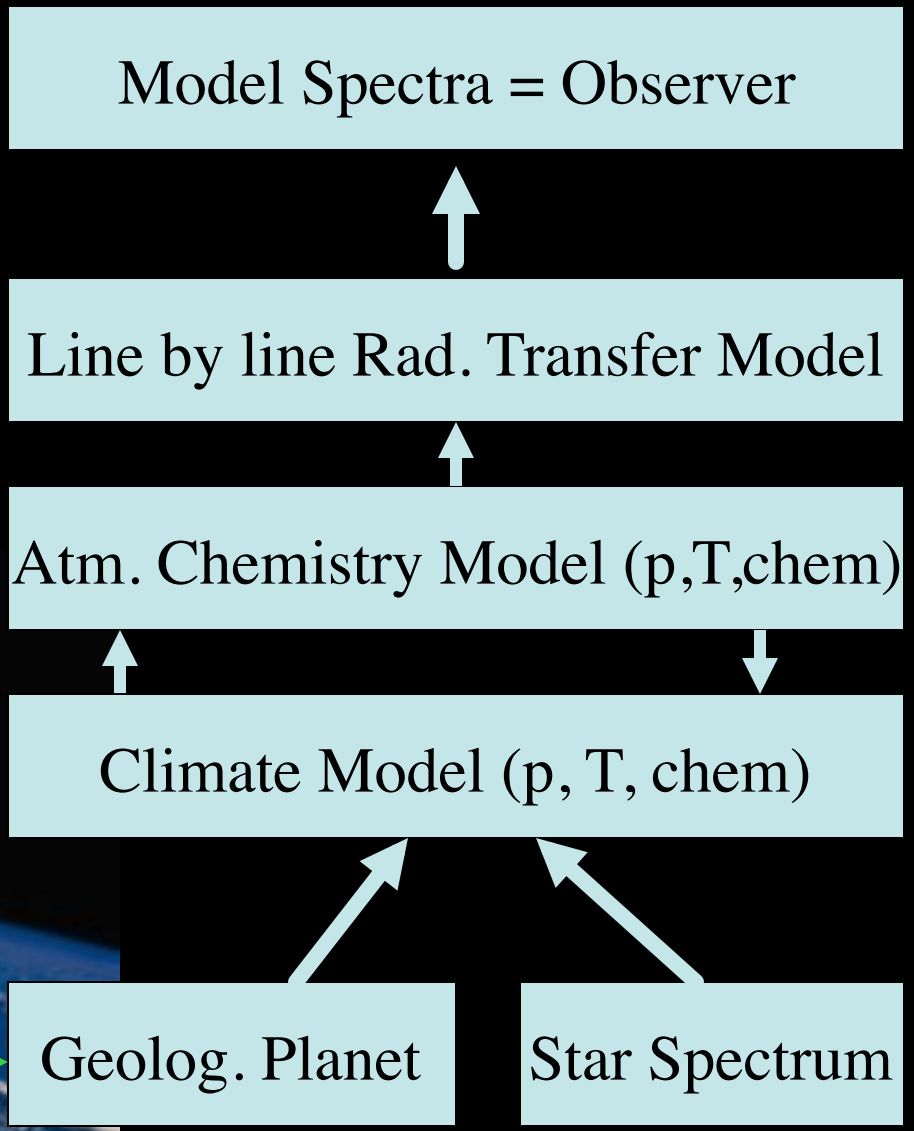
Characterize Rocky Planets = Atmospheres

