

Kristian H. Møller

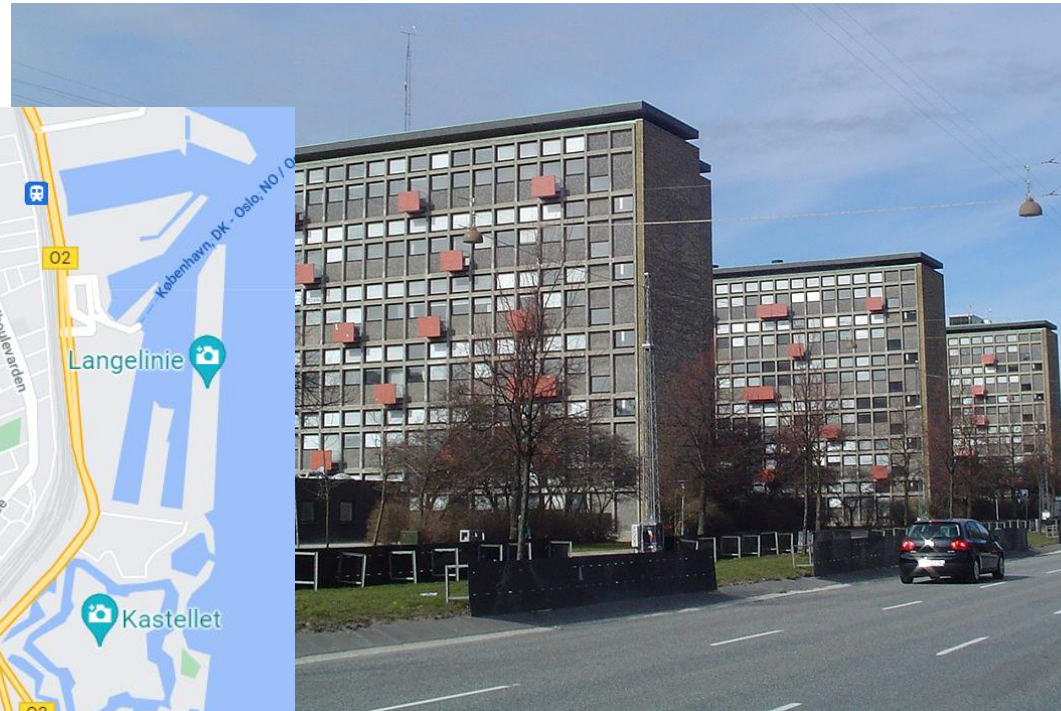
