DTU Space
National Space Institute

Towards

A combined mean dynamic topography model – DTU17cMDT.

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Towards DTU17cMDT:

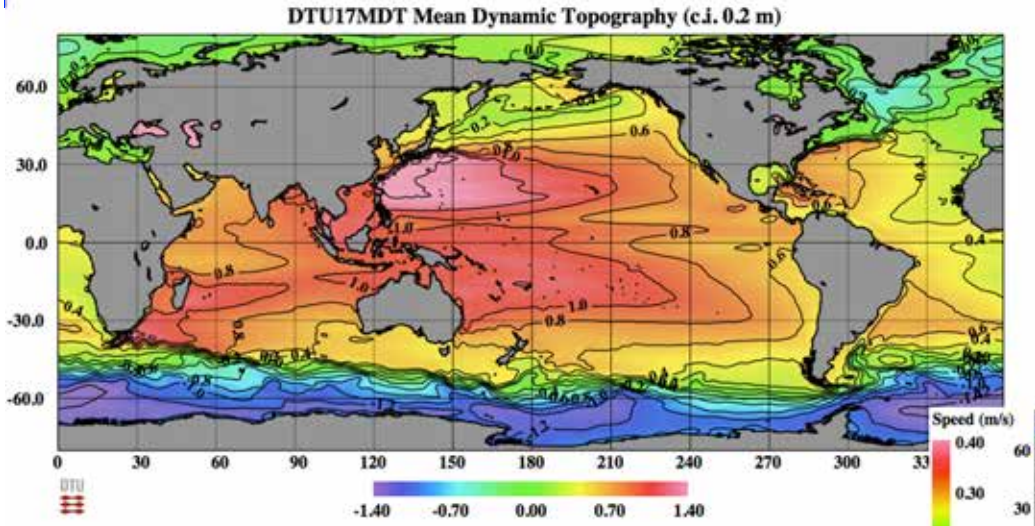
Build on DTU17MDT - a purely geodetic MDT.

- DTU15MSS (improved in coastal and polar areas),
- OGMOC geoid combination/hybrid model (GRACE + GOCE + surface gravity + Eigen-6c4 to d/o 2160),
- Improved filtering (fine tune ½-width and anisotropy).

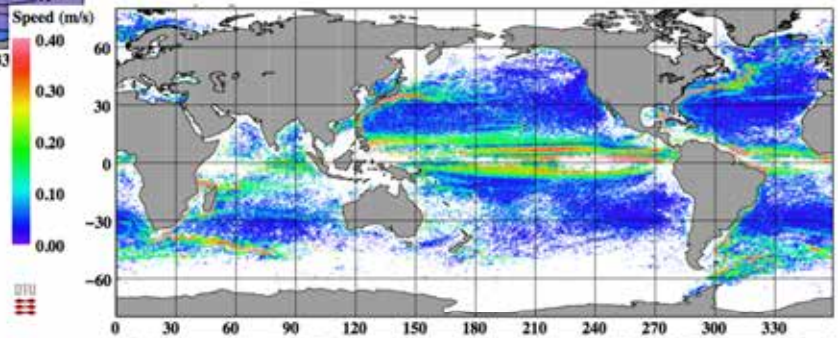
Integration with mean drifter velocities:

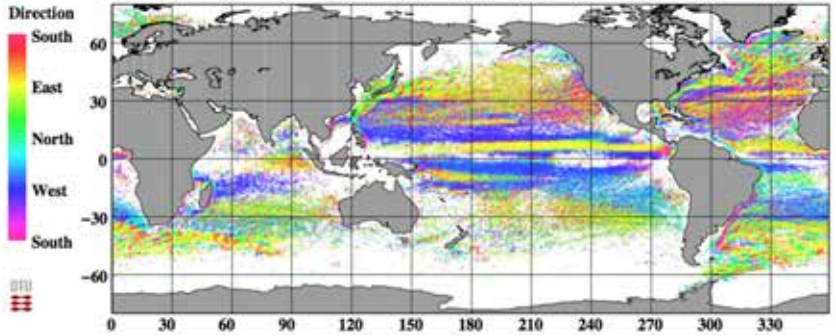
- Processing of drifter velocities (Ekman + Aviso GCA (20y)),
- Comparisons and error assessment (MDT and mean velocities),
- Model set-up and inversion (Smoothing).

DTU17MDT



Poster: GEO_003





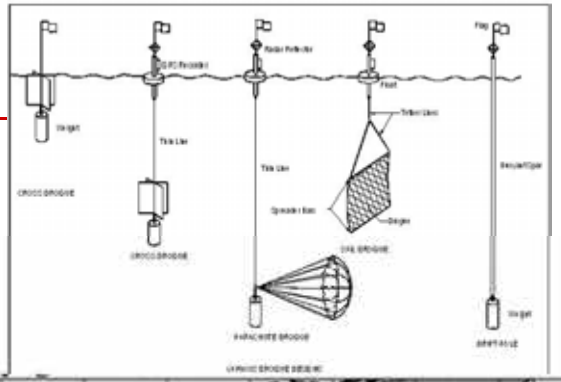
Comparison with drifter means

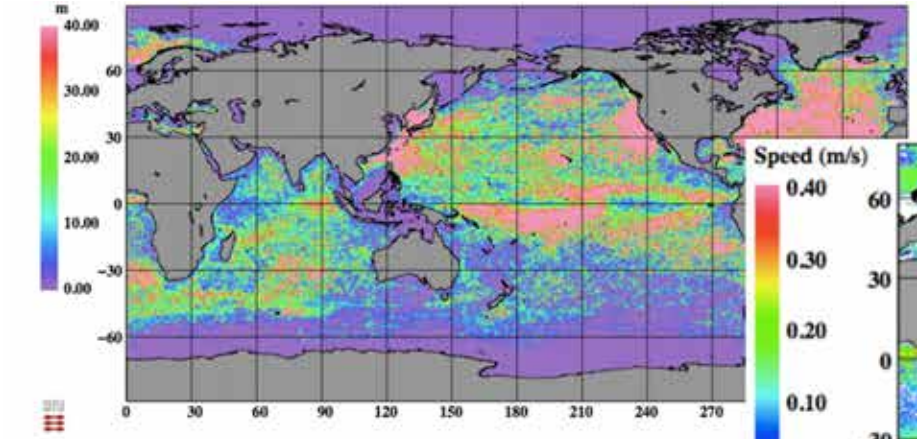
- Stats: [cm/s]

