Utilizing NASA data products to improve ice sheet models

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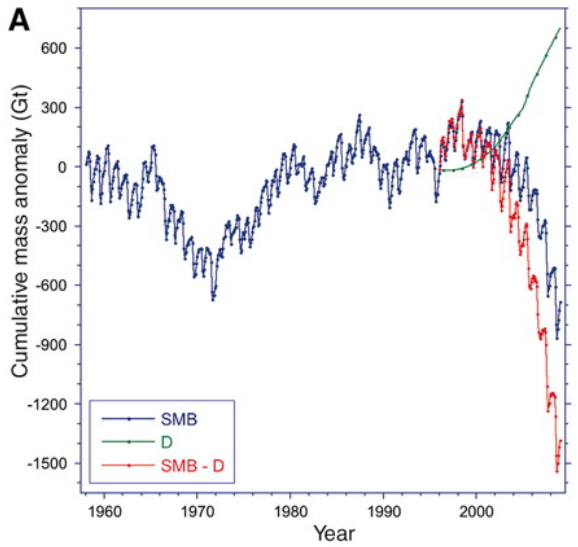
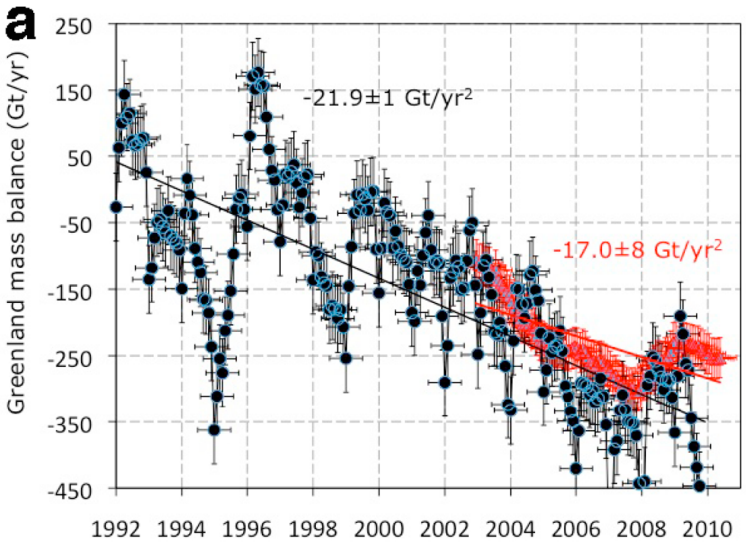
Observations and models



