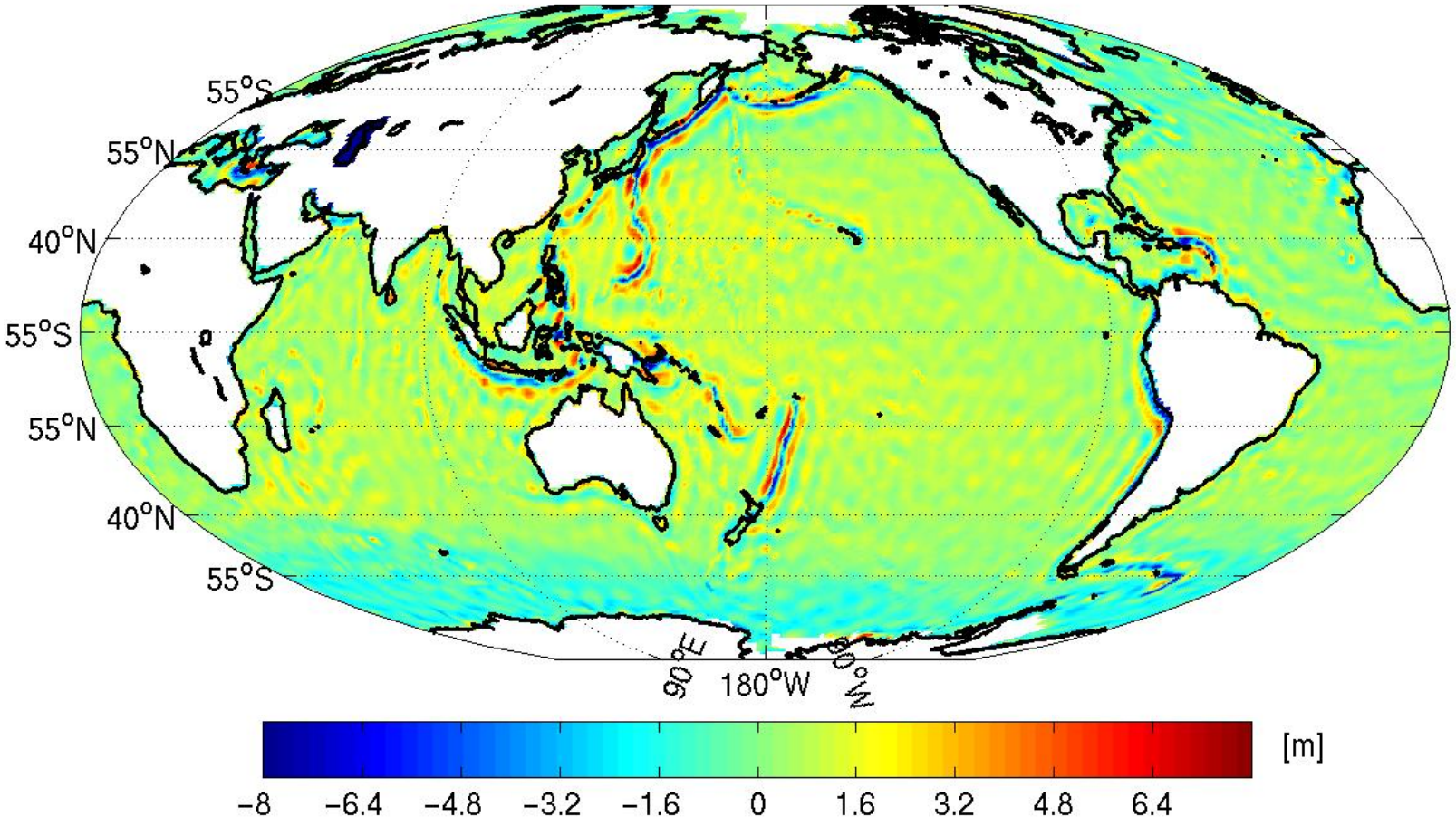
CLS-SHOM98.2-EIGEN2

'forbidden'



Mean ocean surface and geoid have to be expressed:

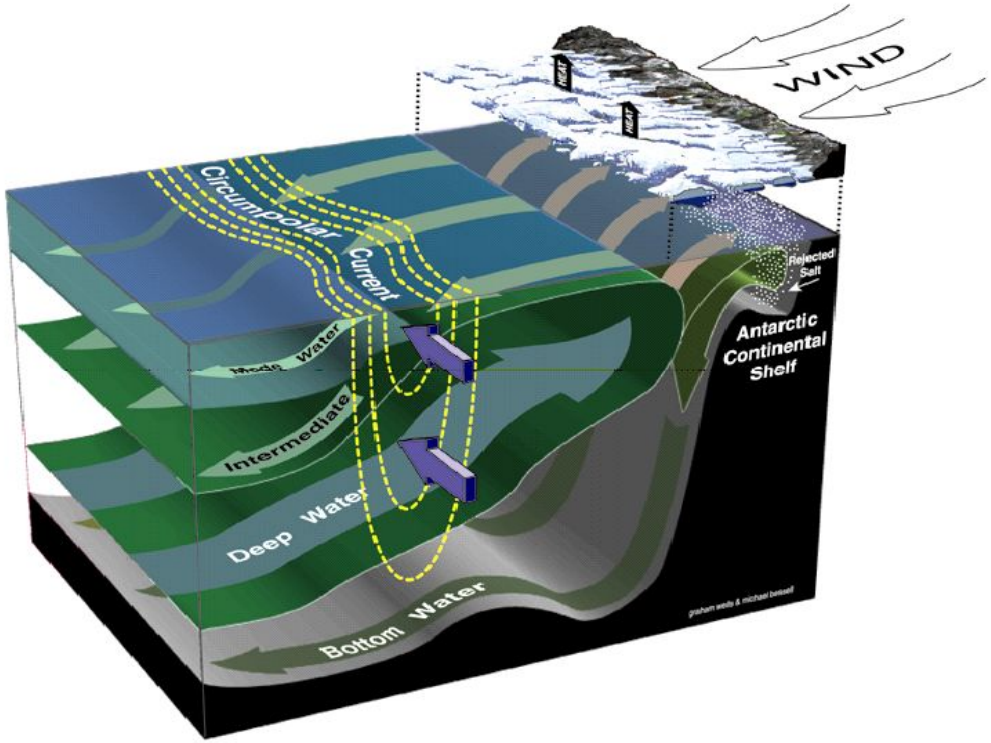
- in the same coordinate system
- in the same coordinate type
- with respect to the same reference ellipsoid
- in the same permanent tide system

and they have to be

- spectrally consistent (a real challenge)

GEOTOP

Sea Surface Topography and Mass Transport of the Antarctic Circumpolar Current



TECHNISCHE UNIVERSITÄT DRESDEN

DGFI

AWI

GEOTOP

- determination of DOT with proper spatial and spectral characteristics
- impact of ICESat and GOCE
- impact on ocean circulation assimilation of DOT(t) in OGCM
- verify results in Southern Ocean and Weddell Sea, a "cold" spot, "tipping point" of climate system

Schellenhuber

Geodetic DOT - rationale

POSTER

DOT = h – N

h and N differ spectrally; h defined only on altimeter tracks; N given by spherical harmonics

➔ DOT = 2D[h – N]

Global Approach:

- Filter in the spectral domain
- Use MSS to compute h
- Extent MSS to land (!)
- h_{MSS} in sperical harmonics

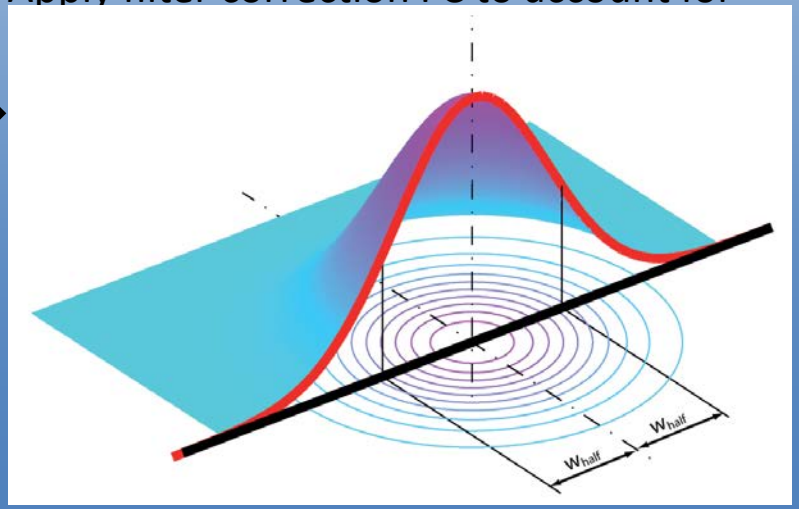
➔ $DOT = 2D[h_{MSS} - N]$

Mean DOT
(for MSS period)

