宇宙惑星環境学

担当教員：今村剛 Imamura, Takeshi・青木翔平 Aoki, Shohei

放射輸送と大気の鉛直構造
大気化学とエアロゾル
大気流出と大気進化
大気力学
火星と金星の気候形成
巨大ガス惑星
太陽系探査

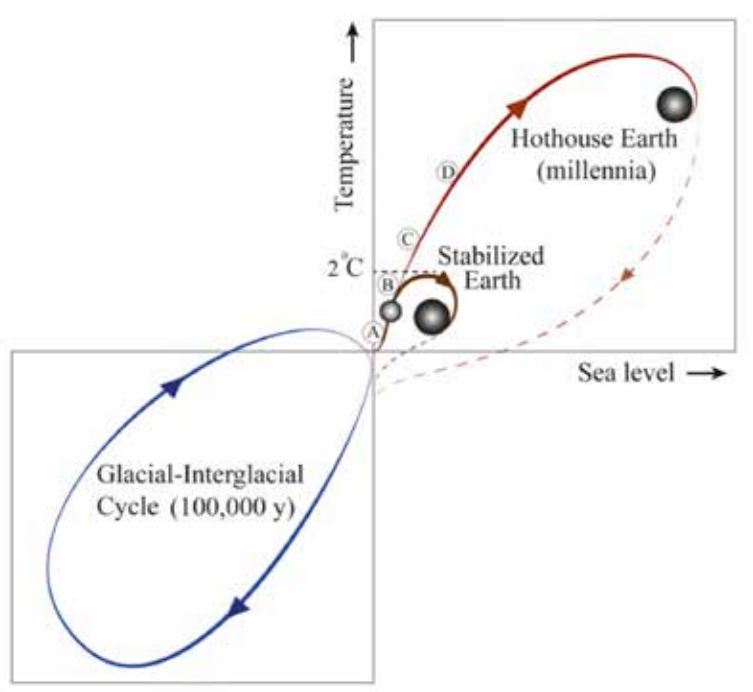
Score will be evaluated based on papers (reports).

The theme for the paper will be given at the end of this course.

