DFG SPP 1158 Antarctic Research: Report Colloquium

How can we learn from an iron fertilisation experiment about the marine biological carbon pump?

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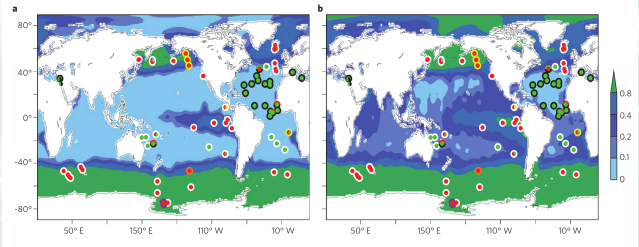
Polar Conference, 17 September 2024, Rauris

- SPP1158 project YE 170/4-1:
  Response of the Southern Ocean biological carbon pump to changing iron supply
- 2-year PostDoc position
- Kathrin Wuttig: just started last month
- reporting the first steps

Dr. Kathrin Wuttig

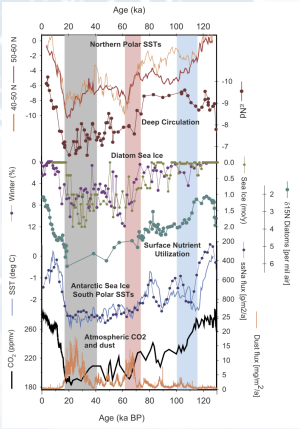
Carbon uptake and nutrient supply in the Southern Ocean



circles filled with red colour = primarily limited by iron

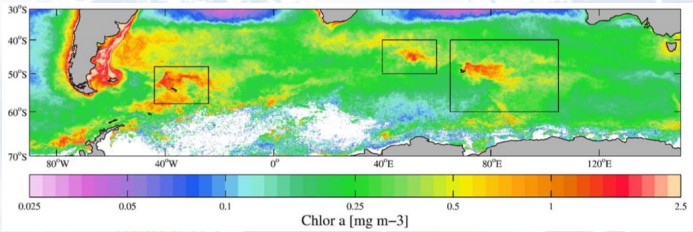
Moore et al. 2013

Main sources of iron into the Southern Ocean at present-day:
– sediment, ice melting, glacial runoff, dust, hydrothermal vents



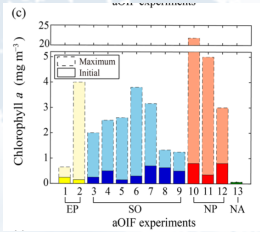
Kohfeld and Chase 2017

how these changes in iron supply affect SO biological pump



Satellite ocean color of SO (South Georgia, Crozet Islands and Kerguelen)

Robinson et al. 2016



Yoon et al. 2018

- natural events: different results due to diatom community structure, supply of other nutrients as silicate
- artificial OIF: no export increase detected during most experiments
- only EIFEX with massive sinking event during bloom termination

iron addition → carbon fixation increase → higher carbon export

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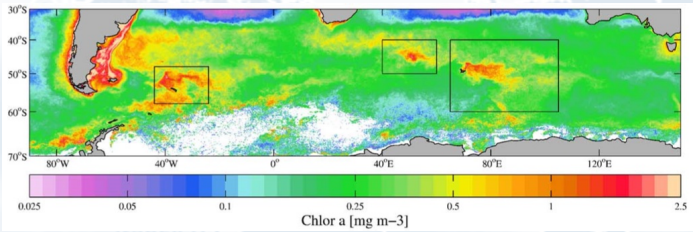

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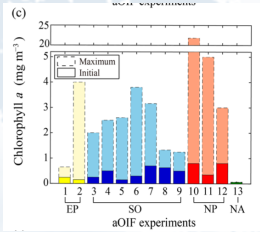

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Do we well understand mechanisms controlling the carbon export?

- biogeochemical models differ from each other in complexity (e.g. from simple box model to GCM: Zeebe and Archer 2005, Aumont and Bopp 2006, Losch et al. 2014)
- common results: blooms reproduced, and low feasibility to reduce CO_2
- model-data mismatch:

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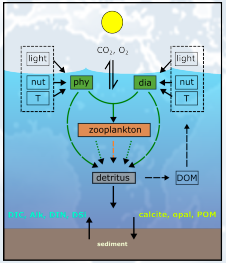
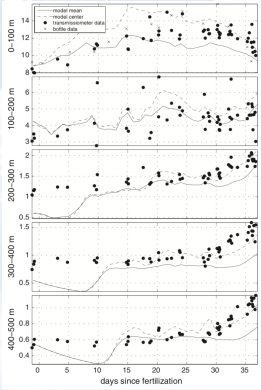
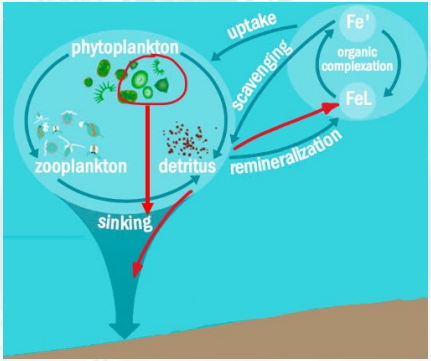
→ **sinking event 24 days after fertilisation mainly contributed by diatom aggregates**



Regulated **Eco**system **M**odel ↑
Losch et al. 2014 →



How can we do better?



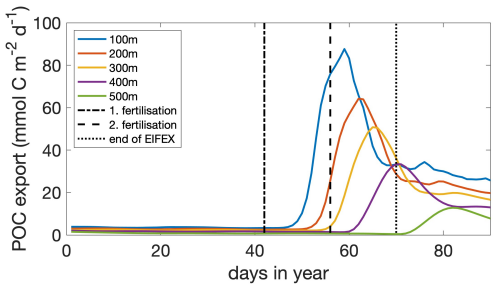
1. 're-run' the model including all recent developments
2. improve model description of particle production, aggregation and sinking
3. improve model description of diatom
4. estimate and predict responses of SO biological pump to changes in iron supply

Start of the project

The first two steps:

1. first 'exercise' with a simulation of EIFEX in a global setup (right figure)
2. first reference simulation with optimised physics in a regional setup (on-going)

Thank you!



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