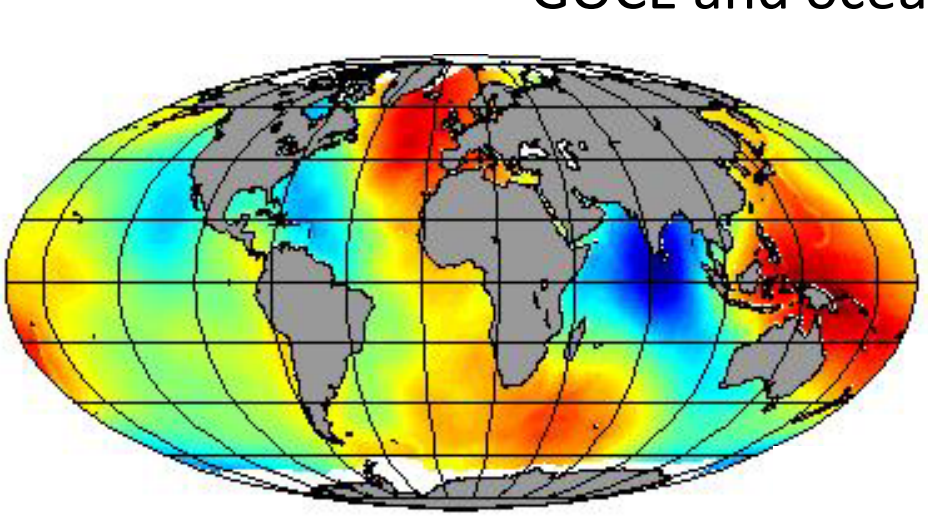
• Profile Approach

- Avoid gridding of h
- Filter h on altimeter profiles
- Apply filter correction FC to account for

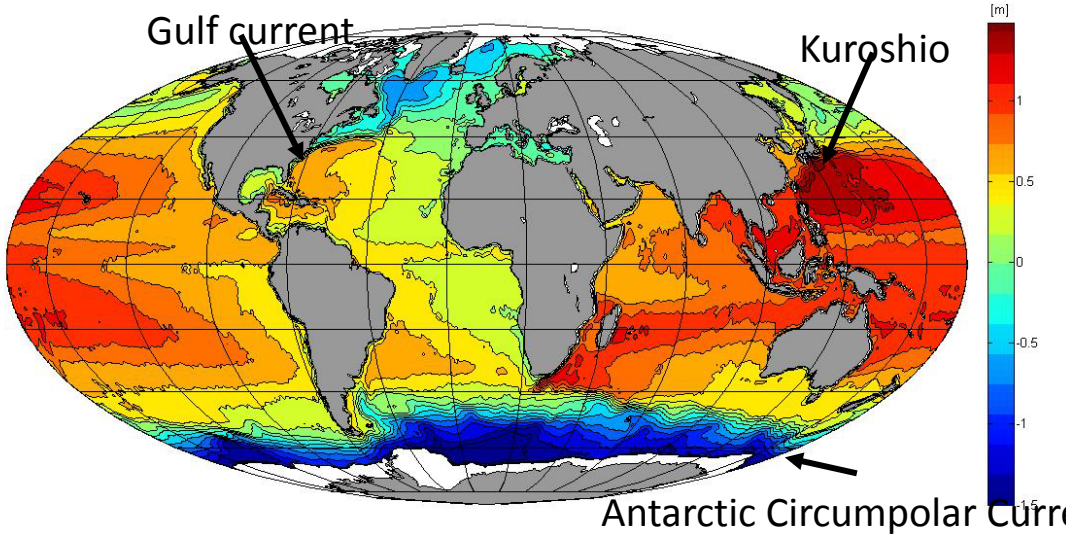
➔

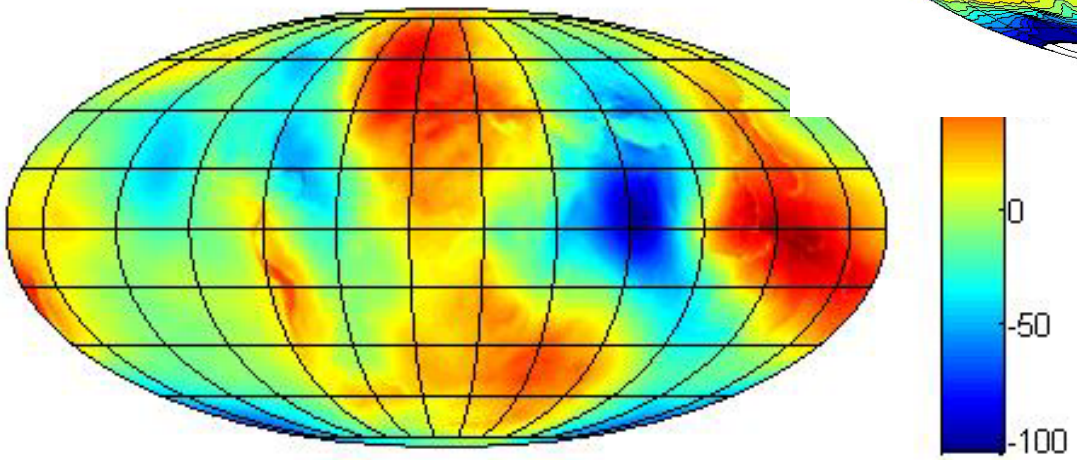


GOCE and oceanography



Mean Sea Surface
1992- 2010
from altimetry
(W. Bosch, 2011)