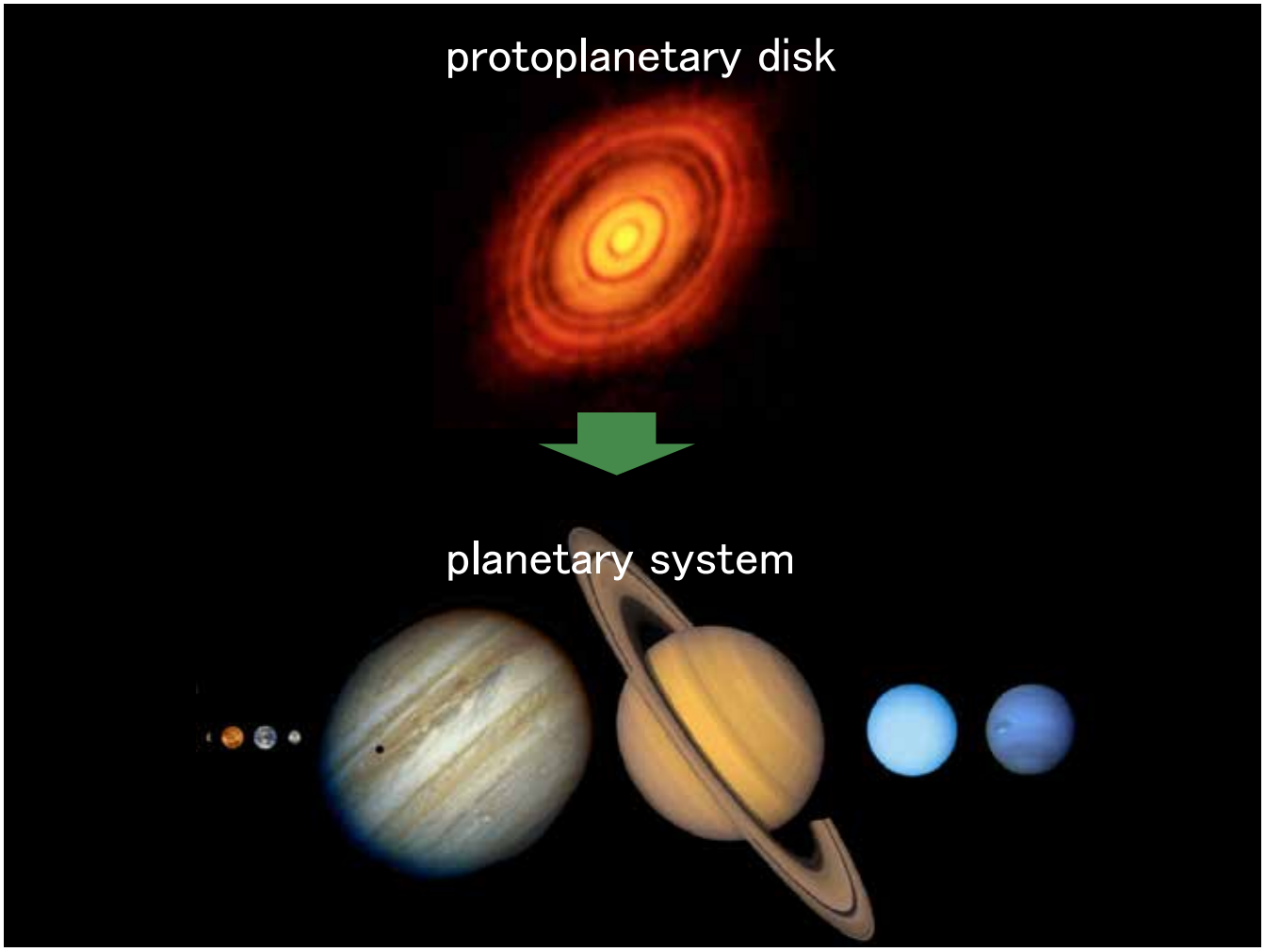
Dates of lectures: 10/5, 10/12, 10/19, 10/26, 11/2, 11/9, 11/16, 11/30, 12/7, 12/14, 12/21, 1/11, 1/18, 1/25

Lecture material by Imamura will be linked from ITC-LMS.

Possible future pathways of the climate against the background of the glacial–interglacial cycles