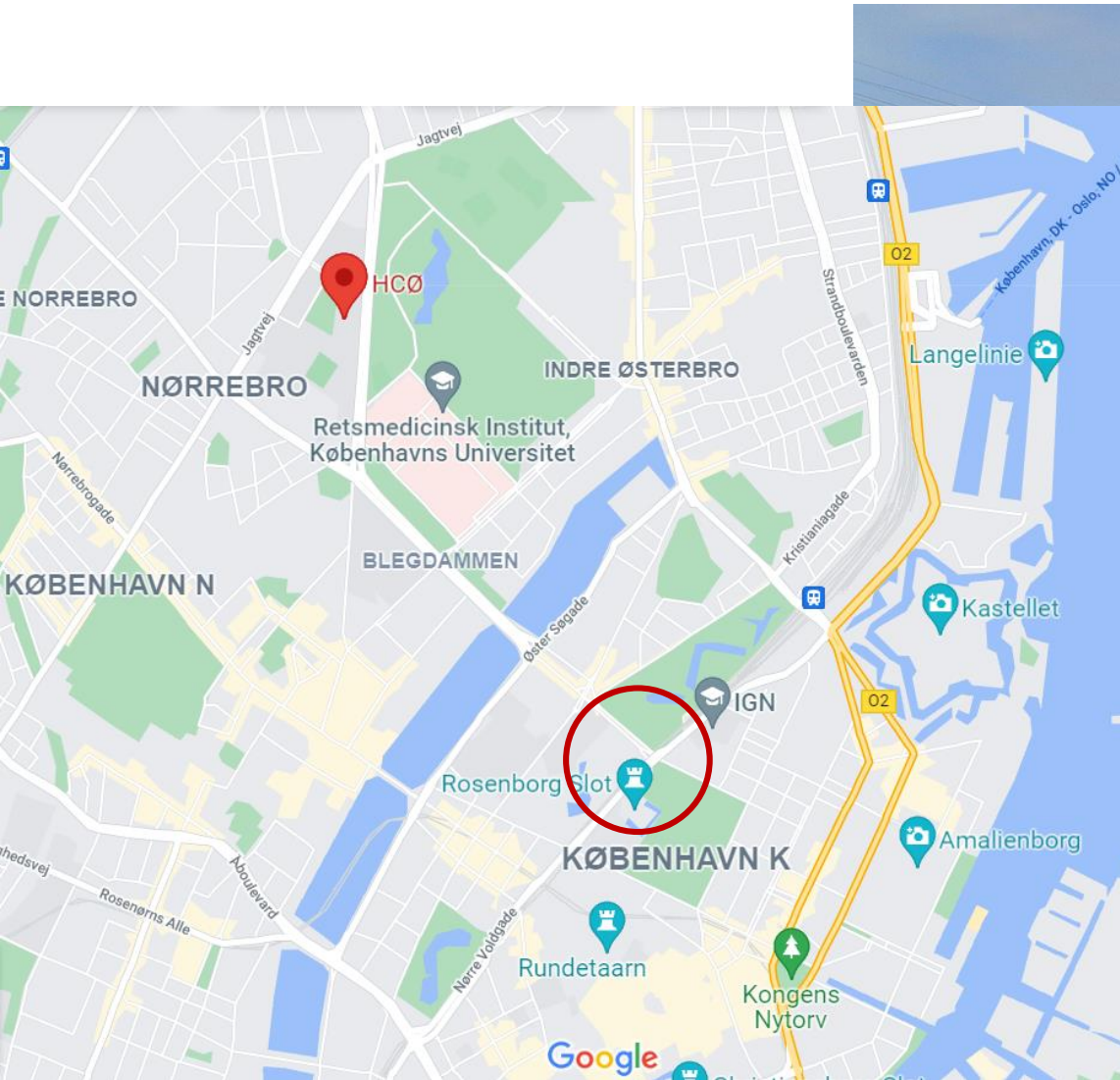
Postdoc