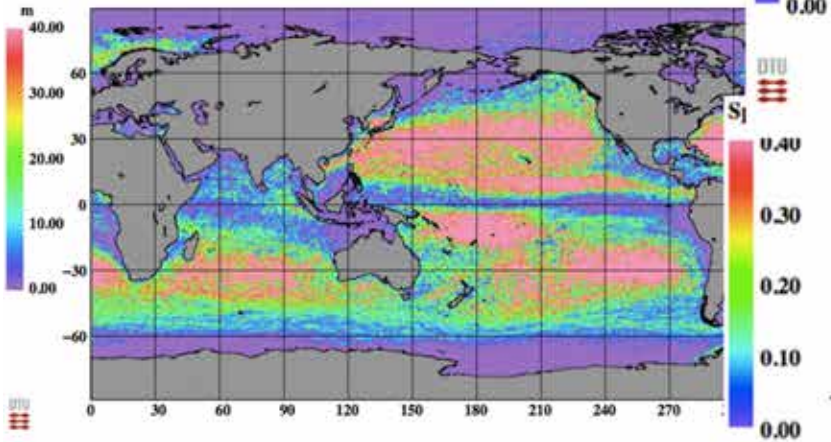
lat 10-30		lat 30-50	
u	v	u	v
4.9	5.5	4.7	4.7

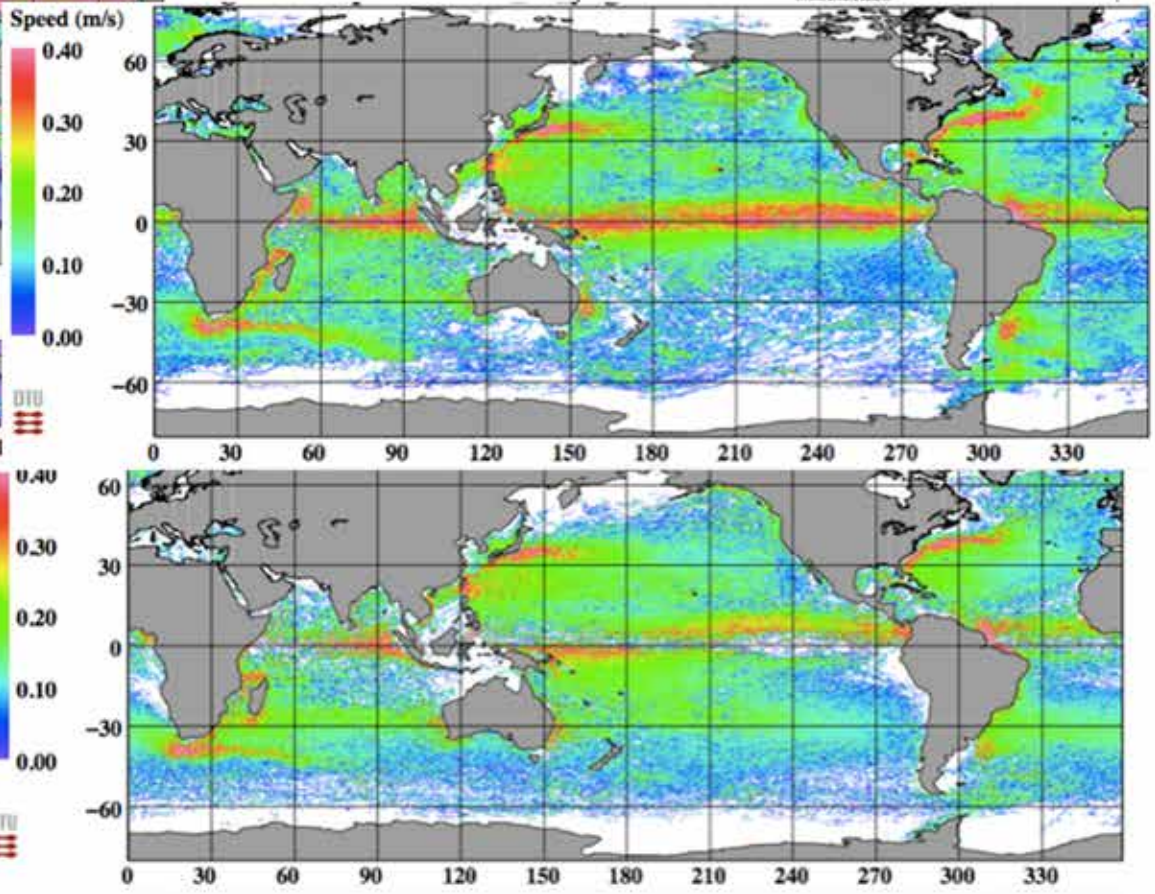
Processing of drifters

Drogued and un-drogued drifters.