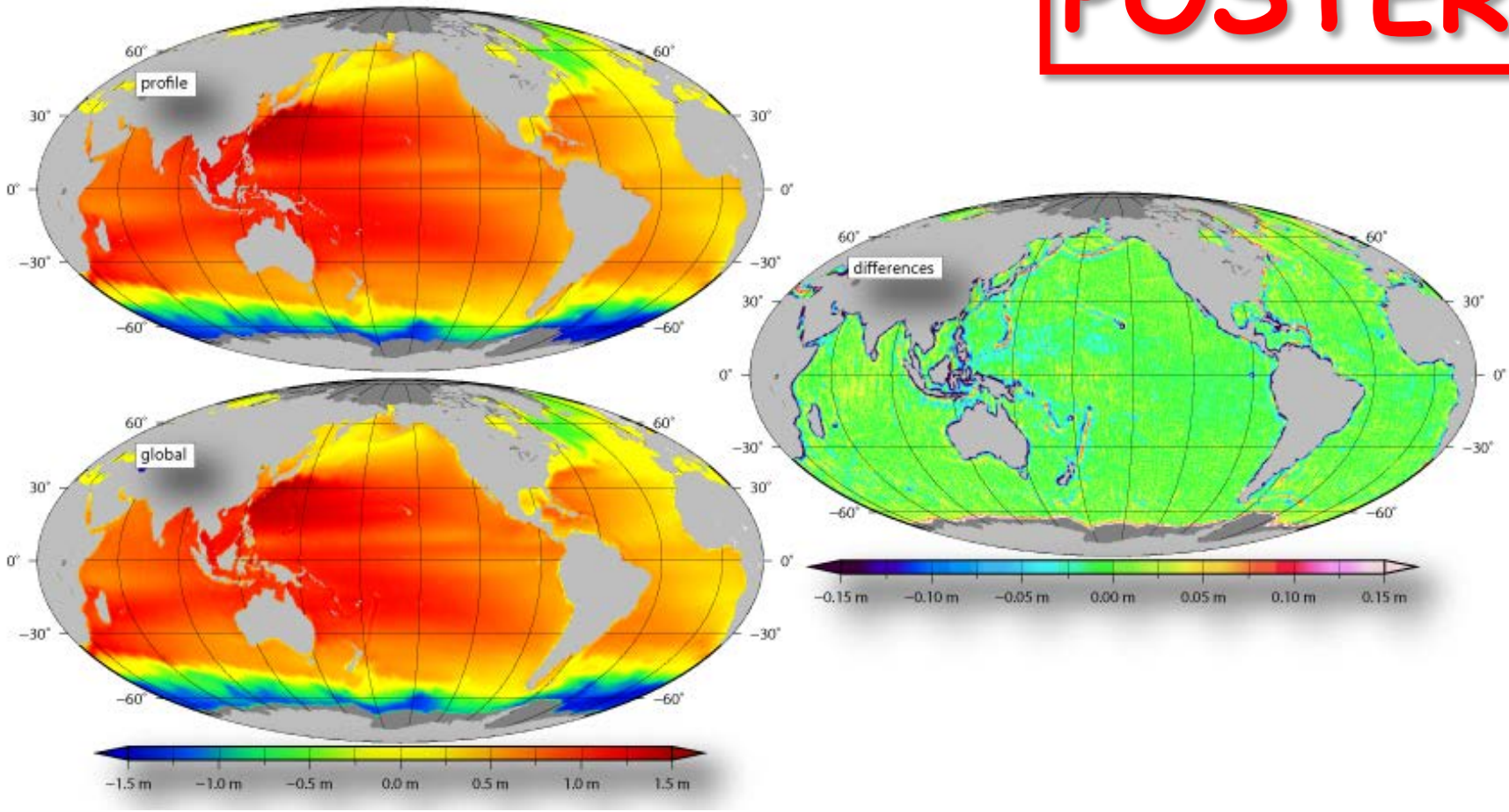




Geoid
based on six months
GOCE

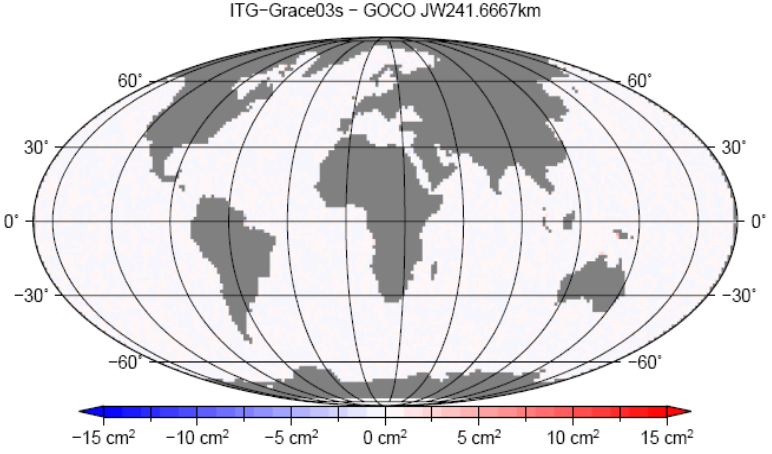
Differences between global and profile approach

POSTER

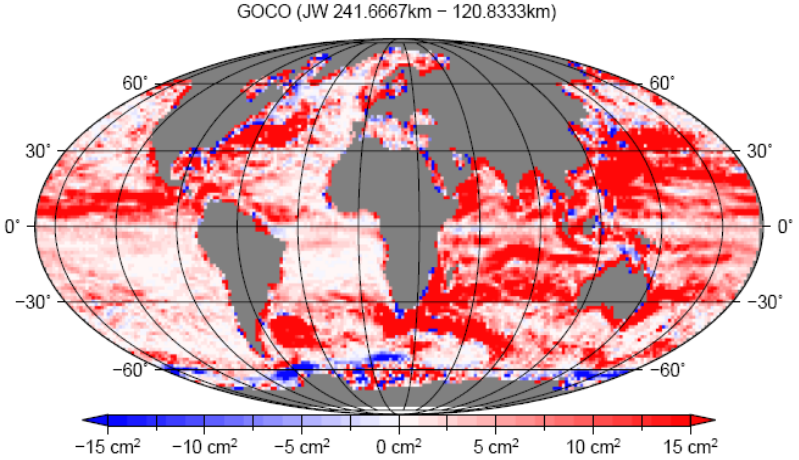


Gain in variance by lowering the filter length

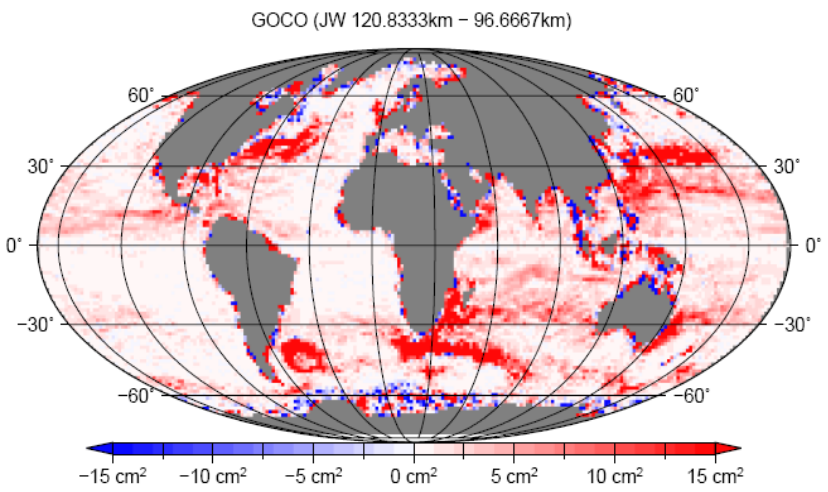
GRACE versus GOCE; Filter D=241km/L=60



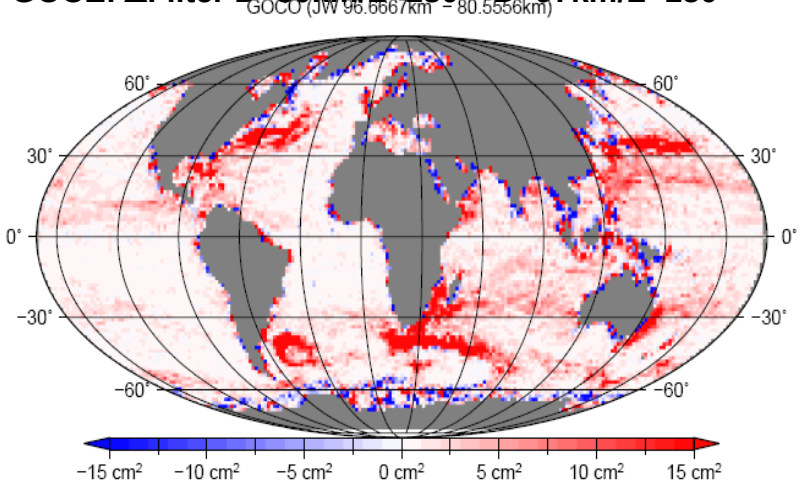
GOCE: ΔFilter D=121km/L=120 – D=241km/L=60