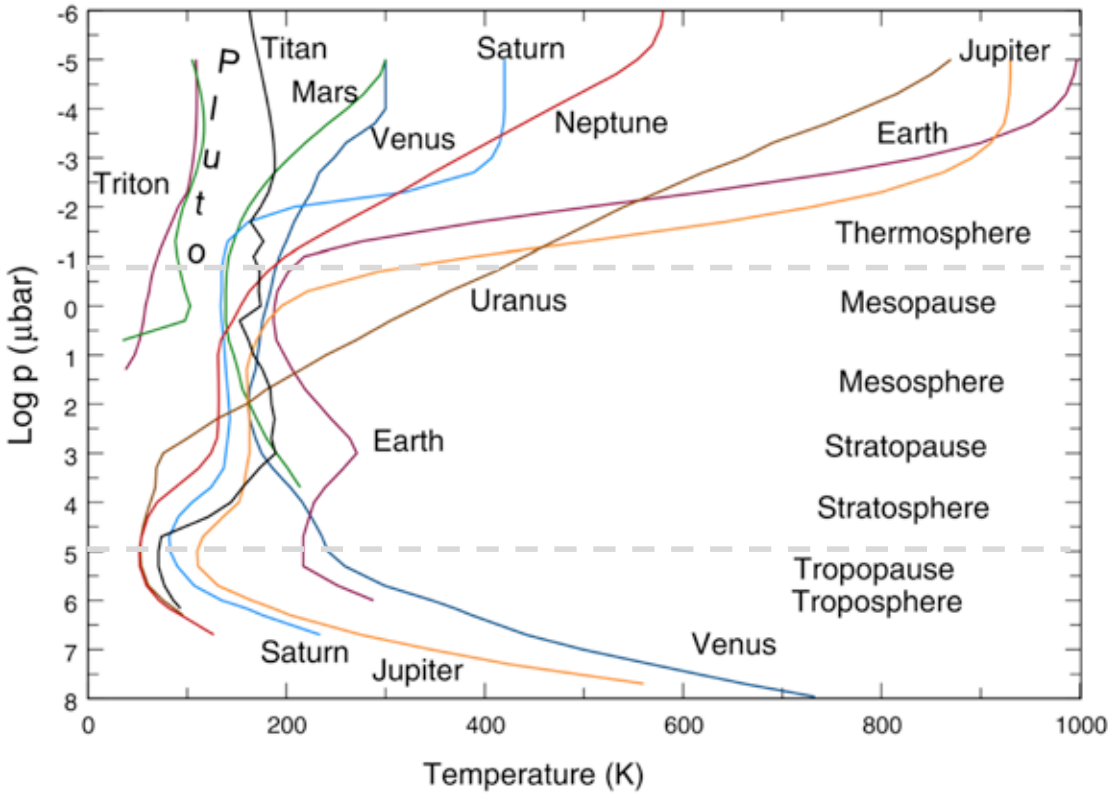


Steffen et al. (PNAS, 2018)



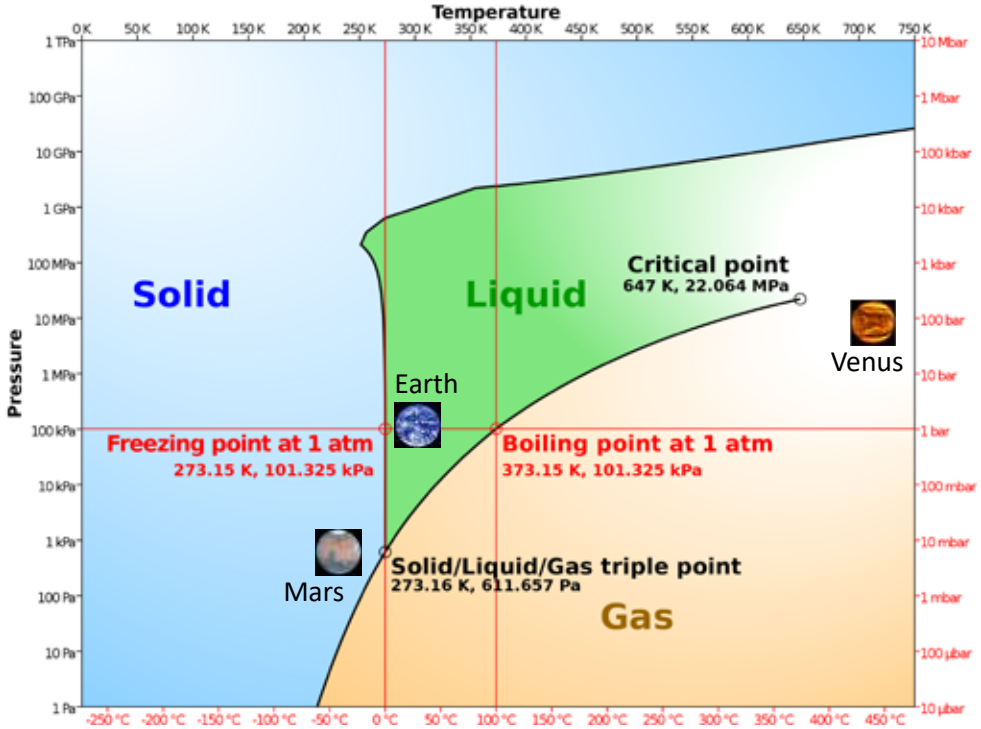
Vertical temperature profiles of planetary atmospheres

