Isochronal ice sheet model: Simulate englacial tracer transport to reconstruct past climates and ice sheet volumes

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Marine Sediment Cores

Ice Cores

Numerical Modeling

Ocean Dynamics

Ice Sheet Dynamics

Decadal climate predictions, fisheries, etc.

Sea level rise
Ice cores contain the entire *depositional* and *dynamical* history of their ice sheets.
Oxygen Isotopic ratio ($\delta^{18}O$)
New approach
New approach
Eulerian description of flow

Accumulation is added to grid box at the surface

Vertical flow *through* model mesh, → numerical diffusion

Euler
(Semi-)Lagrangian description of flow

Accumulation creates new model layer

No flow through mesh necessary
Model-data comparison

![Graph showing model-data comparison with depth below surface on the y-axis and δ¹⁸O (%) on the x-axis.]
Model-data comparison
Model-data comparison
We need the power of **model-data synergies** to figure out what happened to the ice sheets in the past and might happen again in the (near) future.

We now can **model ice cores** and **englacial layers**.

Layer thickness evolves from a numerical necessity to a physically meaningful variable.

**Outlook:**

- Comparison with ice cores (and radiostratigraphy) for a comprehensive model validation and projections of sea level.
- Perfect (in the model) control on layer age helps identify regions where old ice may be found (IPICS Oldest Ice).

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