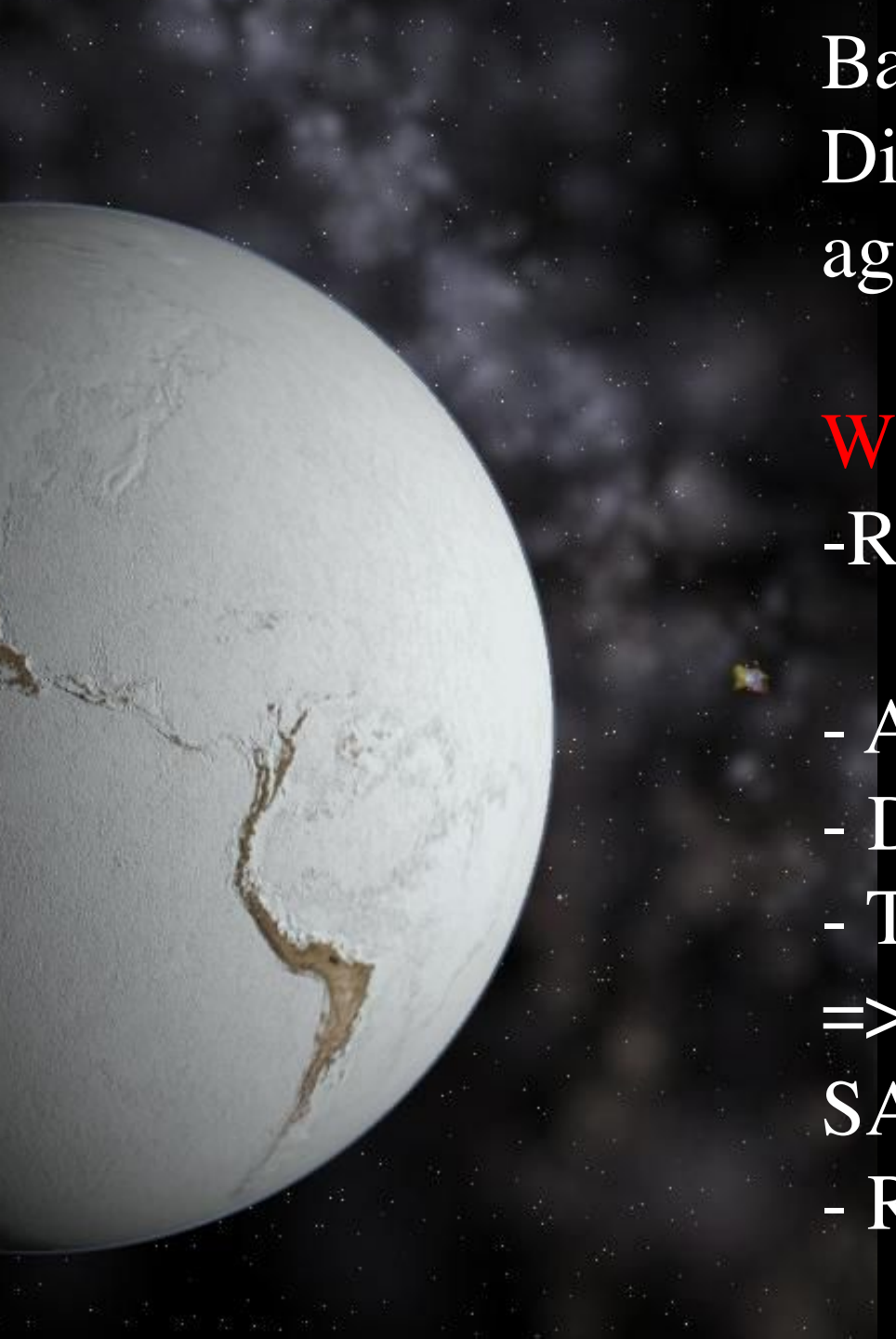
Earth Modeller Groups in SAG 4:

Forget (Obs. Paris)
Kaltenegger (MPIA/CfA)
Kasting (Penn State U.)
Meadows (Univ. Washington)
Pierrehumbert (Chicago)
Rauer (DLR)
Sasselov (CfA)
Seager (MIT)
Selsis (Obs. Bordeaux)
Segura (UNAM, Mexico)

Other interested participants







Baseline: Earth &
Different evolution state / age / mass / etc.

WORKING QUESTIONS:

-Resolution needed for Biomarkers in UV?

- Alternative Biomarkers?

- Detectable (SNR, λ)?