Centre for ExoLife Sciences
(CELS)

UNIVERSITY OF COPENHAGEN



Background in Atmospheric Chemistry



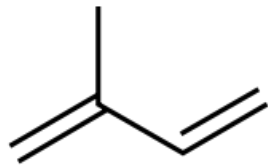
Volatile Organic Compound (VOC) Emissions

Total non-methane VOC

Annual Emission

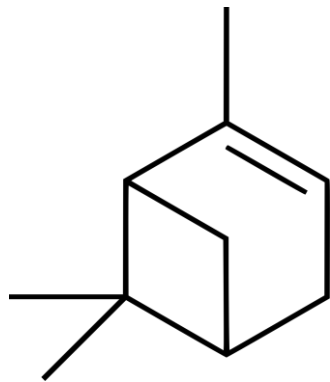
1250 Tg

1 Tg = 1,000,000 tons



Isoprene
(C₅H₈)

500 Tg

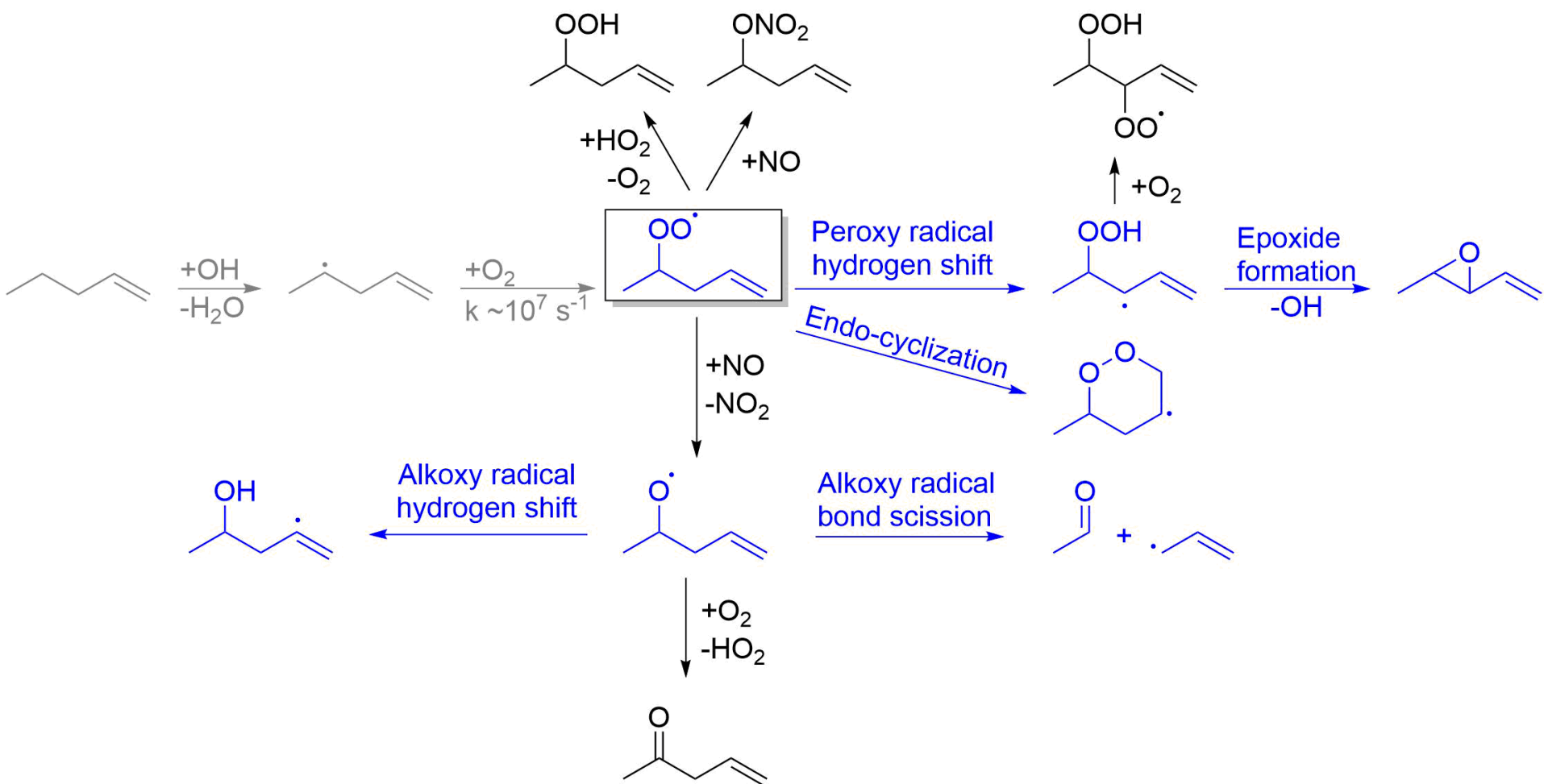


Monoterpenes
(C₁₀H₁₆)