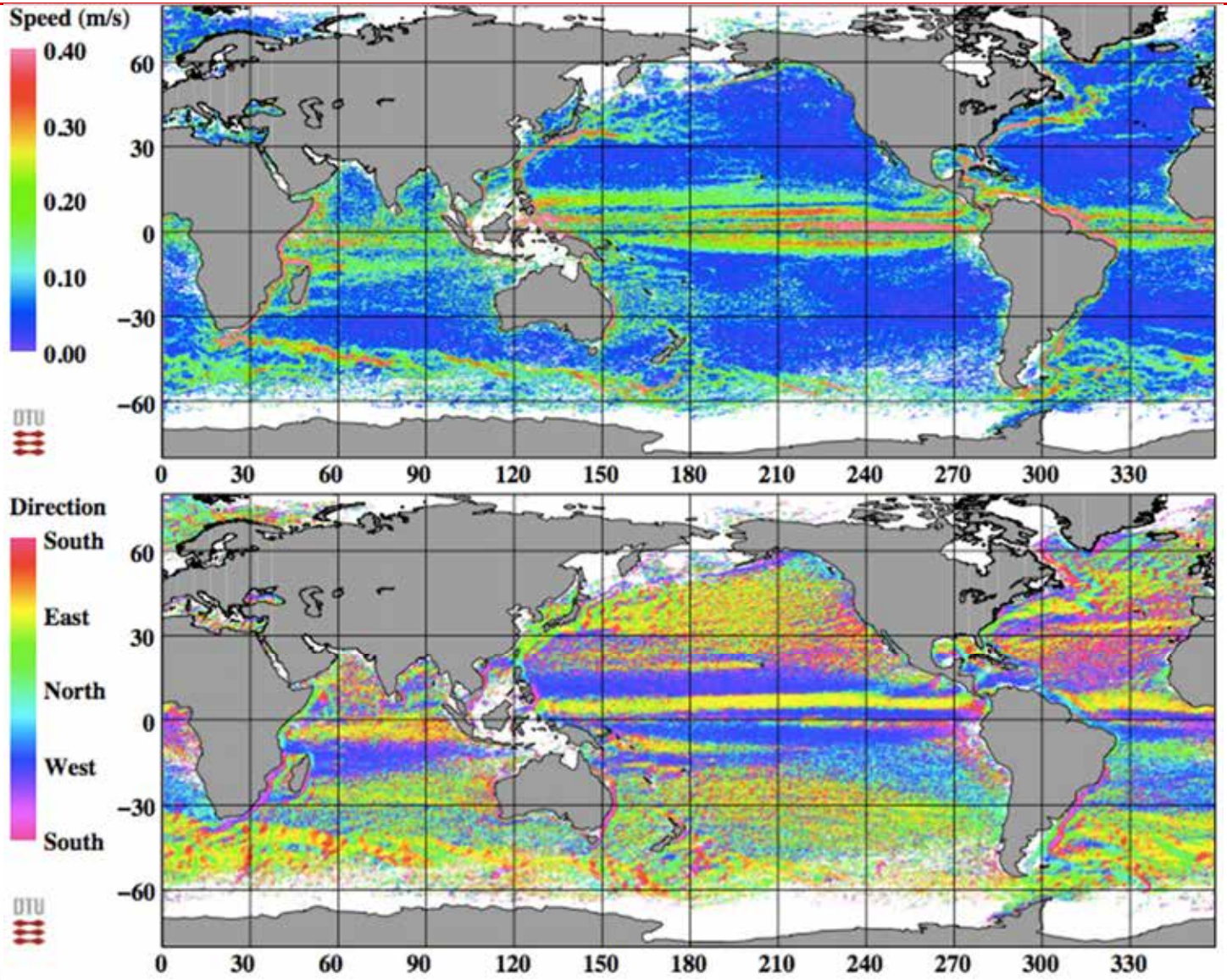








Merged set of mean drifter velocities



Comparison of Geodetic MDT with Drifter MDT

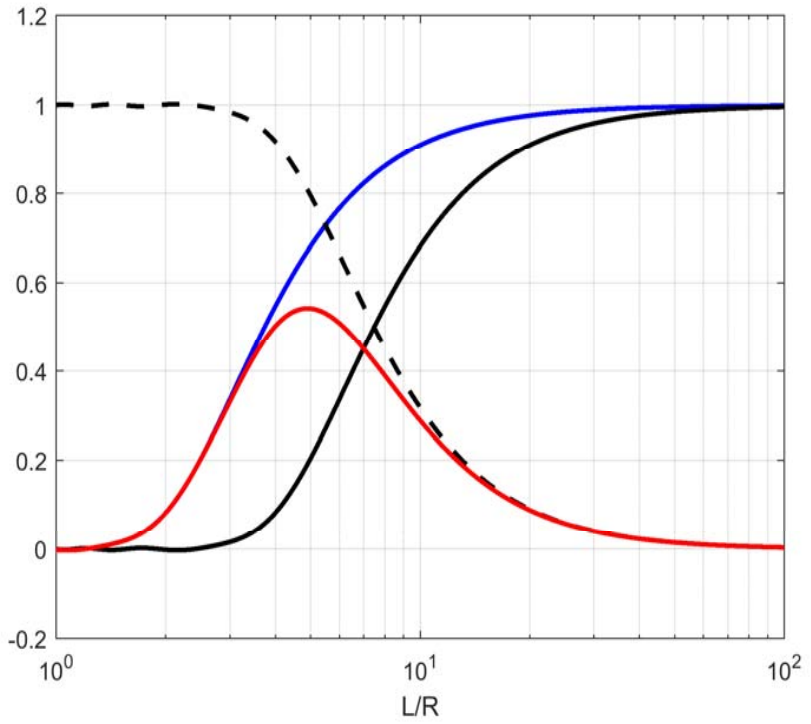
Comparison between mean dynamic topography gradients, derived from DTU17MDT and drifters at different space scales:

16 bands were selected: $L_i = 50\ km \cdot 2^{i/2}$, I = 0:15 – with the shortest at 50 km and longest at 9051 km.

Applied at:

1. Drifter MDT
2. DTU17MDT
3. Differences

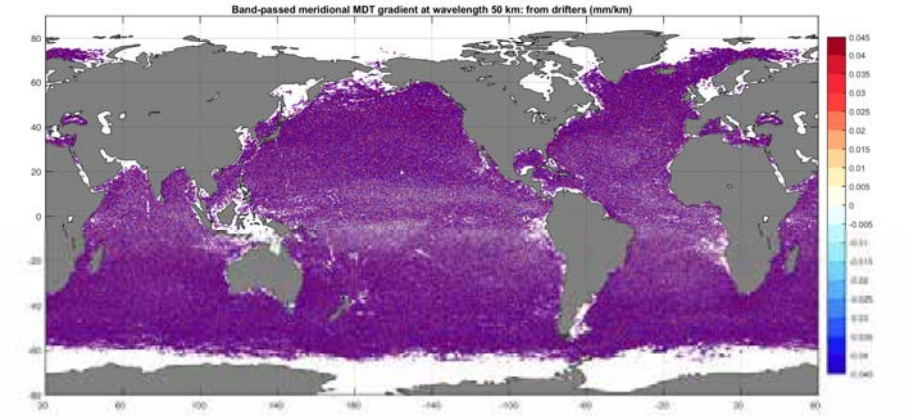
For both zonal and meridional gradients. (96 plots.!)