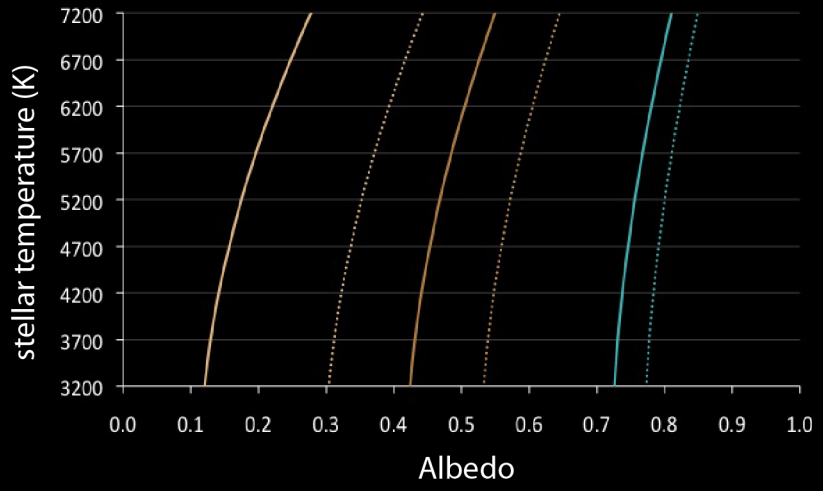
- Temp? Radius?

=> Inst. Requirements (e.g. SAG4 & SAG3 & SAG1)

- Retrieval from data?

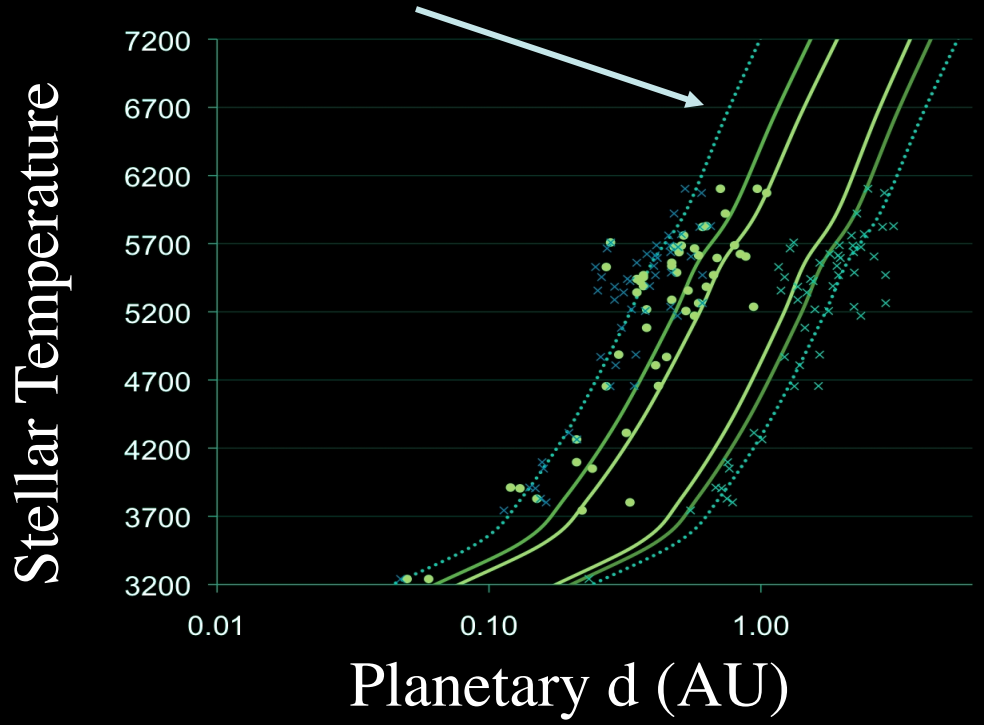
Habitable Zone: Kepler's pot. habitable planets explored