GOCE: ΔFilter D=97km/L=150 – D=121km/L=120



GOCE: ΔFilter D=80km/L=180 – D=97km/L=150

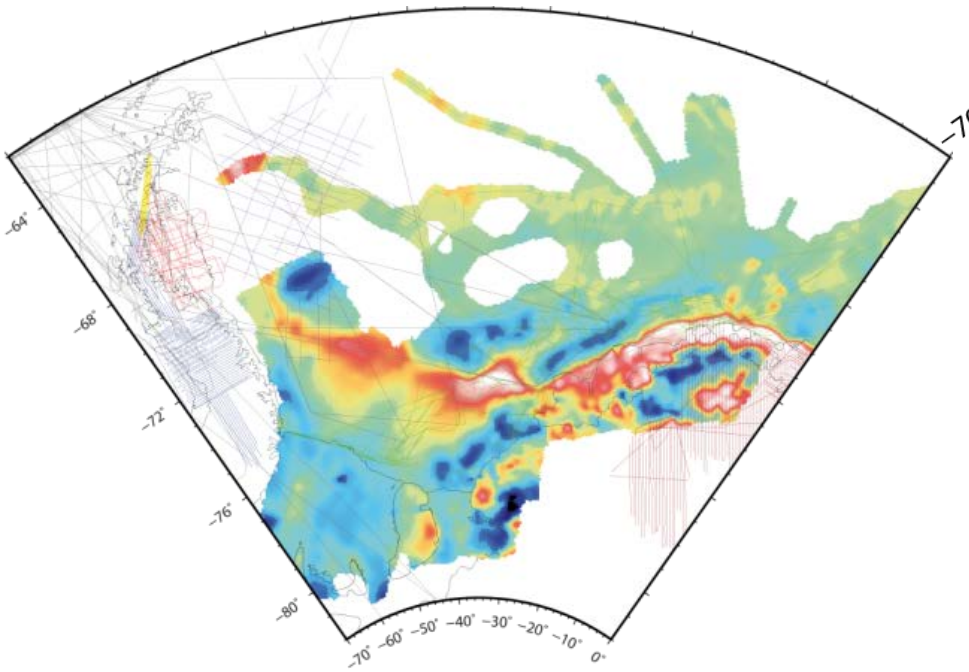


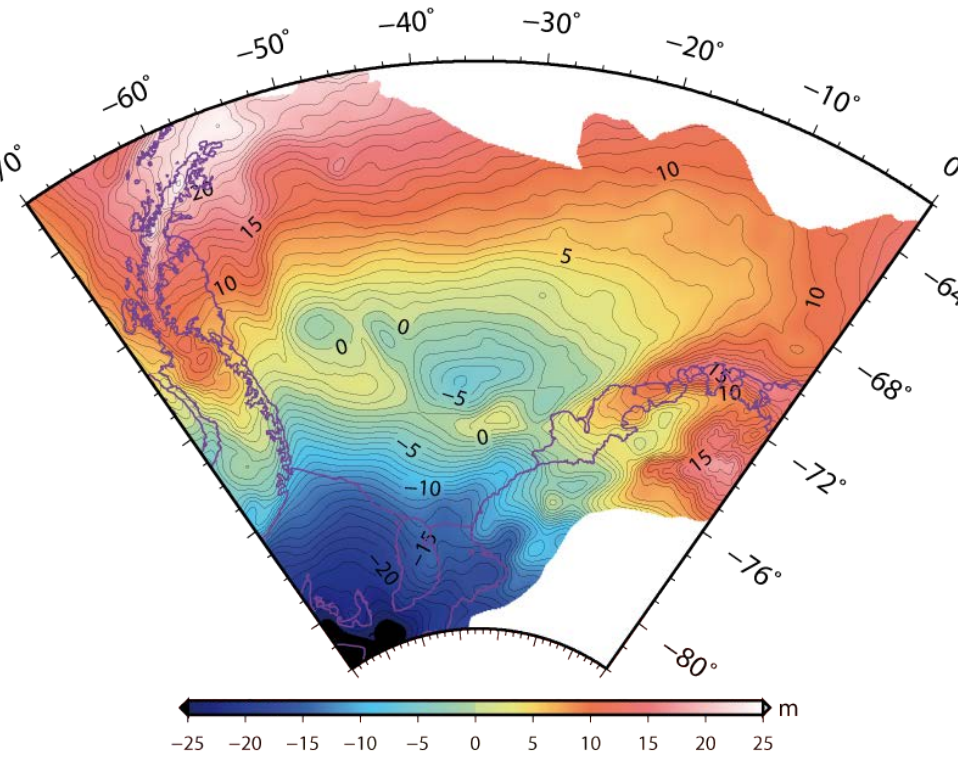
local geoid from terrestrial data ICESat and GOCE

POSTER

airborne gravity

N



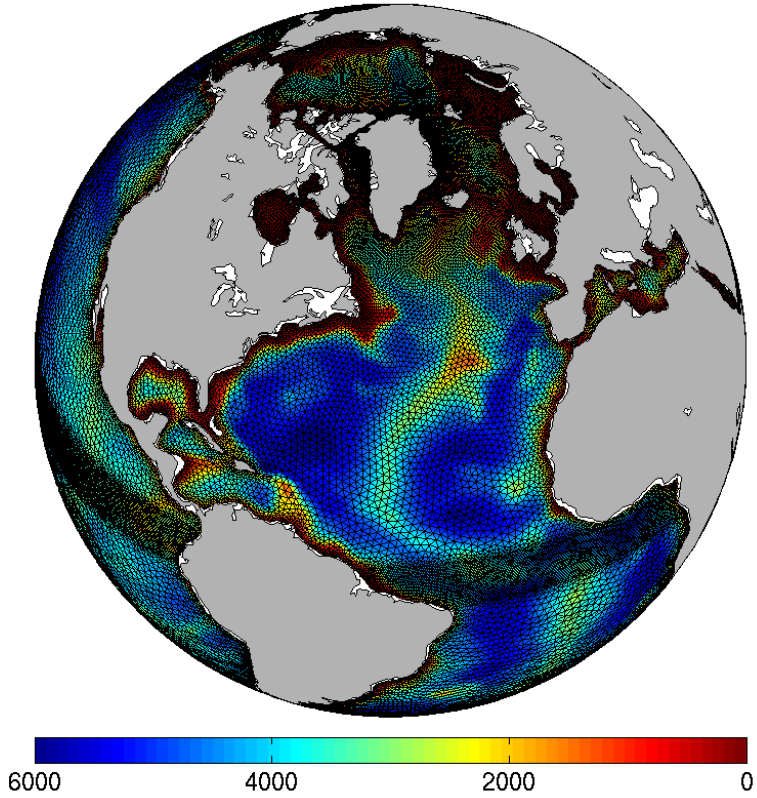


Assimilation of DOT in OGCM

- absolute DOT, mean + anomalies
- EnKF with weighting by error variance-covariance matrix
- assimilation of 10day maps