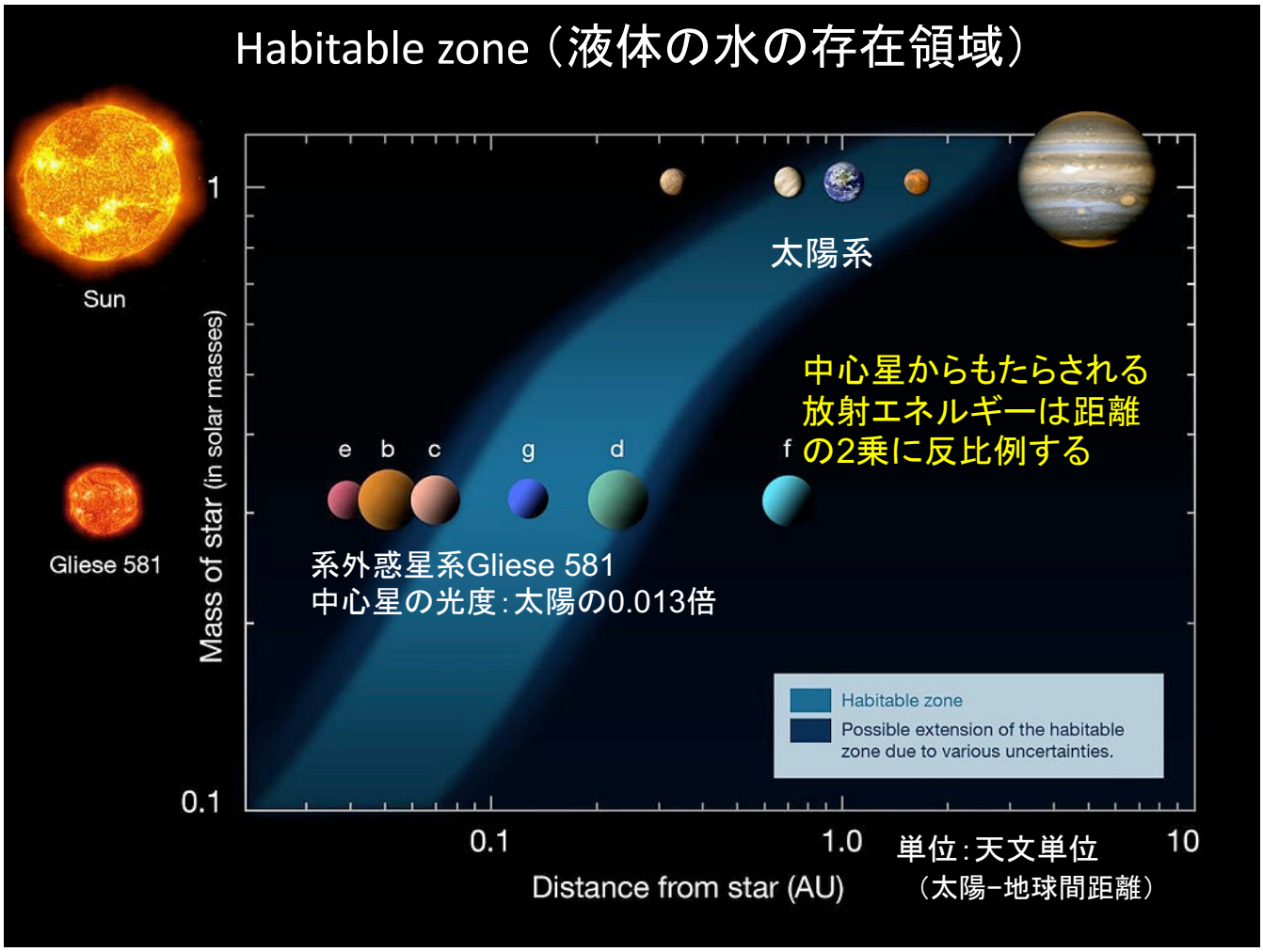
(Mueller-Wodarg et al.)