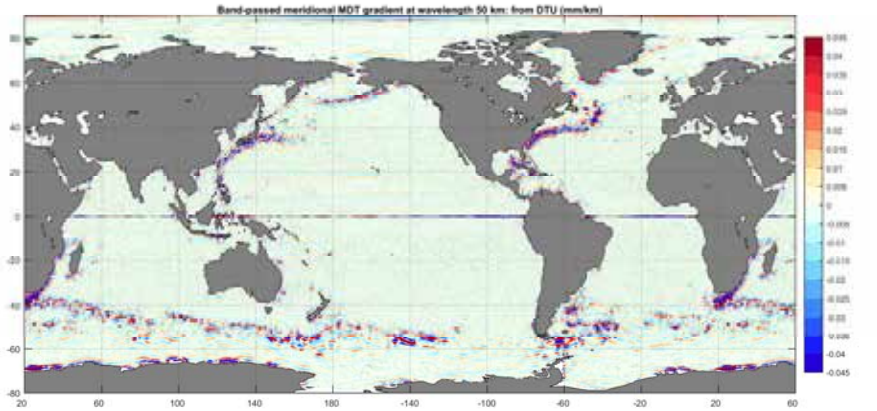


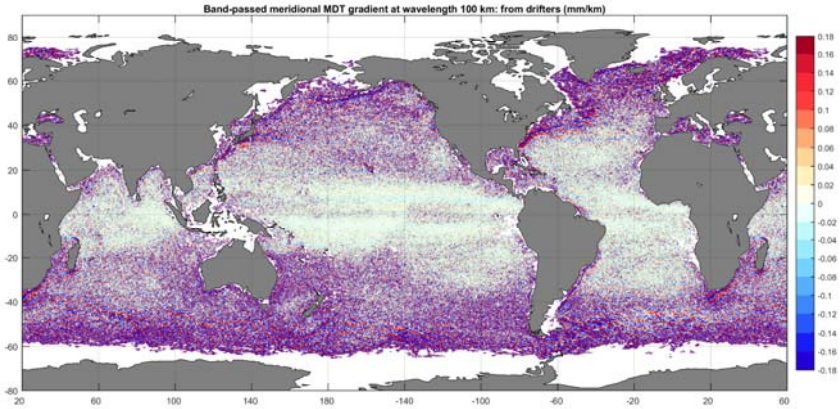
Comparison of Geodetic MDT with Drifters

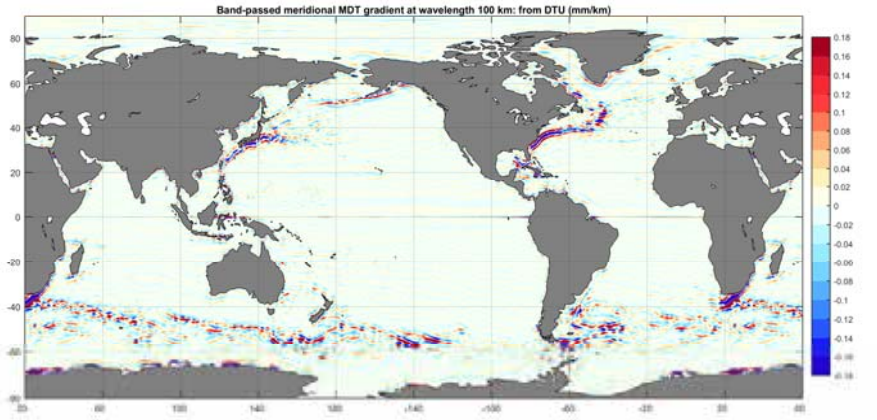
Meridional gradients at 50 km and 100 km

Drifter MDT and DTU17MDT:





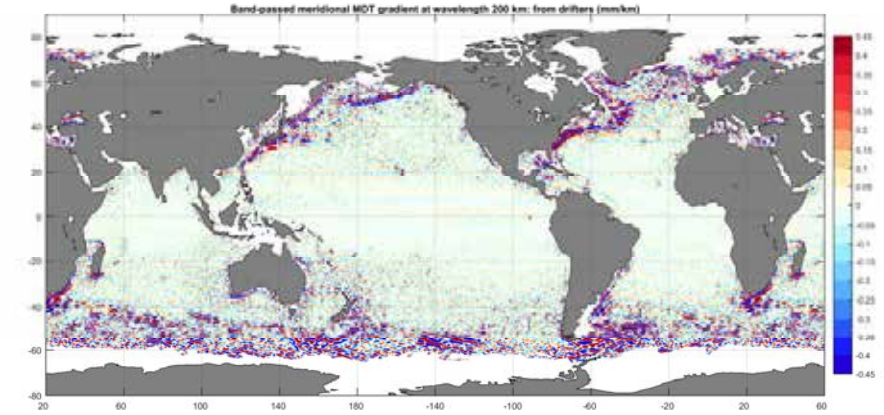


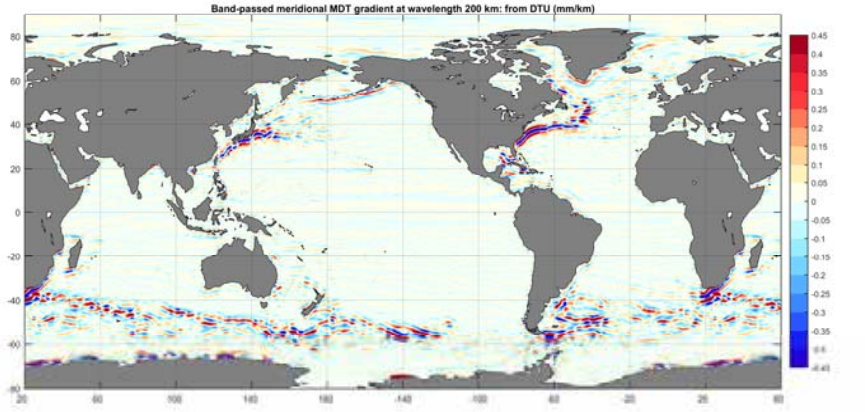


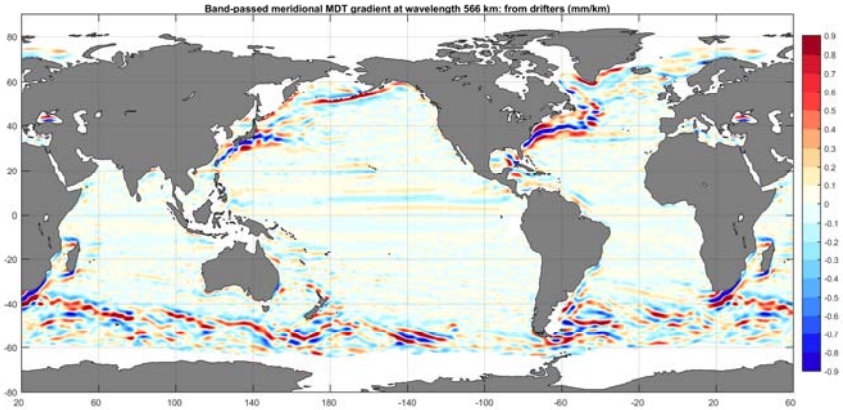
Comparison of Geodetic MDT with Drifters

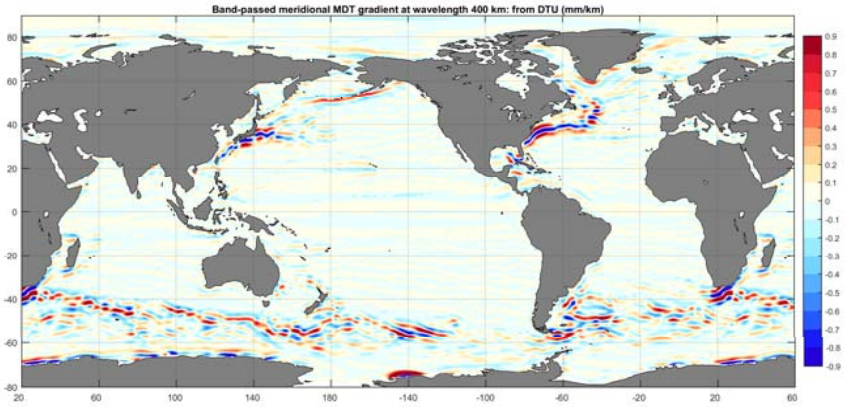
Meridional gradients at 200 km and 400 km

Drifter MDT and DTU17MDT:



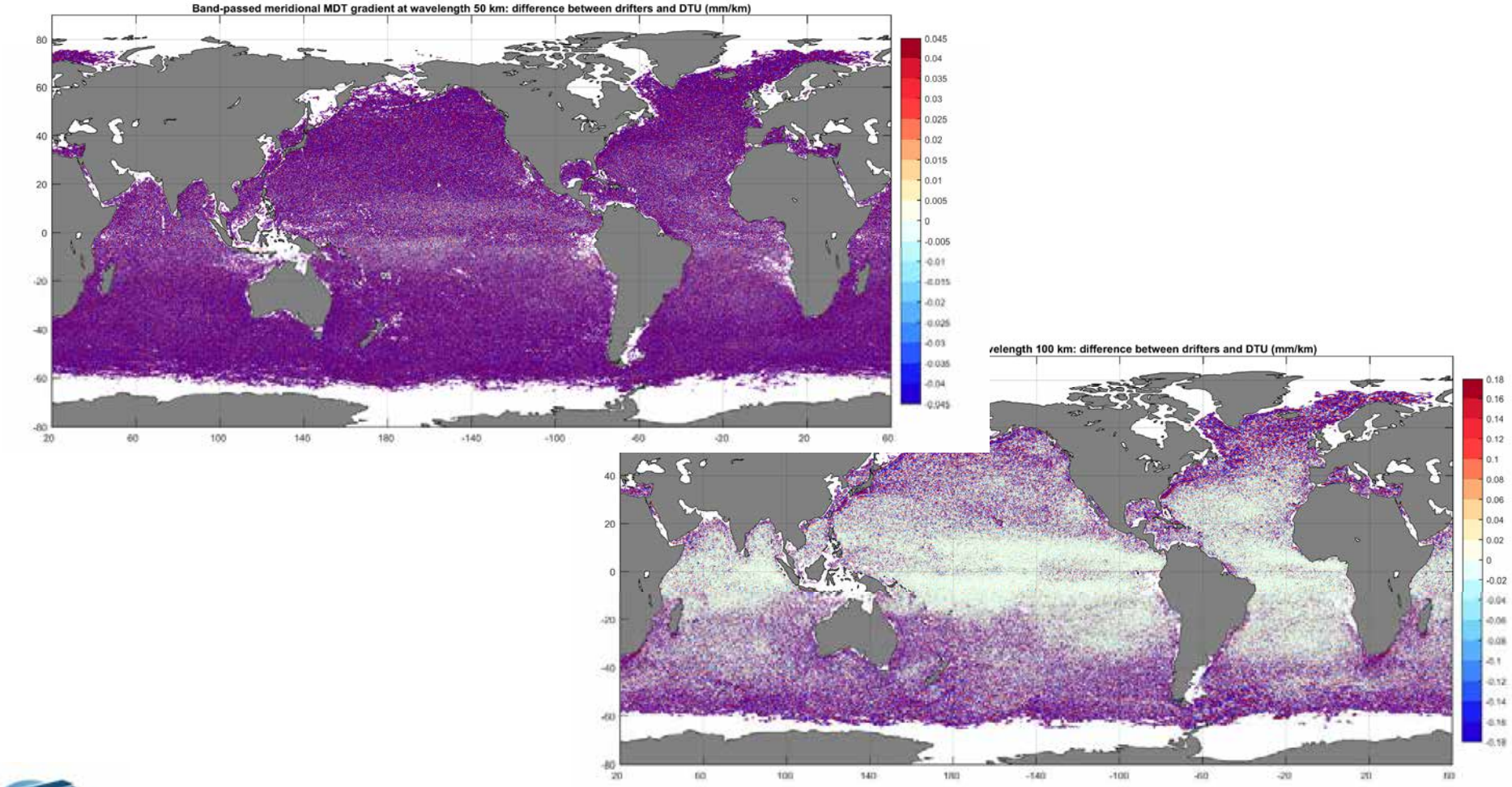






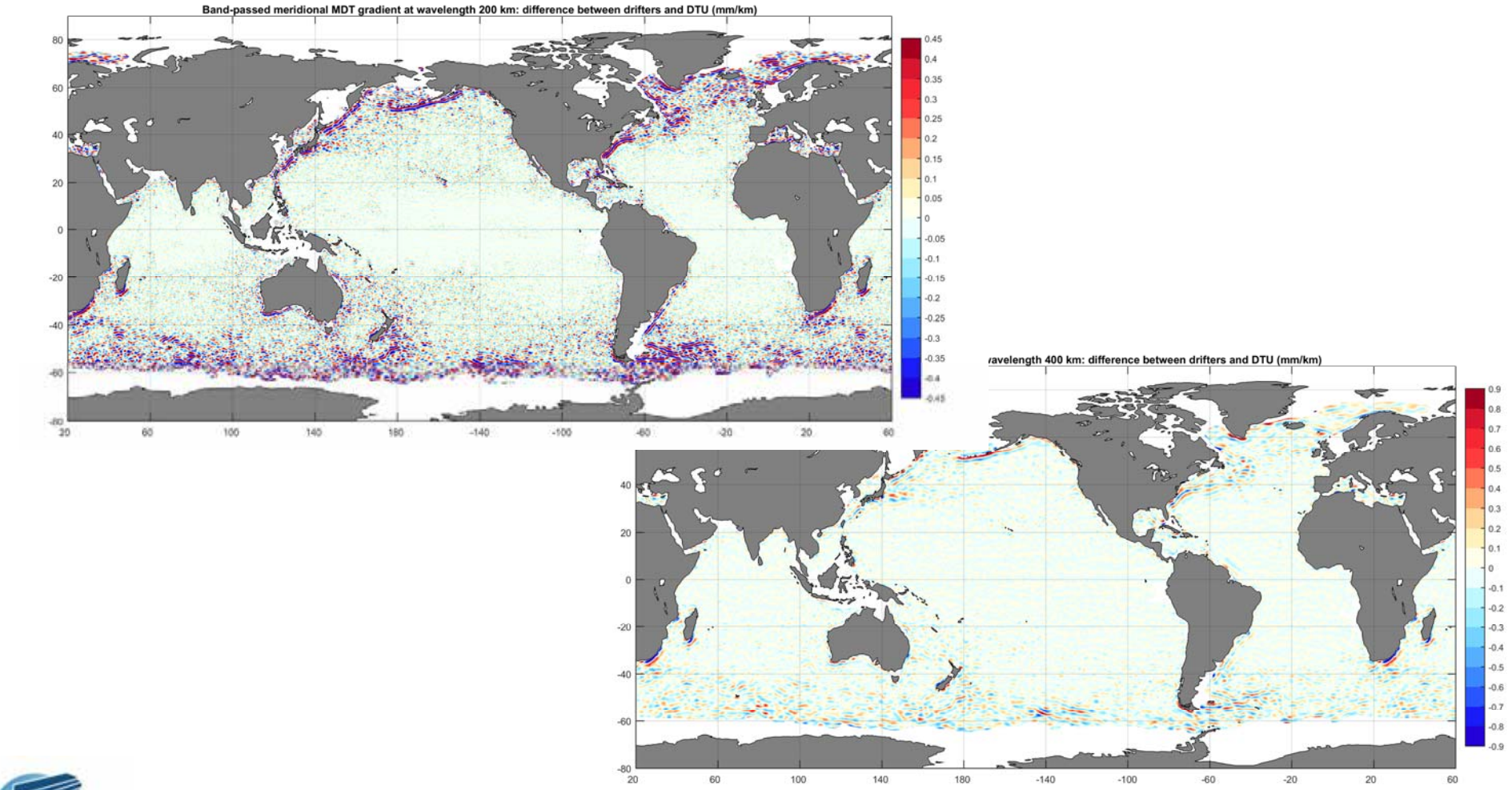
Comparison of Geodetic MDT with Drifters