Kaltenegger & Sasselov 2011 ApJL

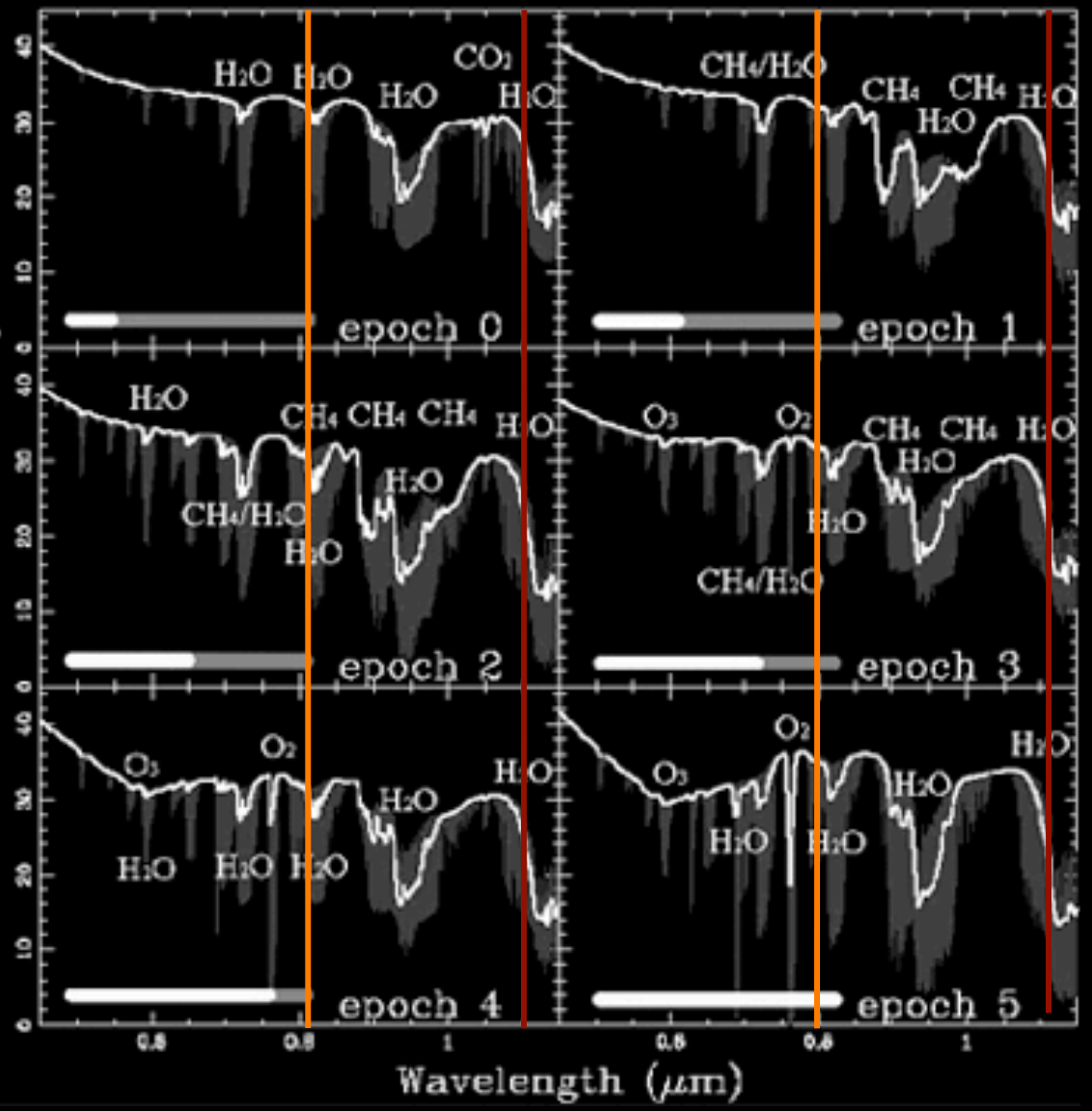


HZ - extreme limits
100% cloud coverage

Kepler Planet candidate



Earth Evolution over geological time - CSI



Kaltenegger, Traub Jucks 2007 ApJ