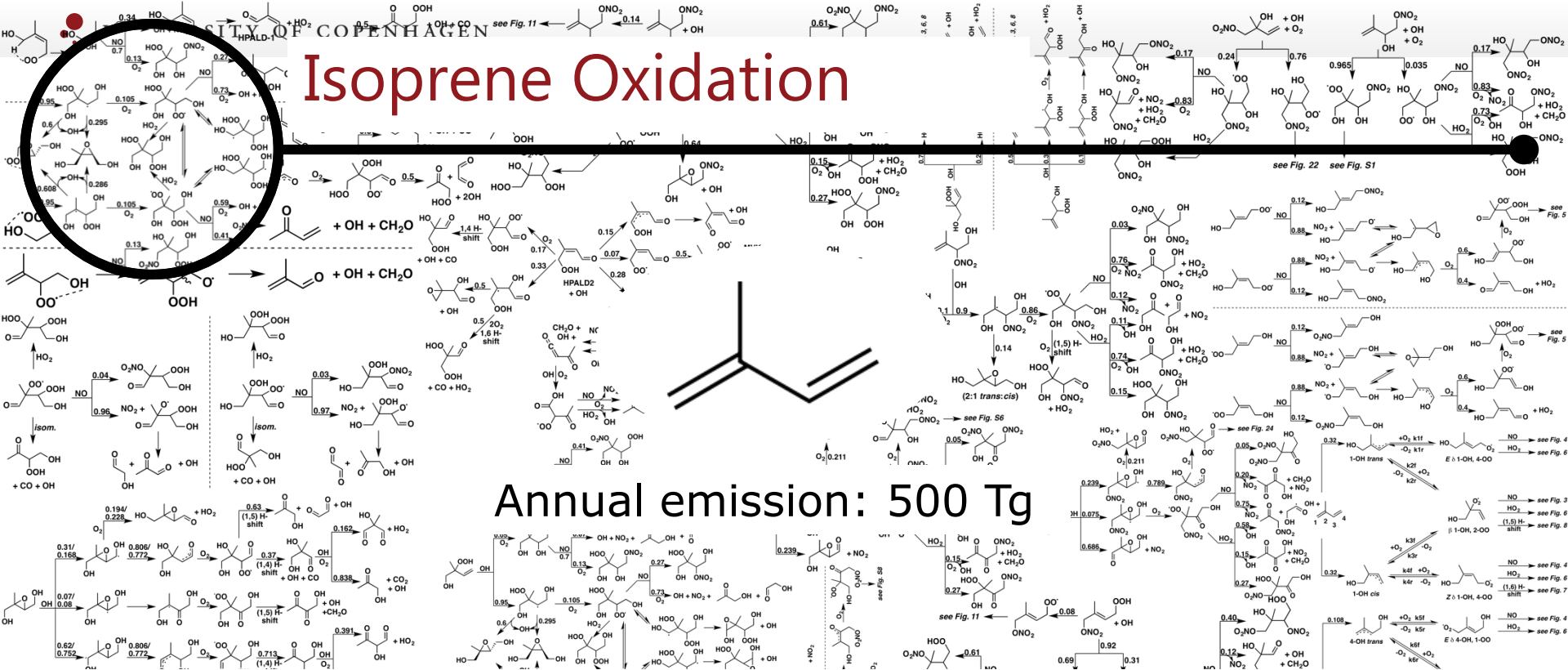
100 Tg



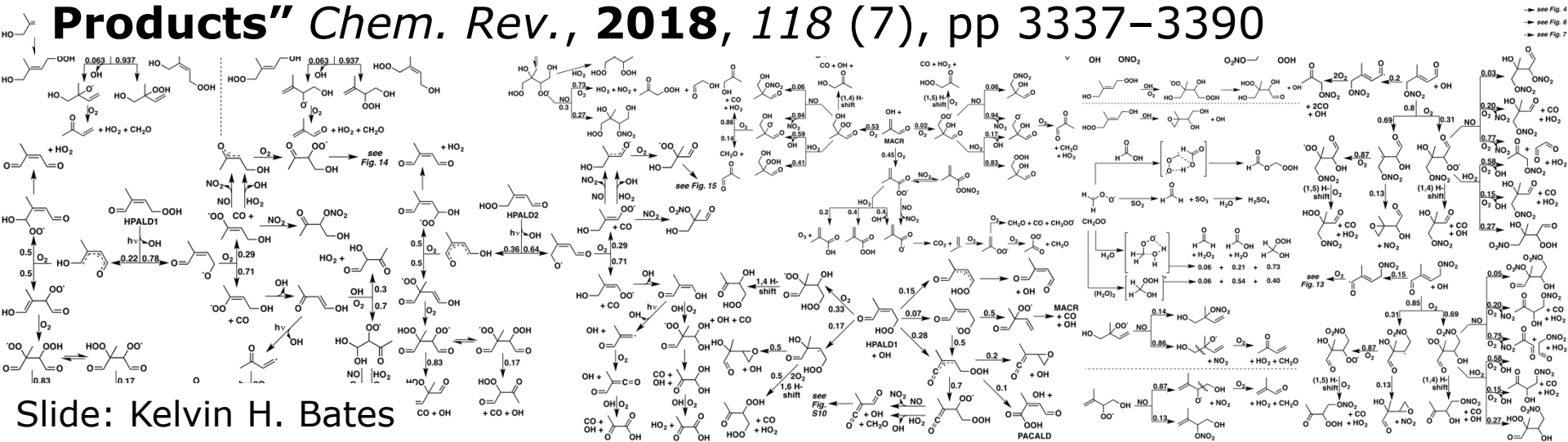
Atmospheric Oxidation Reactions



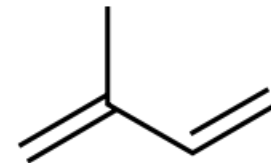
Isoprene Oxidation



"Gas-Phase Reactions of Isoprene and Its Major Oxidation Products" *Chem. Rev.*, 2018, 118 (7), pp 3337–3390