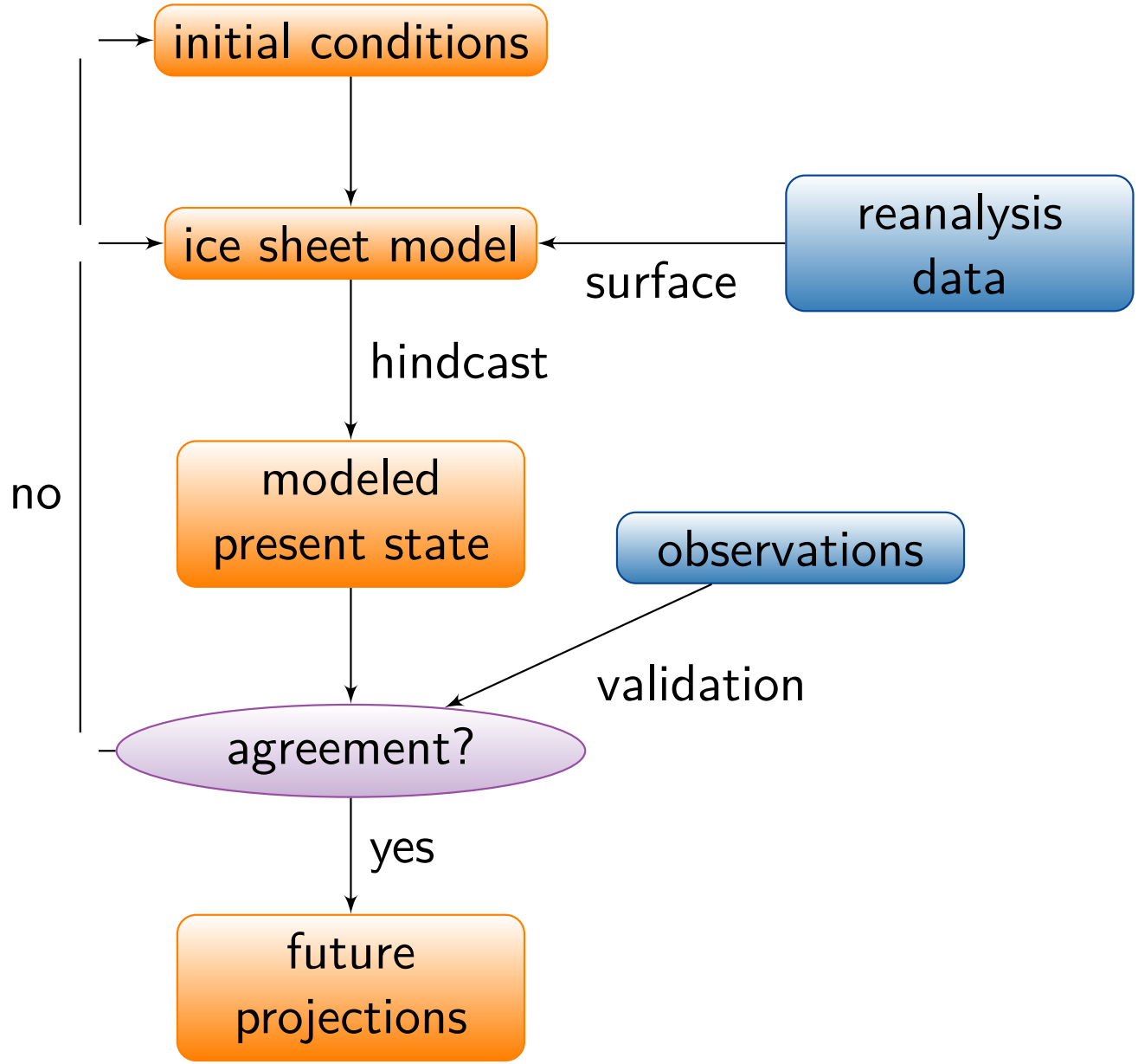
van den Broeke et al. (2009)



Rignot et al. (2011)

- Observations tell us something about the present state
- Prognostic models are needed for future projections
- Models need initial conditions
- Initial conditions need to be validated with present-day observations