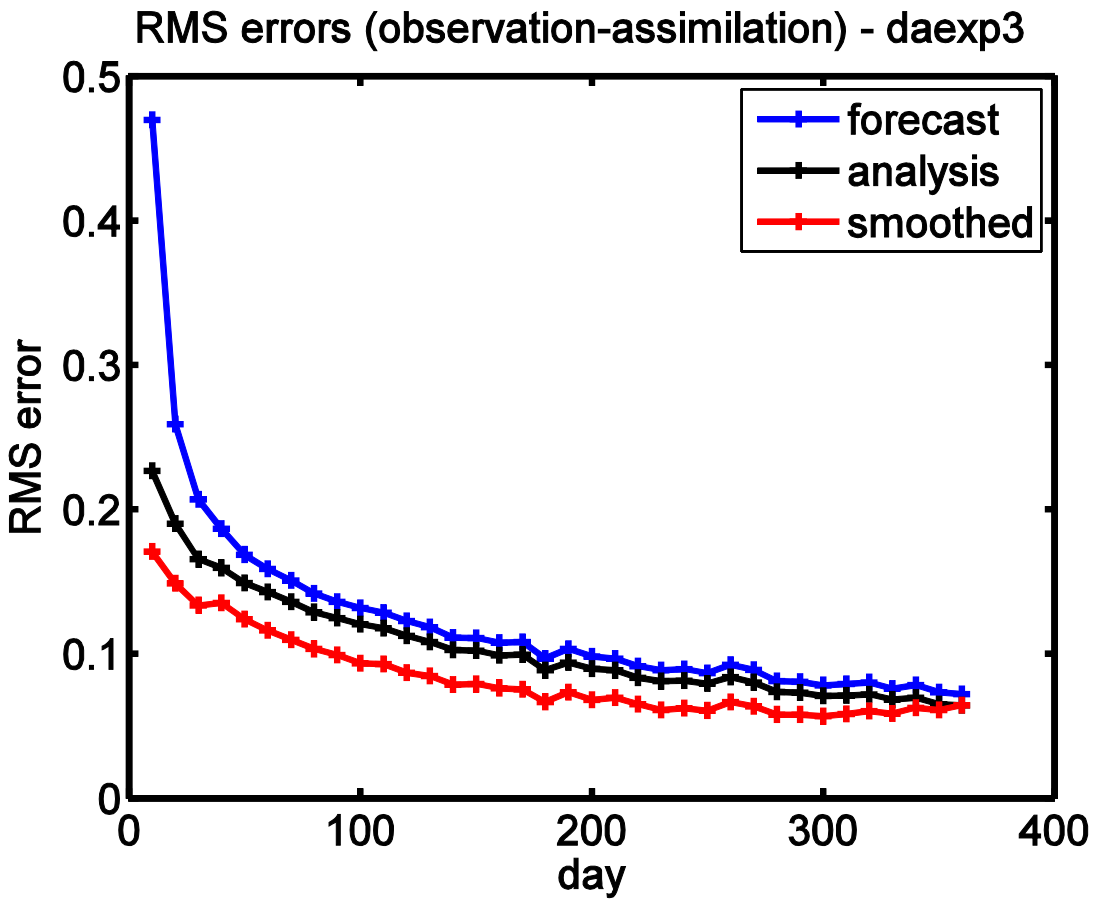
FESOM

- hydrostatic primitive equation Sea Ice- Ocean General Circulation model
- non linear free surface, boussinesq, GentMCWilliams, Smagorinski, KPP, Redi etc.
- freshwater flux is flux of volume and mass, no salinity restoring,
- resolution varies locally to include the impact of small scale processes on the global circulation



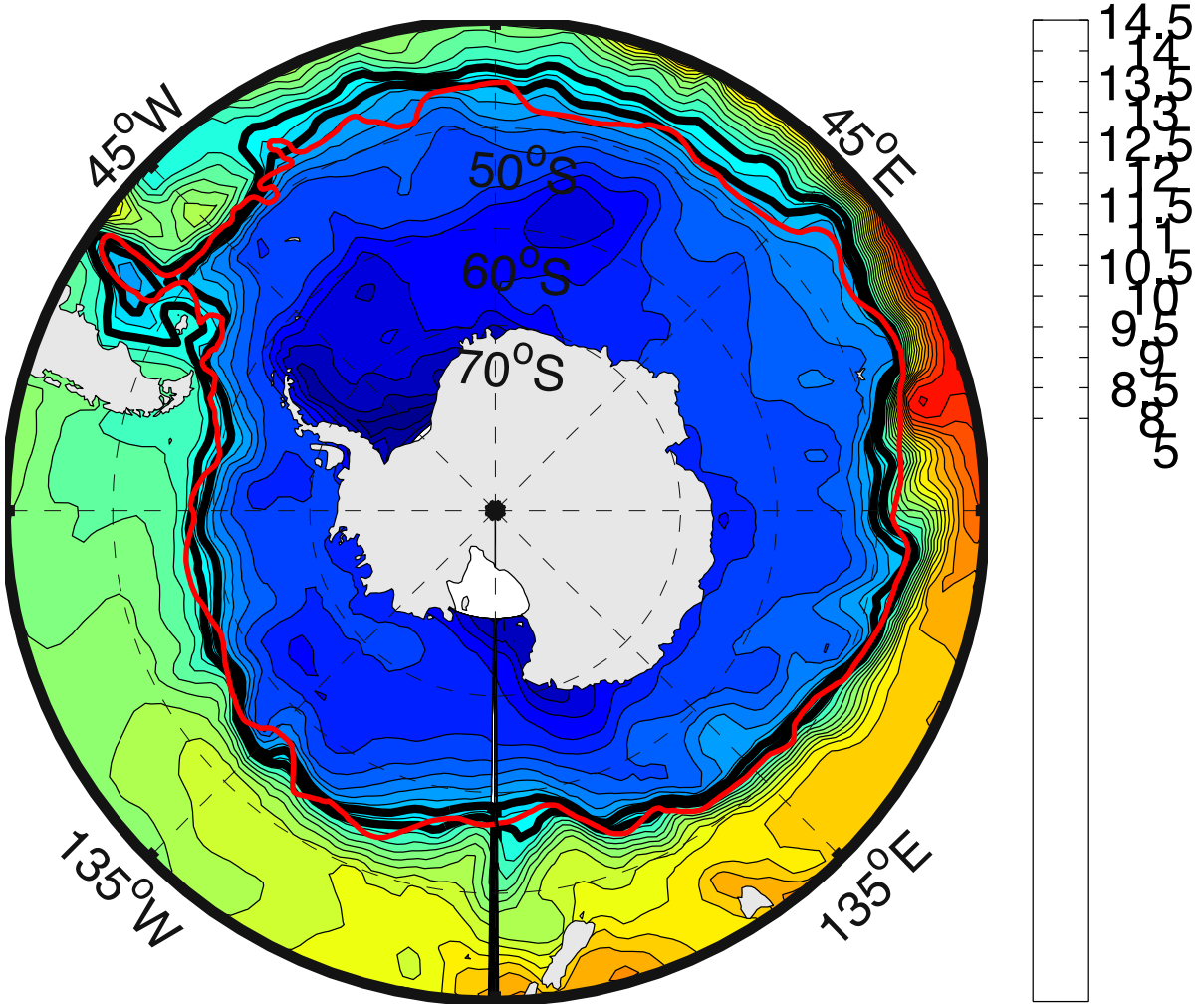
resolution:
20km to 150 km

Assimilation of DOT (d/o150) RMS differences [m], 2004



potential temperature 400m

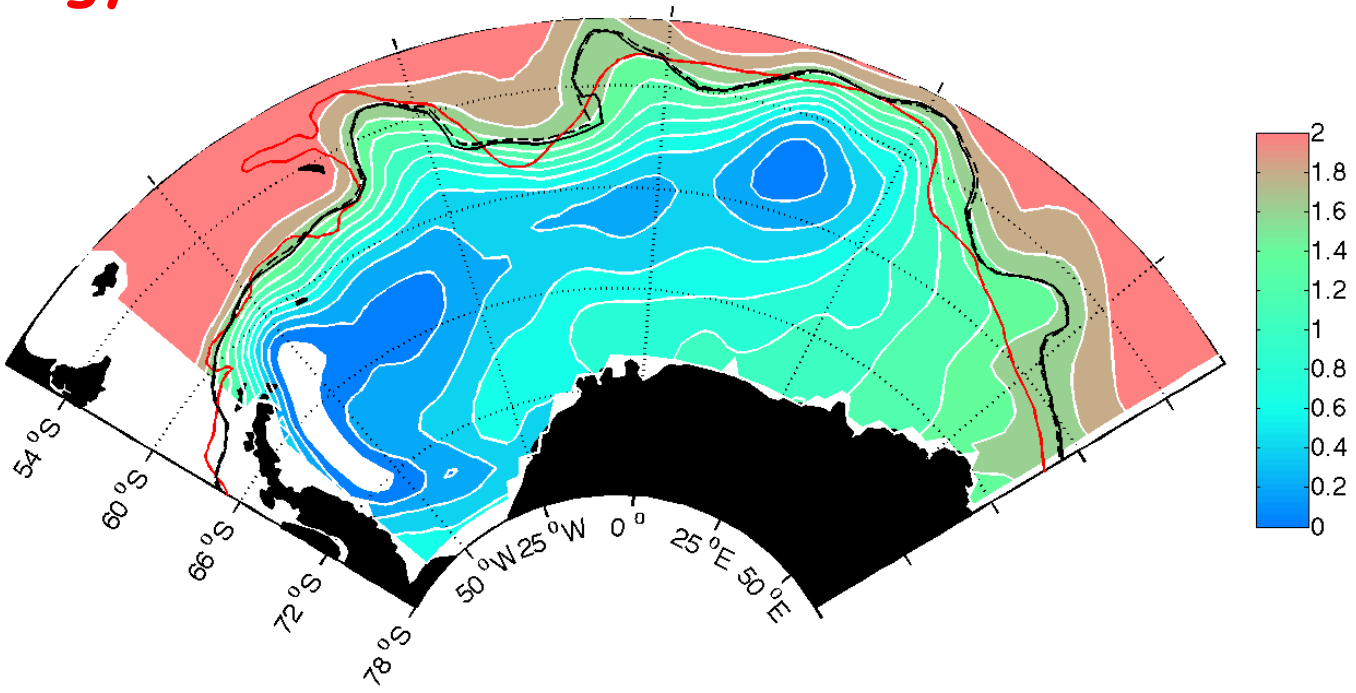
Sub Arctic Front
Orsi,climatology
assimilation



temperature in 800m in Weddell SEA

POSTER

southern ACC front
Orsi,climatology
assimilation



RMS error 0.4°C -> 0.2°C

We appreciate the funding be DFG SPP1257

good visibility of GEOTOP in national and international conferences and workshops

