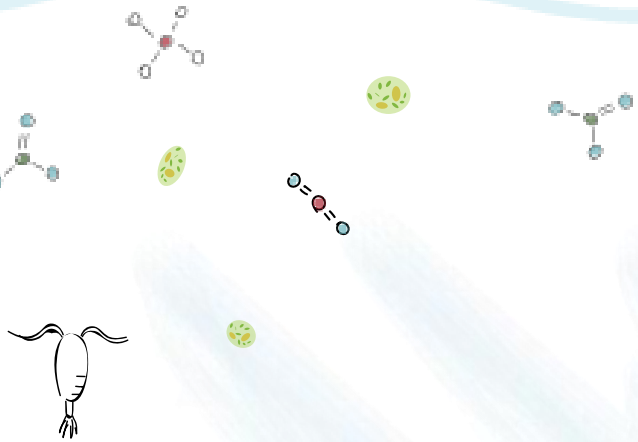

Reactive Transport in the Hydrosphere

Department of Earth Sciences, Faculty of Geosciences, Utrecht University

Lecturers: Lubos Polerecky and Karline Soetaert

Illustrations, narration and video editing: Renee Hageman
Additional contributions: Dries Bonte, University Ghent
Audio effects: mixkit.co

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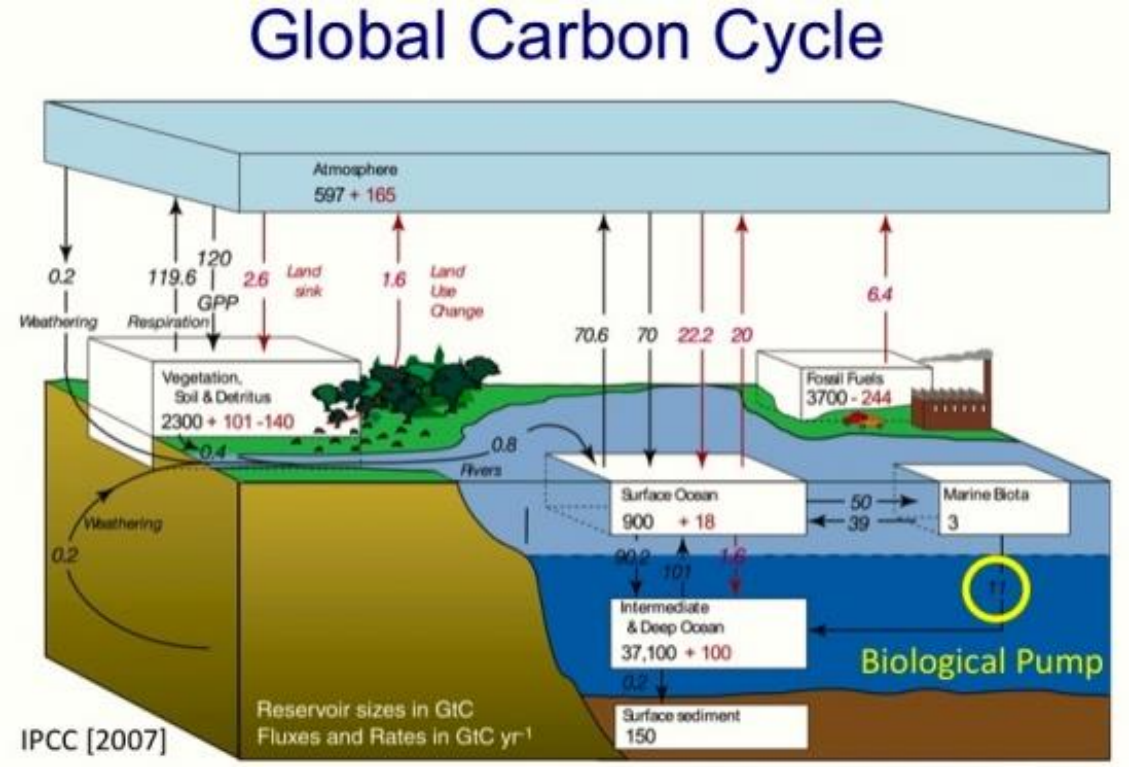
Rate laws for . . .



$$Flux = k \cdot SOURCE$$

Chemical reactions

- Irreversible
- Reversible
- Enzyme-catalyzed (metabolic)
  - Substrate limitation
  - Substrate inhibition
  - Rate saturation

Large-scale models

Partitioning between phases

- Mineral dissolution / precipitation
- Gas exchange

Ecological interactions

- Grazing, predator-prey type

Transport

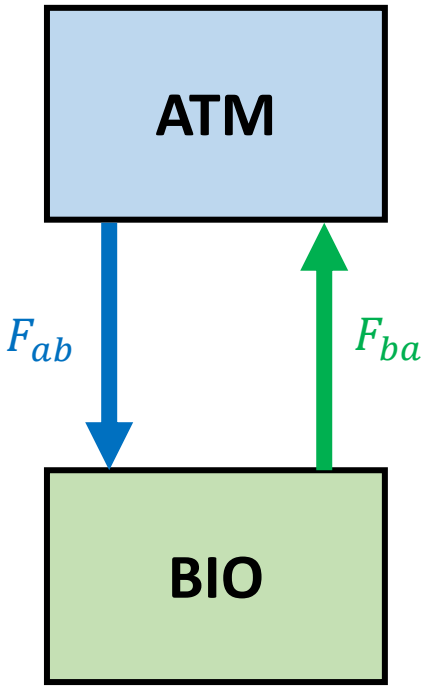
Rate law in large-scale models

Crude (two-box) global C cycle model

Global annual productivity

$$F_{ab} = k_{ab} \cdot \mathrm{ATM}$$

i.e., productivity **is limited** by the available **atmospheric CO_2**, and **not** by the biosphere.