An iterative approach



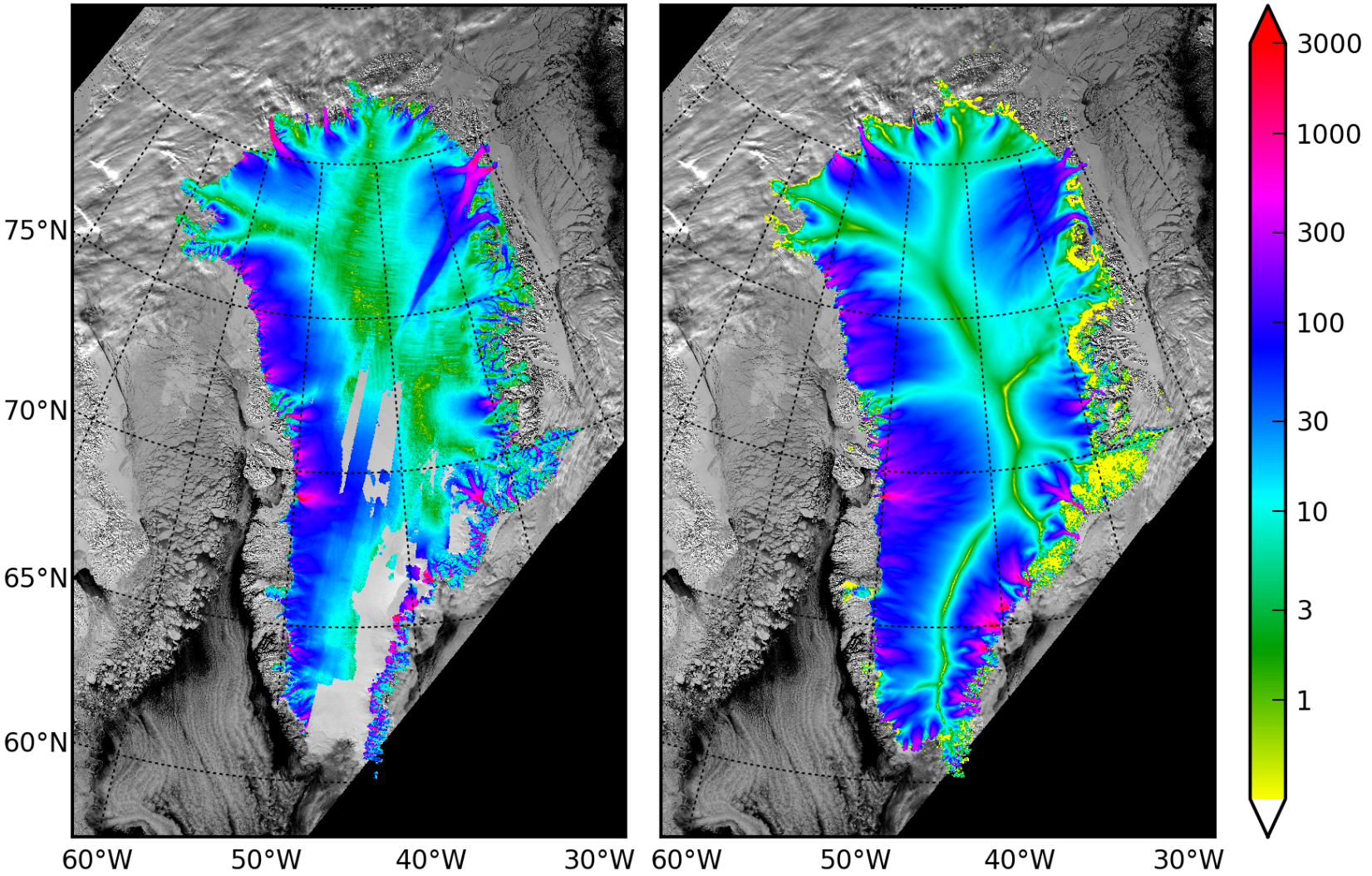
Initial conditions

As an example we test 3 initial conditions obtained by forward modeling

- constant-climate (HHCMB)
- paleo-climate (PALEO)
- paleo-climate with flux correction (PFLUX)

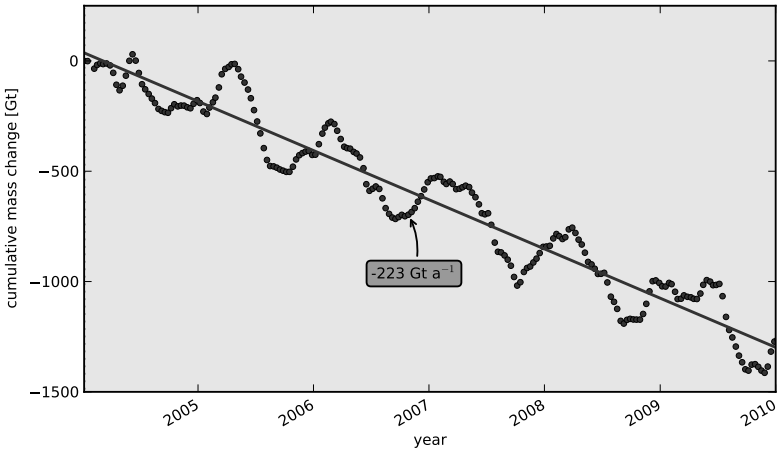
$\Rightarrow$ details are irrelevant, just demonstrate the idea

Surface speeds



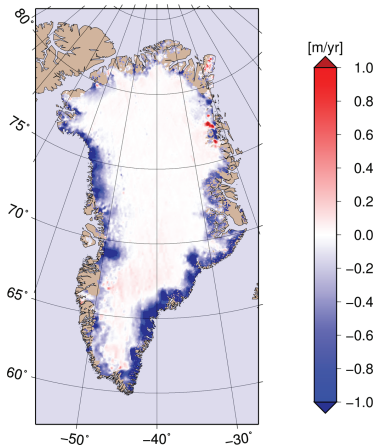
left: InSAR (Joughin et al., 2010), right: PFLUX. Values in m/a.