Phase change diagram for water

From Wikipedia





Inner edge of habitable zone

- Water loss limit
  Escape of water/hydrogen to space
- Runaway greenhouse limit
  Complete evaporation of ocean

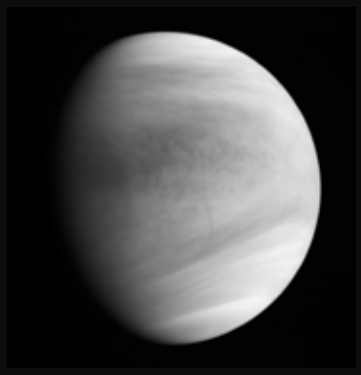
→ How/when did **Venus** lose water and get the thick CO_2 atmosphere ?

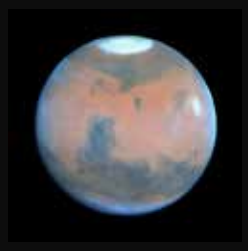
Outer edge of habitable zone

- Greenhouse effect by CO_2 and other gases
- Enhancement of cloud albedo in cold, massive atmospheres

→ How/when did **Mars** lose thick atmosphere and freeze ?

Clouds and albedo

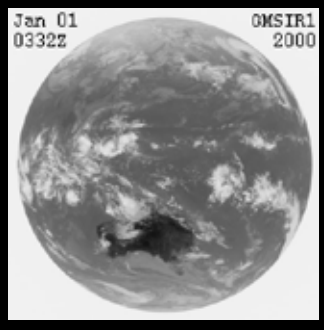




Albedo 0.78 0.30 0.16

Atmospheric circulation

Venus



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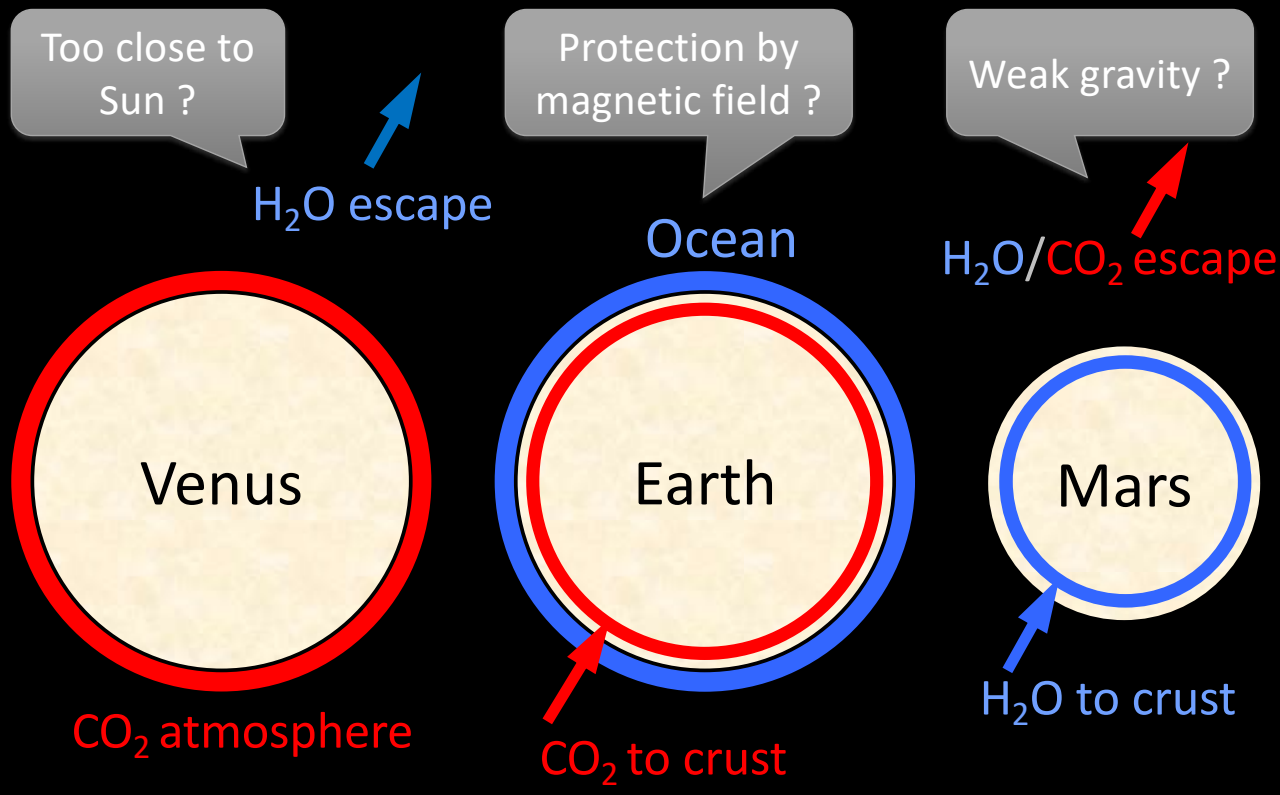
Earth