> 60 oral and poster presentations
> 20 conference papers and reports

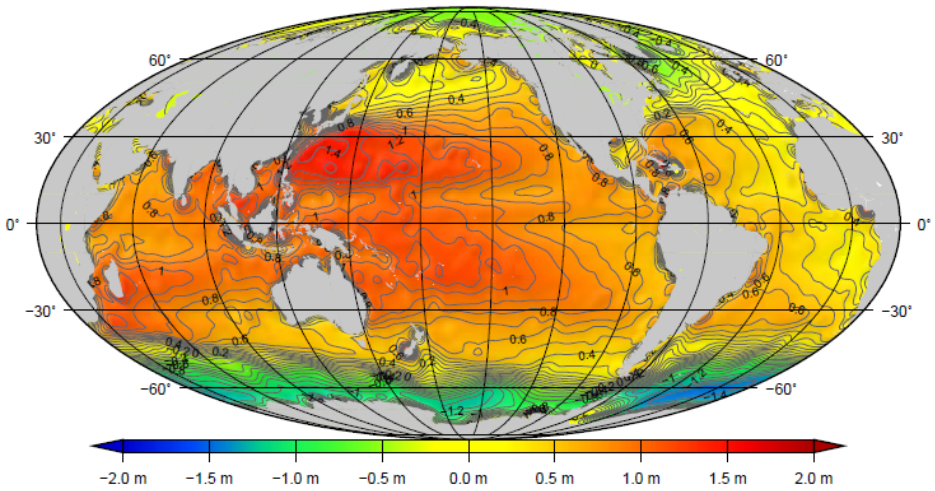
- Janjić T., et al. (2012) **Journal of Geodynamics**
- Albertella, et al. (2012):**Geophysical International Journal**
- Janjic et al. (2012 **Ocean Science**
- Albertella et al. (2012) DGFI/IAPG Report No.82
- Schwabe & Scheinert (2012) **Journal of Geodesy**
- Nerger et al.(2012) **Quarterly Journal of the Royal Meteorological Society**
- Nerger et al. (2012) **Monthly Weather Review**
- Nerger & Hiller W. (2012) **Computers & Geosciences**
- Janjic et al. (2011) **Monthly Weather Review**
- Janjic et al. (2011) **Journal of Geodynamics**
- Dettmering & Bosch (2010) **Marine Geodesy**
- Albertella & Rummel (2009) **Journal of Geodesy**
- Rollenhagen et al. (2009) **Journal of Geophysical Research**
- Skachko et al.(2008) **Ocean Science**

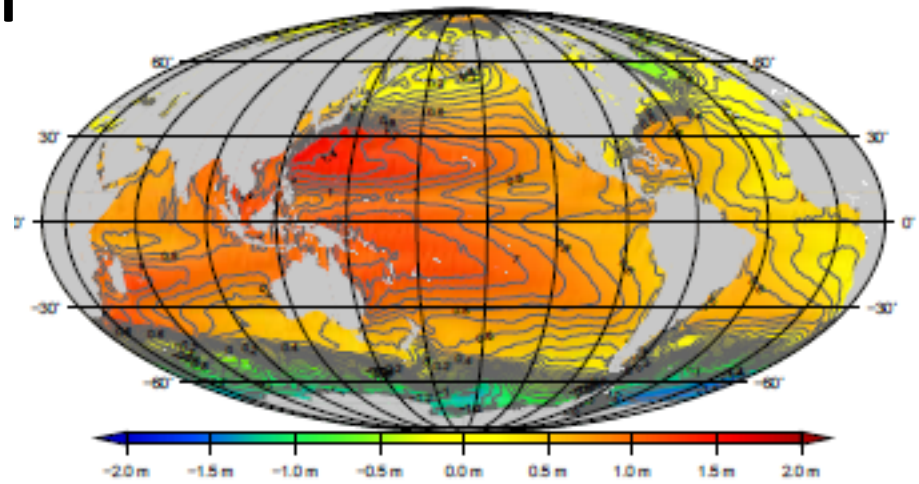
Results

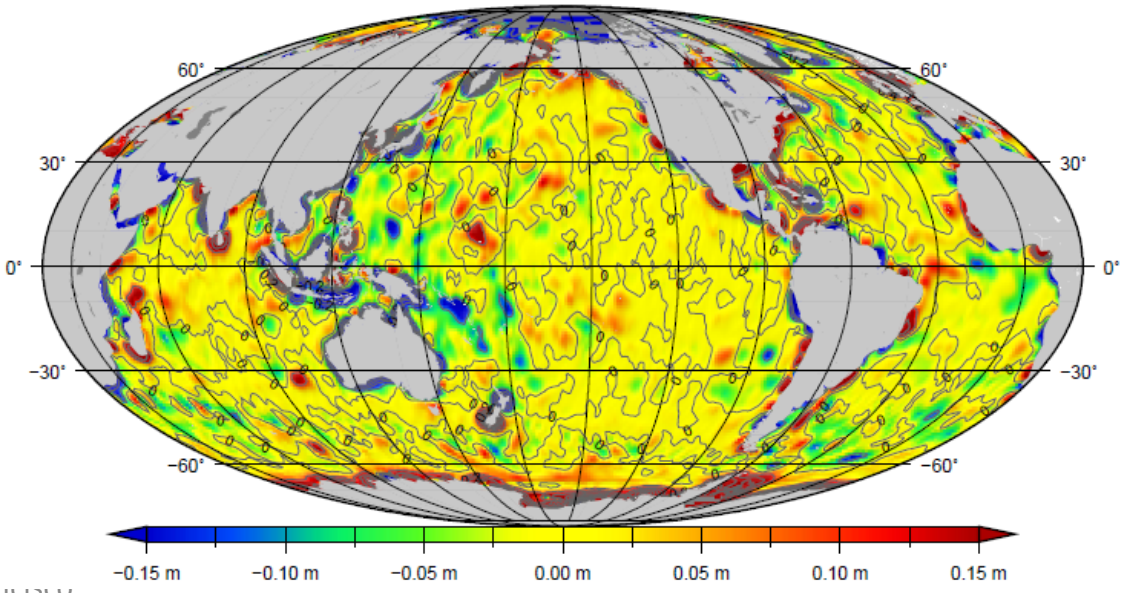
- DOT in two approaches are reliable but different in detail, mostly small scale and coastal
- strong impact of GOCE on oceanic fronts and temporal variability
- impact of ICESat in Weddell Sea