NASA data used for validation



GRACE

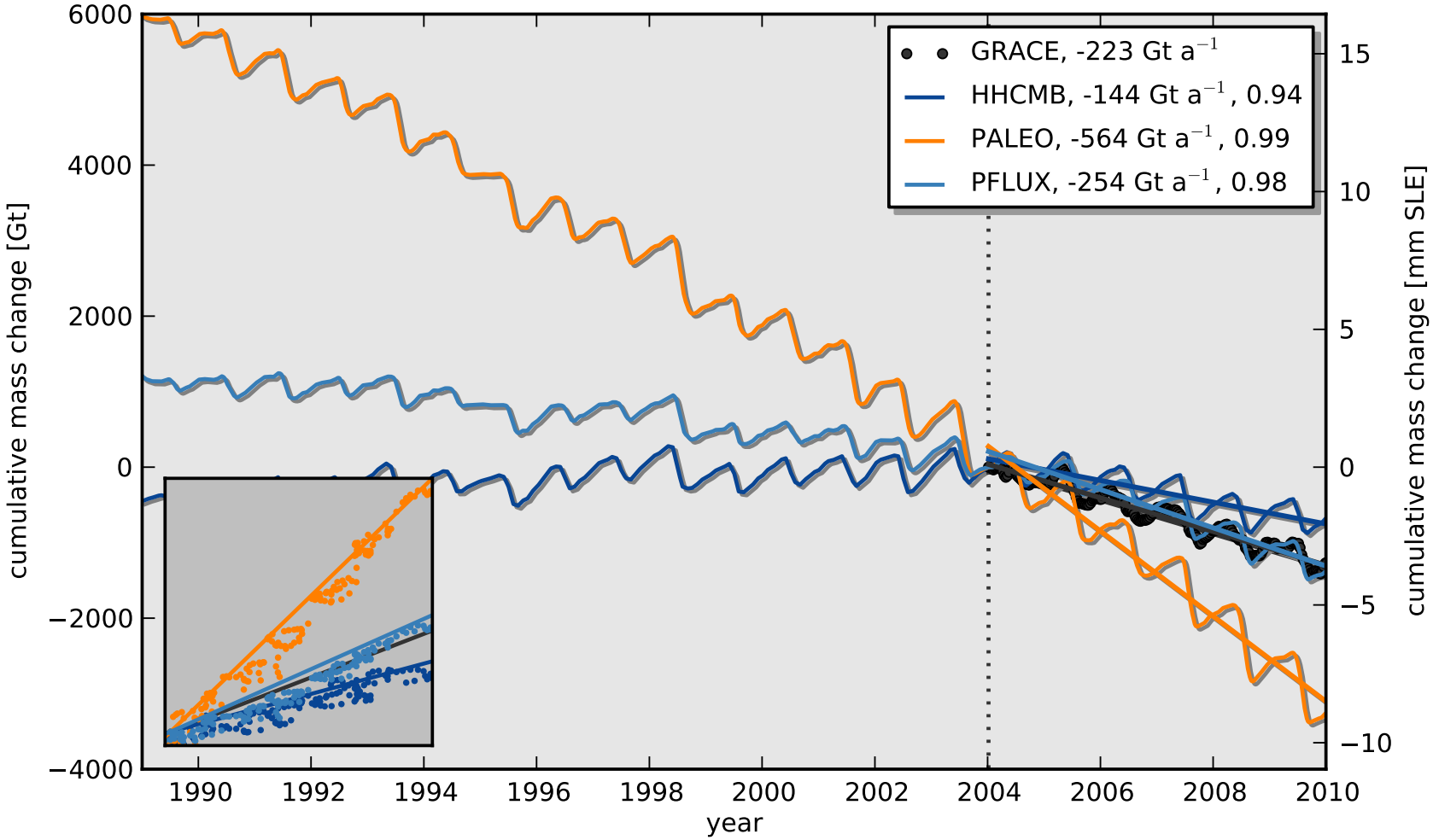
- cumulative mass change from 2004–2010 from *S. Luthcke*