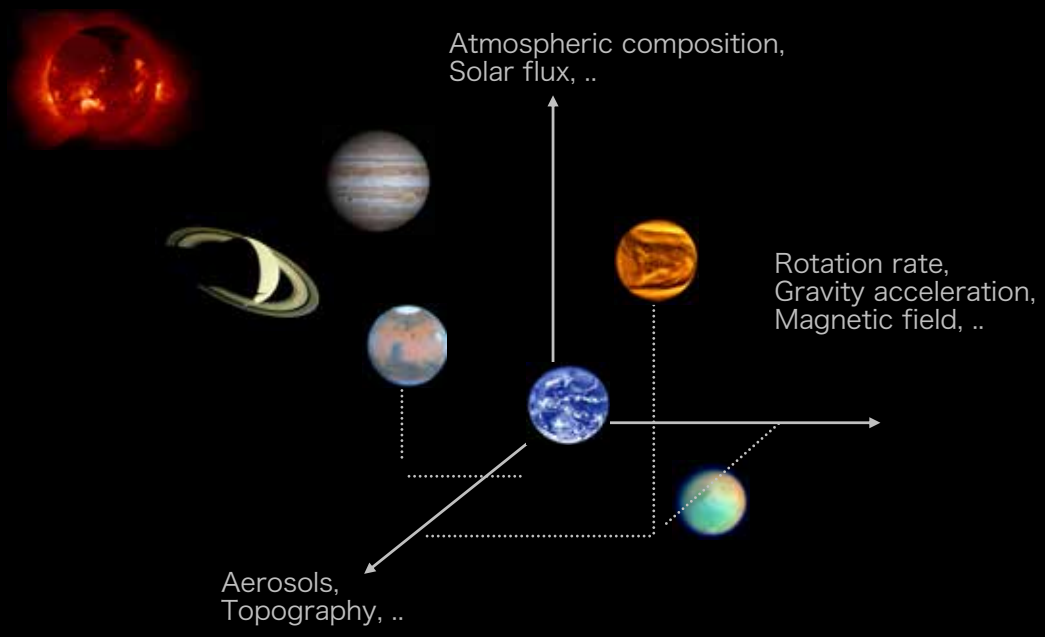
Mars

Jupiter

Possible scenarios of planets' evolution



Understanding the diversity in a multi-dimensional parameter space



Questions

- How are the compositions, amounts and albedo of those planetary atmospheres controlled ?
- How does the climate system work and evolve with time?
- How does a star-planet system evolve with time?