AWI TUM DGFI TECHNISCHE UNIVERSITÄT DRESDEN

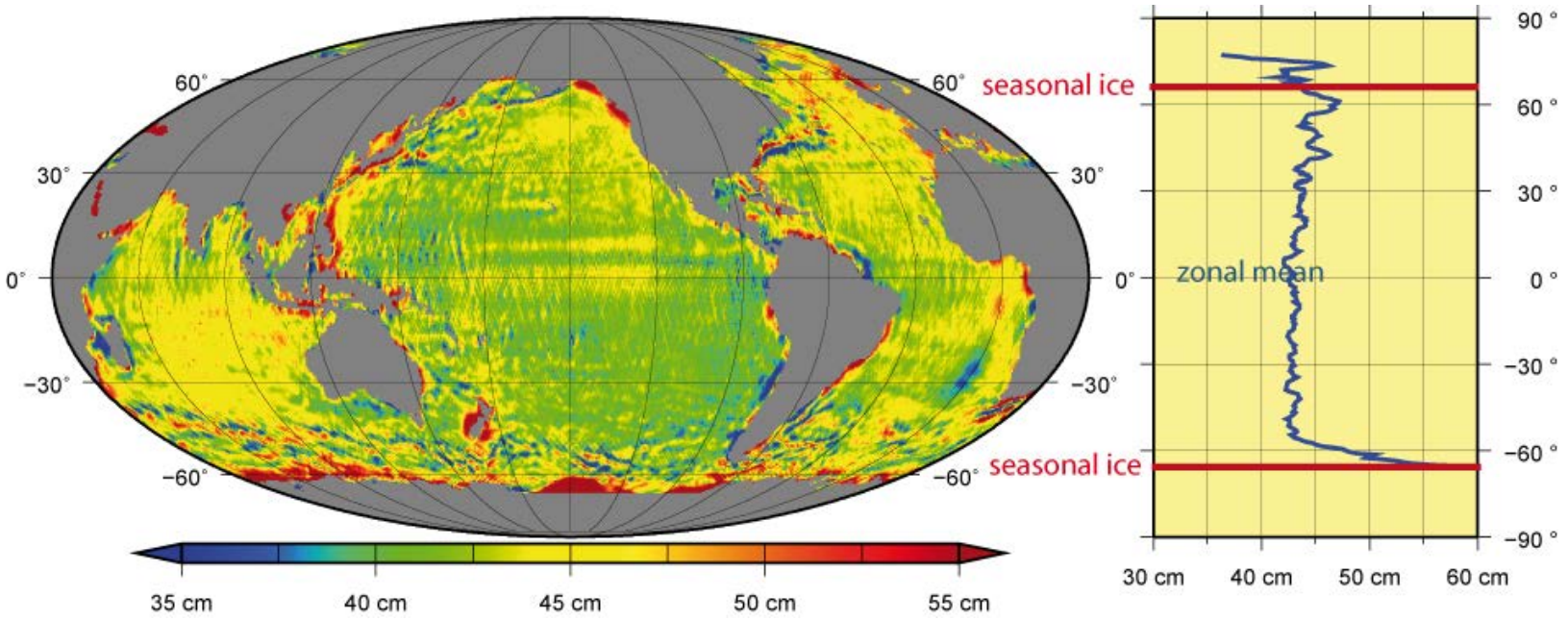
Global DOT (left), Profile DOT (right), Diff's





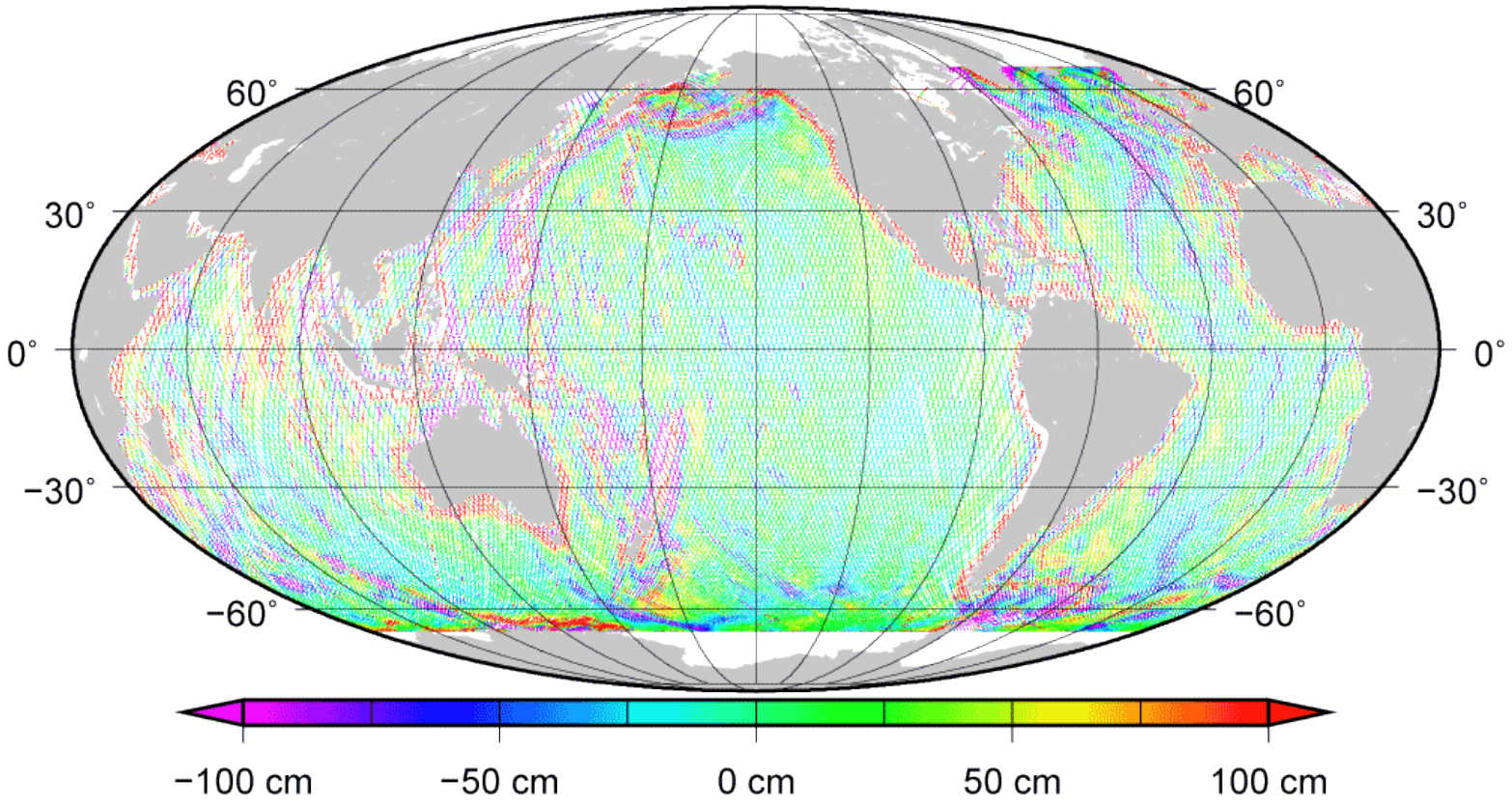


Diff Maximenko ´09 – MiDOT, period 1992-2002



Filter correction (with EGM2008, N_{max} = 2190)

DOT = 1D[*h*] + (2D[N_{EGM08}] – 1D[N_{EGM08}]) - 2D[*N*]



DOT

- apply spectral expansion for N, SSH
  a) treat SSH over land as missing
  b) extend SSH over land

- apply spatial expansion for N, SSH
  treat 2D filtering (N) and
  1D filtering (alongtrack altimetry)
  with filter correction

Determination of the mean sea-surface topography in sea-ice covered areas (Weddell Sea)

utilizing **ICESat** release 31 (02/2003 – 10/2009)

classification problem, solved by:
lowest-level filtering in a remove-compute-restore technique

working steps:
- ICESat specific corrections/reductions
  - o correction of offsets (*global MMXO*)
  - o robust outlier elimination
  - o DAC reduction
  - o ocean tide reduction (*EOT11a*)
  - o geoid reduction (*EGM2008, d/o 2190*)
- median filter, interpolation, restore
- final Gauss filter (d/o 210, 69 km halfwidth)

conclusions:
- ICESat delivers suitable data to determine sea-surface heights in (partly) ice-covered Southern Ocean
(only static surfaces)
- further improvement by careful application of techniques and by combination with Cryosat-2 data