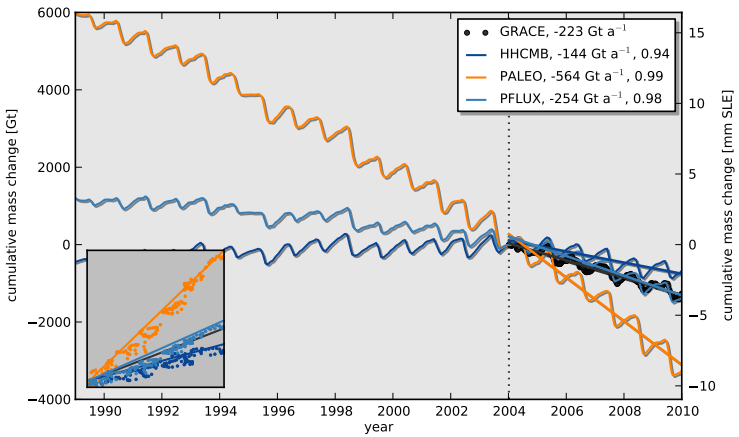
ICESat

- elevation change from 2003–2008 from *Sørensen et al.* (2011)

Total mass changes



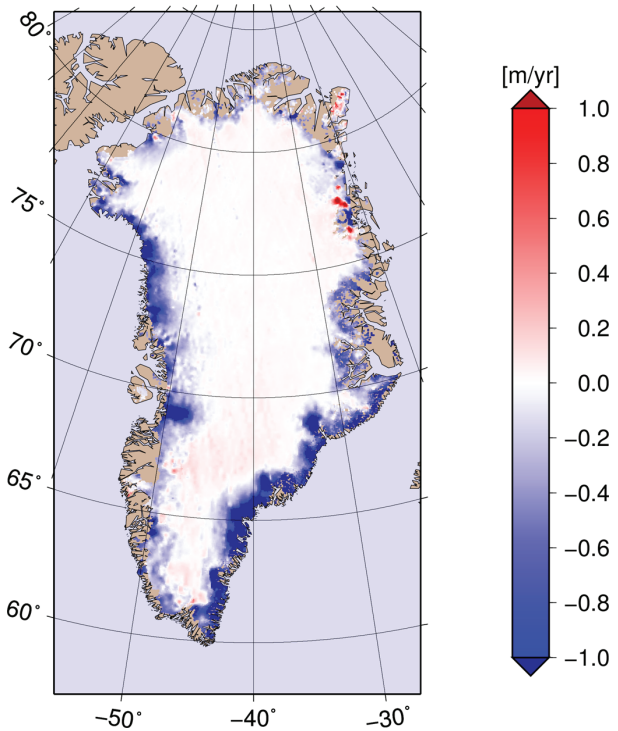
Total mass change: preliminary conclusions



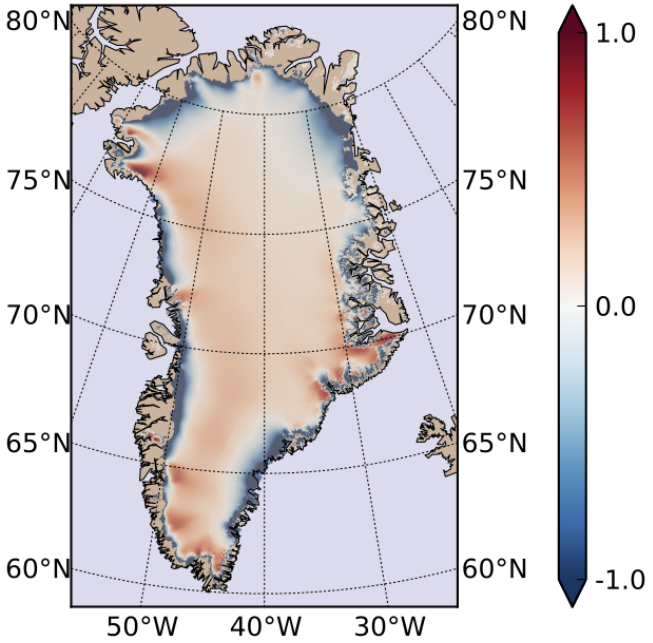
- total mass change is temporally-dense but just a scalar
- are we getting the trend right for the wrong reasons?
- additional, spatially-rich observations needed

$\Rightarrow$ drainage basin-scale validation with GRACE or ICESat

Observed and modeled elevation changes 2003–2008



Sørensen et al. (2011)



PFLUX

- stronger metric than total mass change

Summary

- Combine NASA observations and NASA-funded modeling efforts in an iterative approach
  - use observations to improve models
  - use models to improve observations
- by simultaneously using a variety of independent data sets for validation we arrive at more realistic initial conditions
- with well-validated models more reliable future projection can be made