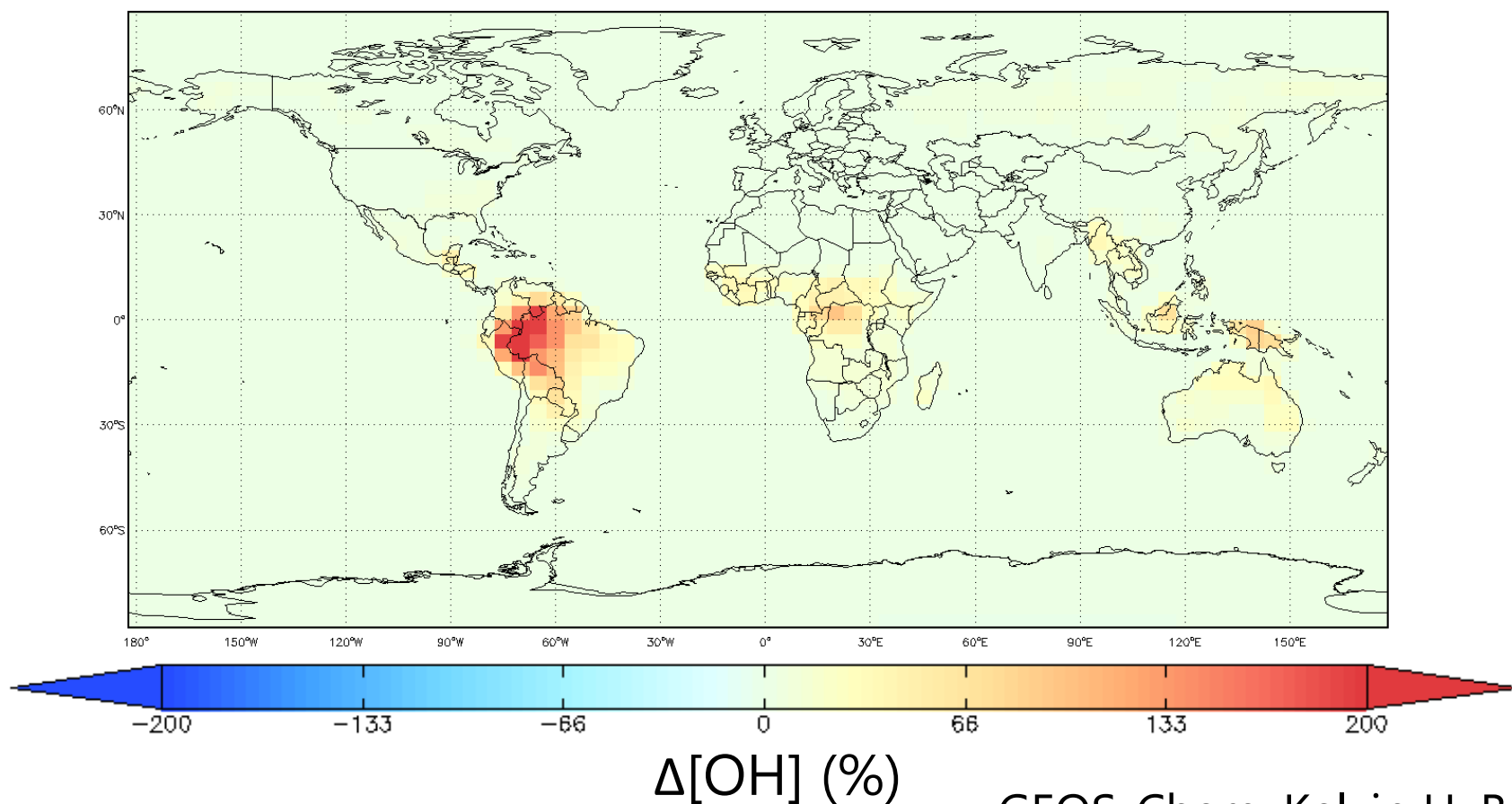


Atmospheric Importance of H-shifts



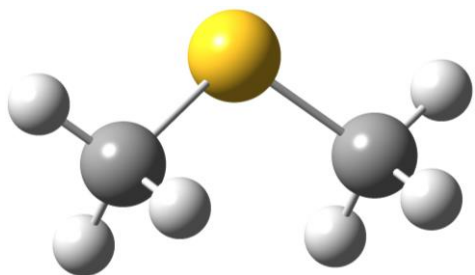
H-shifts: $\geq 0.30 \times$ isoprene

Change in [OH] due to H-shifts