Global annual respiration

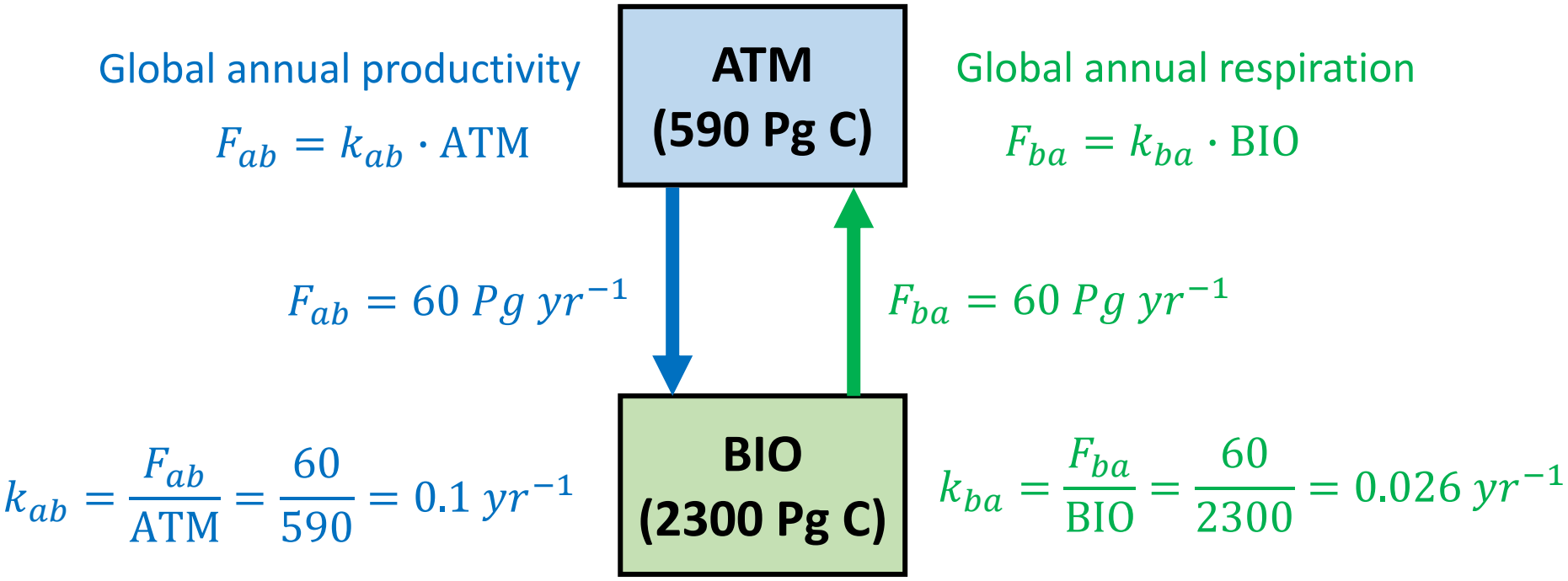
$$F_{ba} = k_{ba} \cdot \mathrm{BIO}$$

i.e., respiration **is limited** by the size of the **biosphere**, because O_2 is always present and thus not limiting.

SOURCE → SINK First-order kinetics with **source** being the rate-limiting factor

Rate law in large-scale models

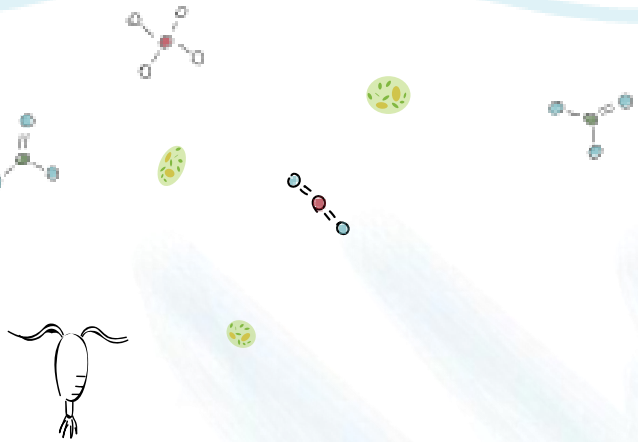
Crude (two-box) global C cycle model



Study effects of perturbations

- Deforestation
- Fossil fuel burning

Part of homework assignment



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