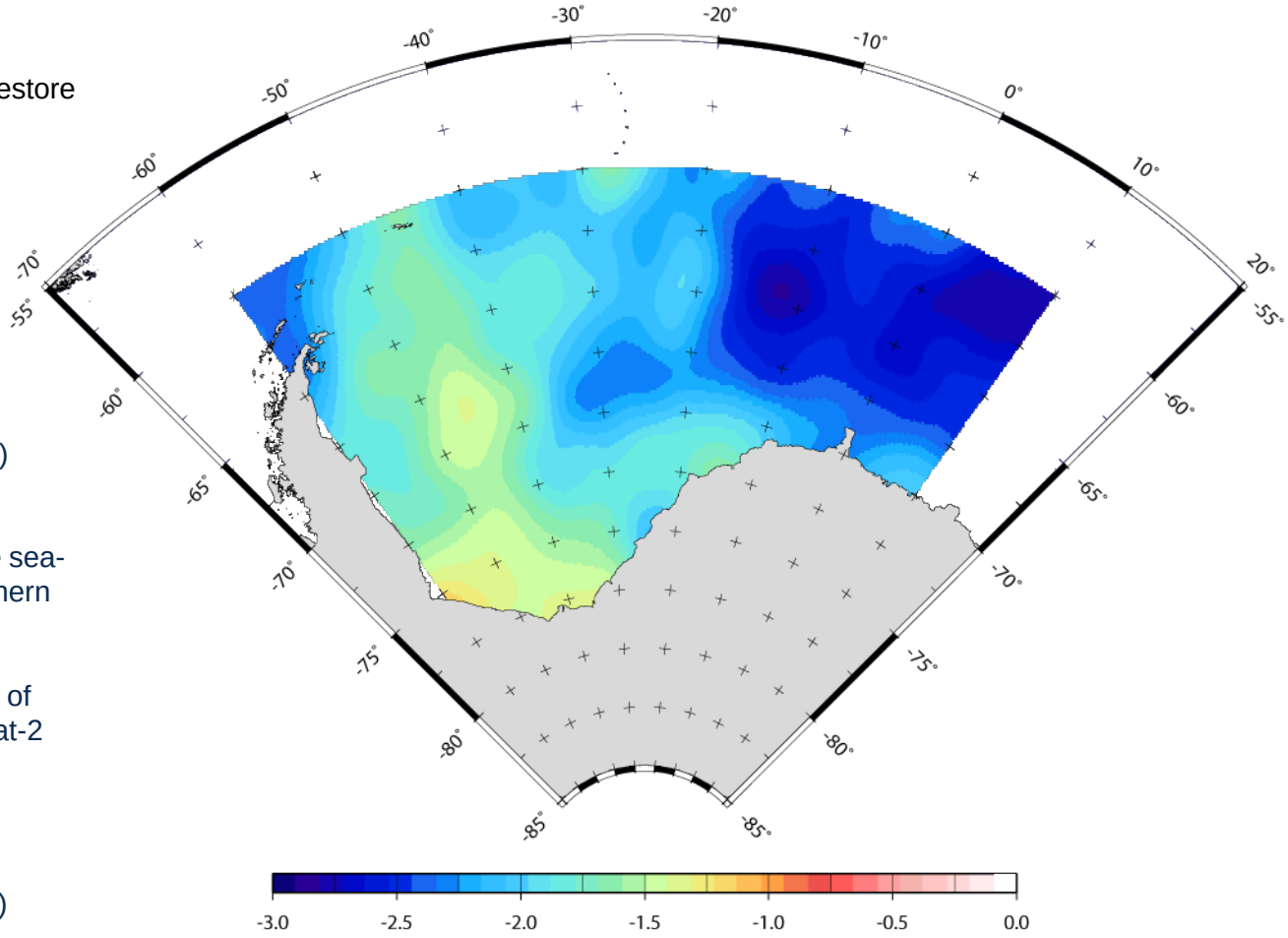


Fig.: **mean sea-surface topography**
(referenced to GOCO02S) (unit: meter)

TECHNISCHE UNIVERSITÄT DRESDEN

Projekt: SCHE 1426/6
Mirko Scheinert, Joachim Schwabe
diploma thesis: Verena Lieb (2011)

Regional Geoid Improvement in the Weddell Sea region

utilizing heterogeneous data
remove-compute-restore technique
least-squares collocation

background model: GOCO02S (Pail et al., 2010)

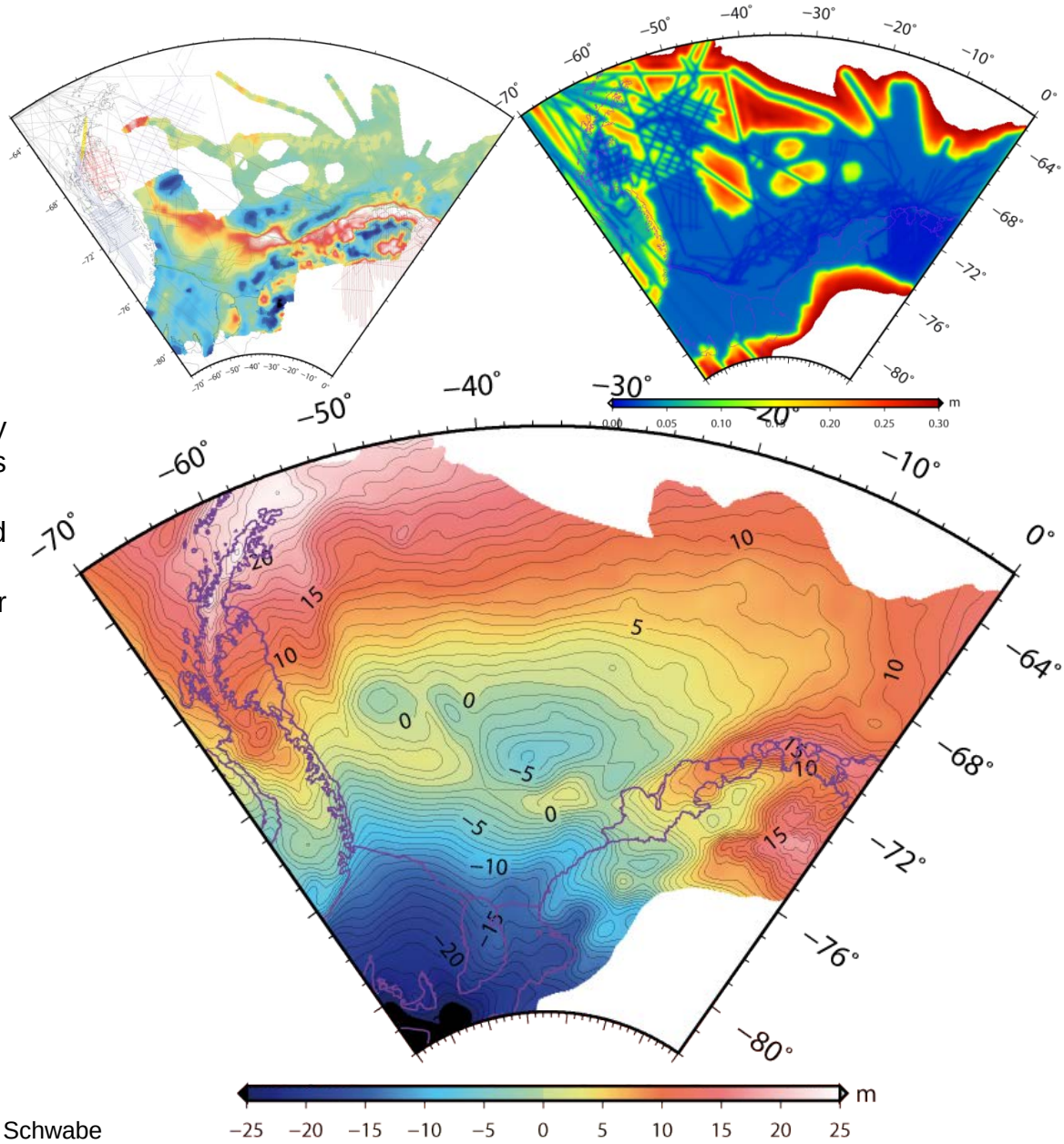
upper left: terrestrial and airborne gravity anomalies

right: improved regional geoid

upper right: prediction error

conclusions:
• GOCE already delivers reliable information
• more signal added at shorter wavelengths by incorporation of terrestrial gravity anomalies
• a more complete terrestrial data coverage would further improve the solution

Schwabe & Scheinert (2012):
Journal of Geodesy (in review)



TECHNISCHE UNIVERSITÄT DRESDEN

Projekt: SCHE 1426/6
Mirko Scheinert, Joachim Schwabe

legrand vergleich
sr3 etc
glolbal + localization