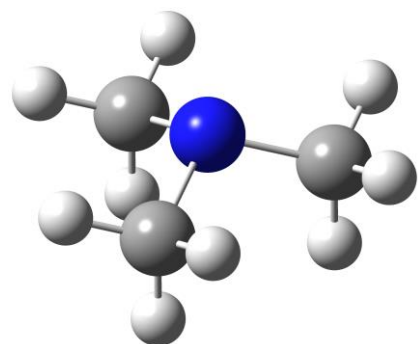


GEOS-Chem, Kelvin H. Bates

Small molecule autoxidation

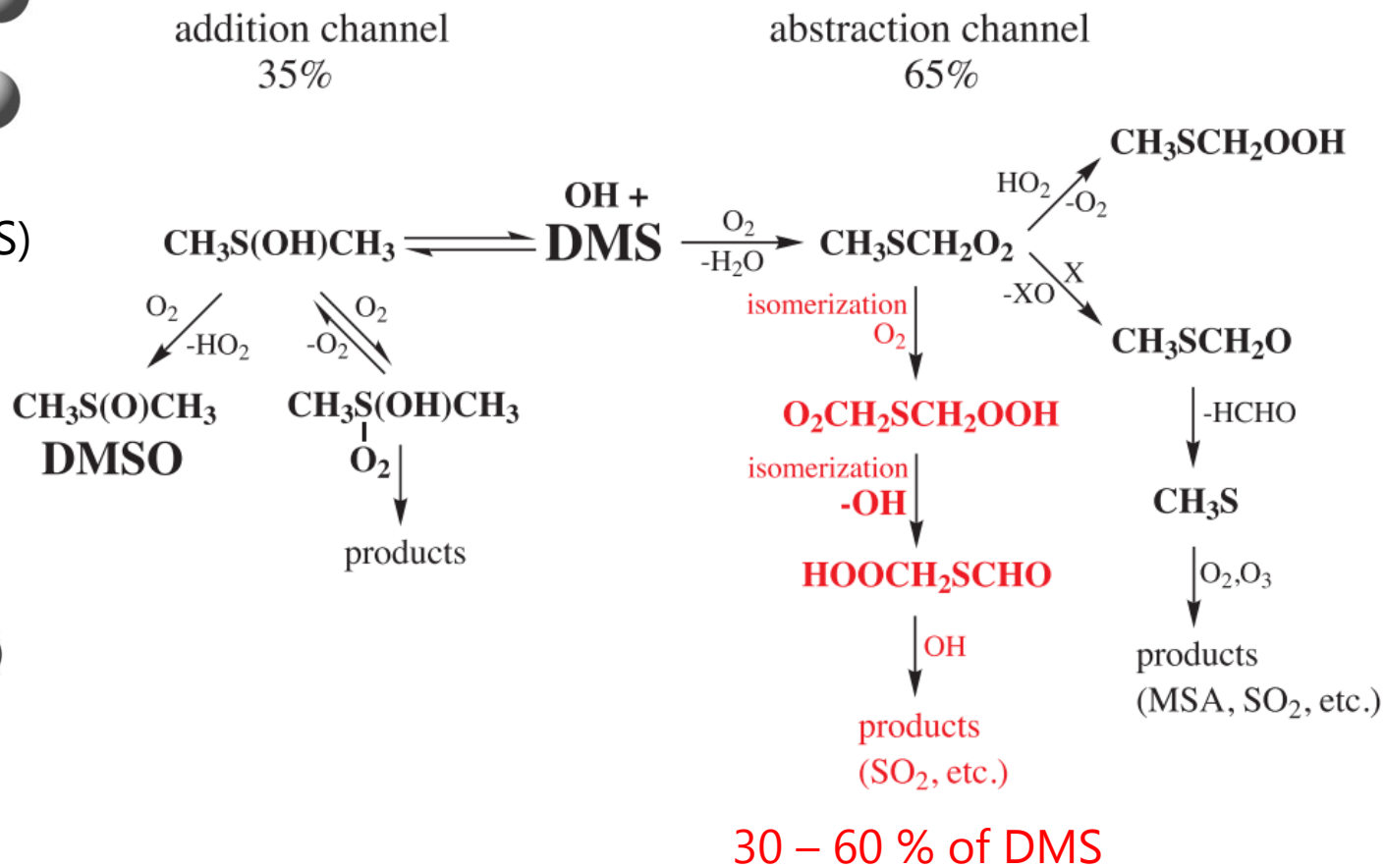


Dimethylsulfide (DMS)



Trimethylamine

>80 % H-shift

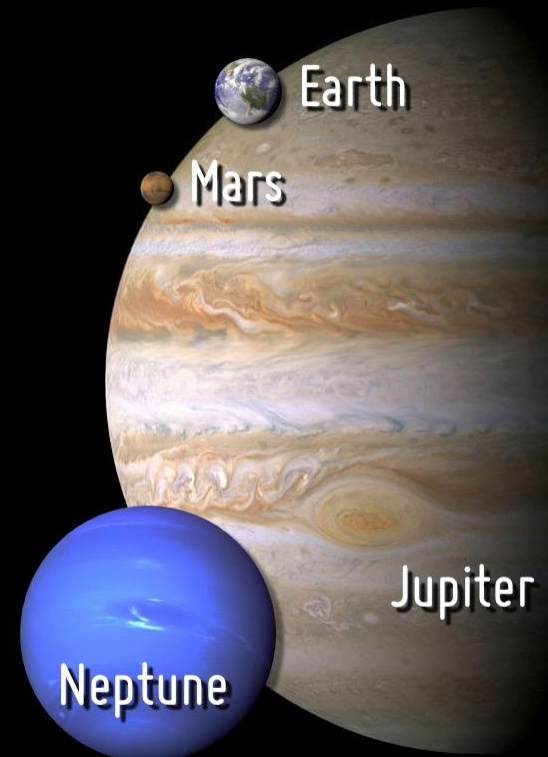
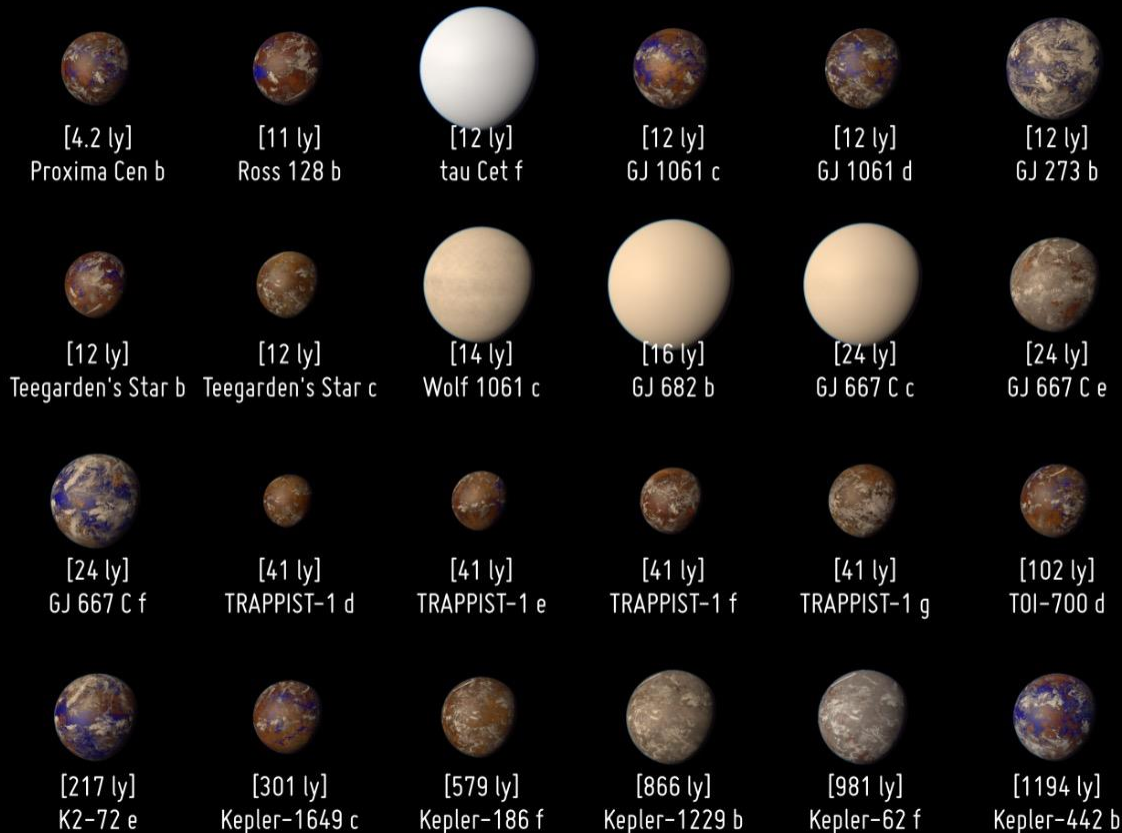


Atmospheric Chemistry on Exoplanets



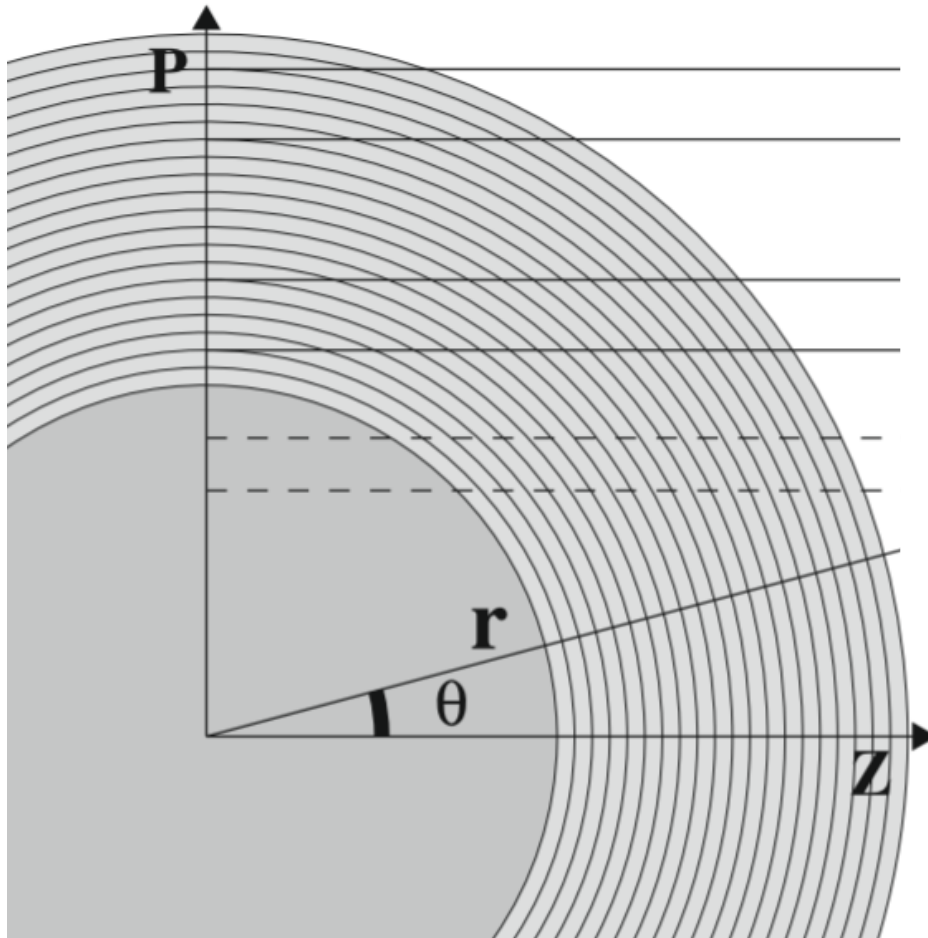
Potentially Habitable Exoplanets

Ranked by Distance from Earth (light years)



Artistic representations. Earth, Mars, Jupiter, and Neptune for scale. Distance from Earth is between brackets.

Exoplanet model atmospheres



MARCS (Model Atmospheres in Radiative and Convective Scheme):

- Calculates atmospheric structure
- Molecular composition calculated - assuming equilibrium

Beyond Equilibrium: Atmospheric Chemistry



1. Framework

2. Reactions