Meridional gradients at 50 km and 100 km of differences



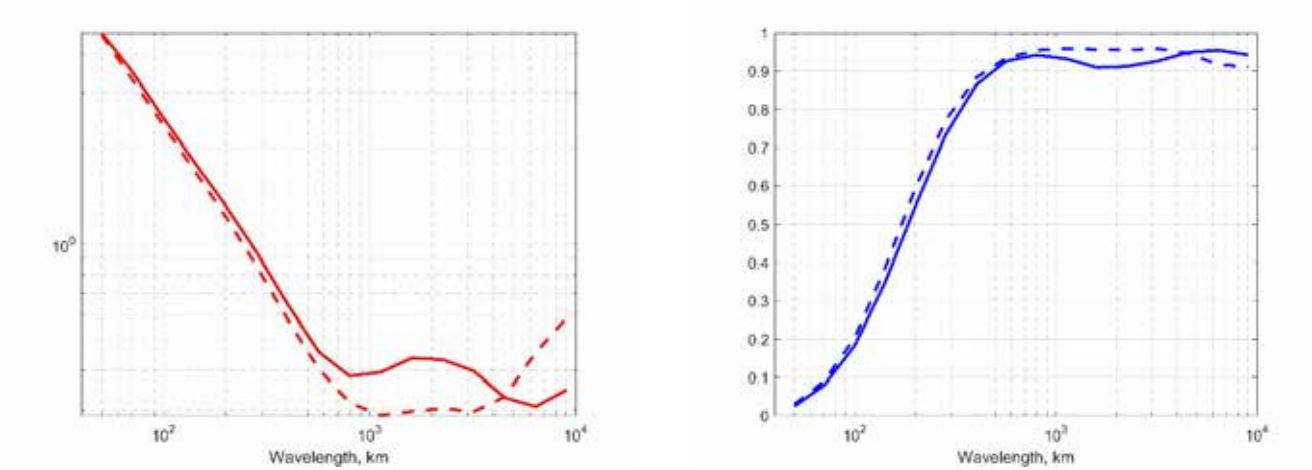
Comparison of Geodetic MDT with Drifters

Meridional gradients at 200 km and 400 km of differences



Comparison of Geodetic MDT with Drifter MDT

Comparison between mean dynamic topography gradients, derived from DTU17MDT and drifters at different space scales:



(a) Ralative r.m.s. difference between zonal (solid line) and meridional (dashed line) MDT gradient estimates.

(b) Correlation coefficient between zonal (solid line) and meridional (dashed line) band-passed signals from oceanographic and geodetic MDT gradient products

Inversion

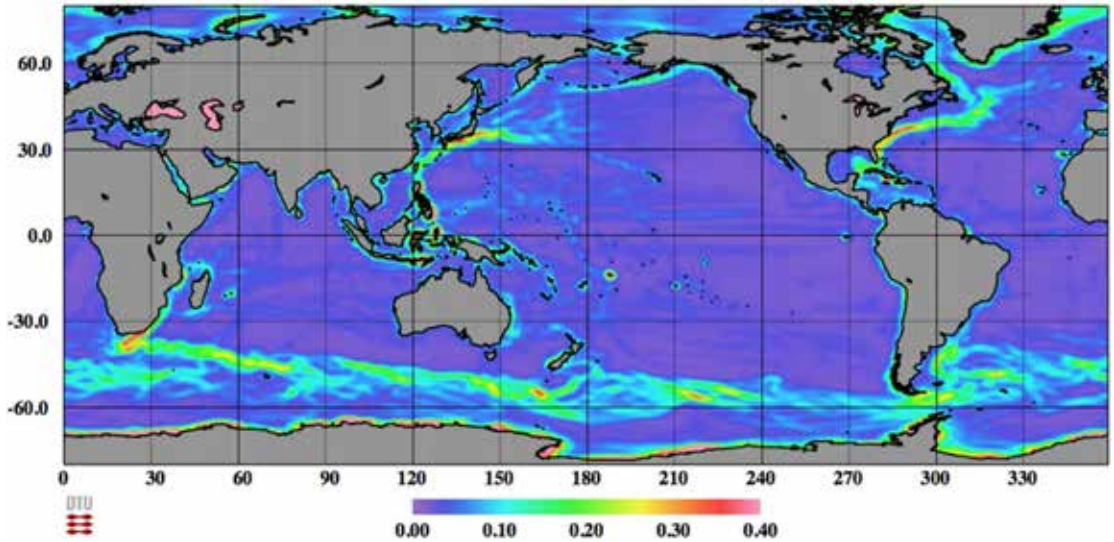
Model: MDT heights at nodes of a regular ¼ by ¼ deg grid.

Minimizing the cost function:

$$F = \sum(MDT - MDT_{geodetic})^2 + C_{gradient} \cdot \sum(\nabla MDT - \nabla MDT_{oceanographic})^2 + C_{smoothness} \cdot \sum(\Delta MDT)^2$$

Consider errors

- Mean drifter velocities: e ~ 1/sqrt(n)
- MDT error:



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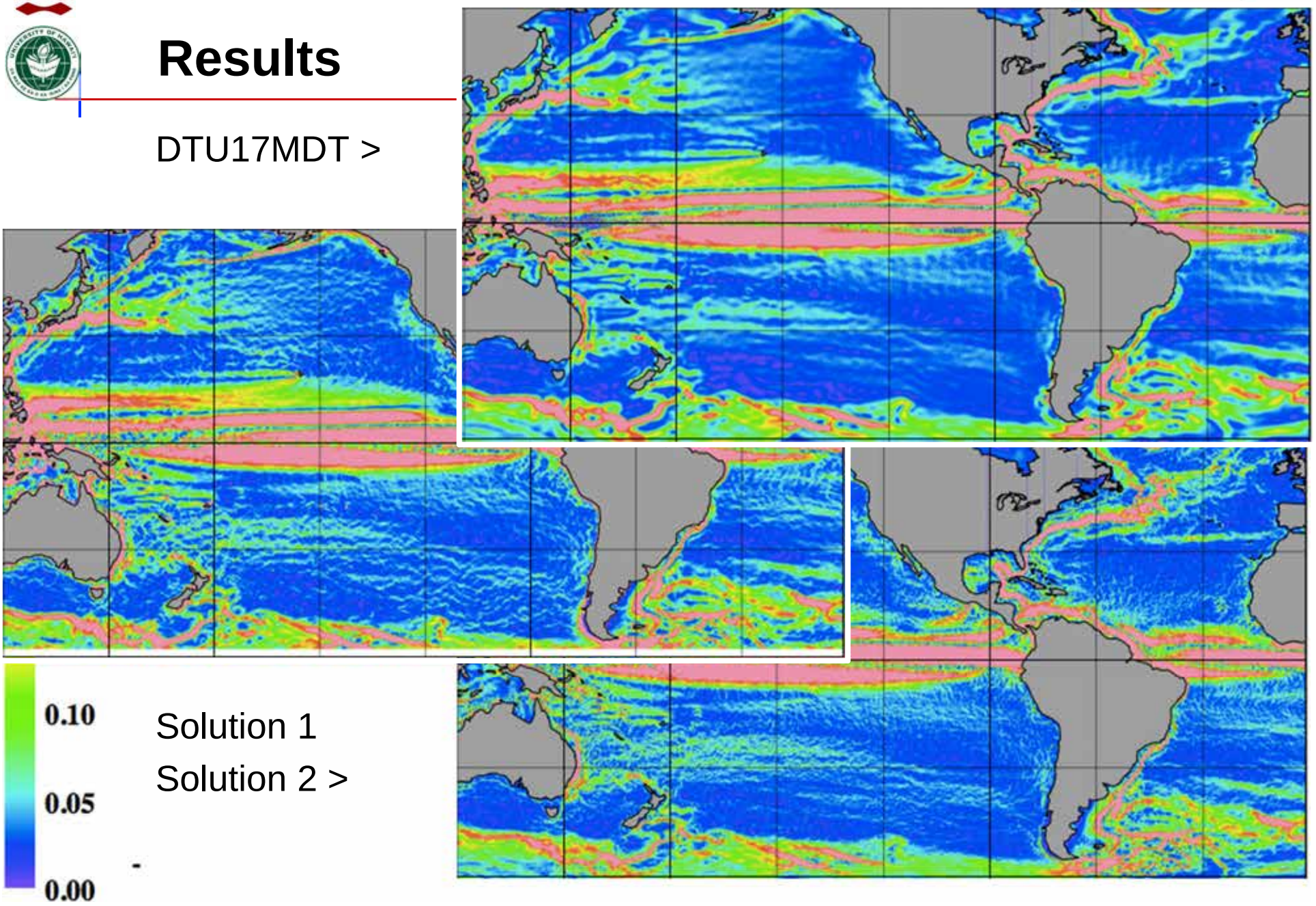
Results

DTU17MDT >



Solution 1

Solution 2 >

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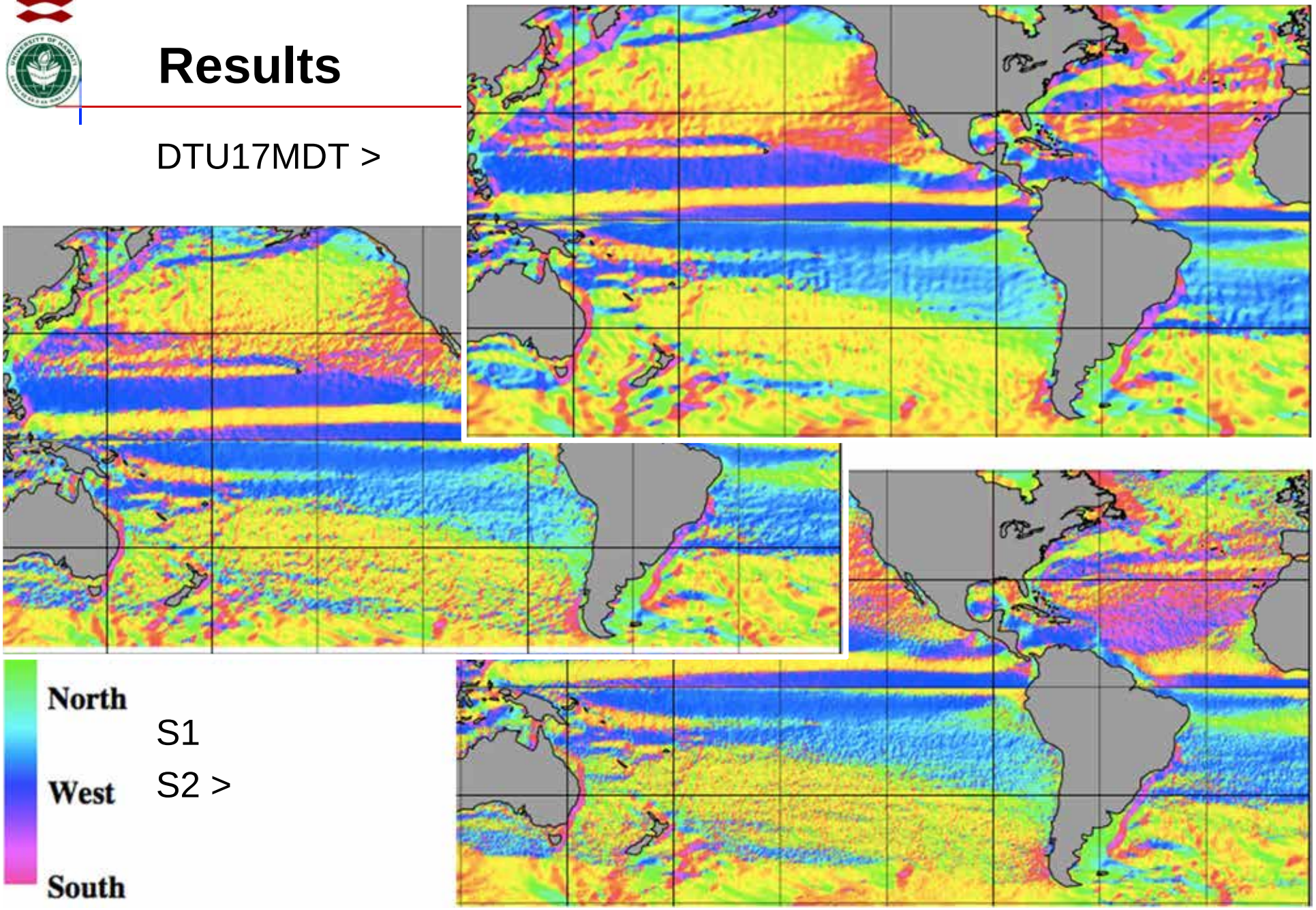
Results

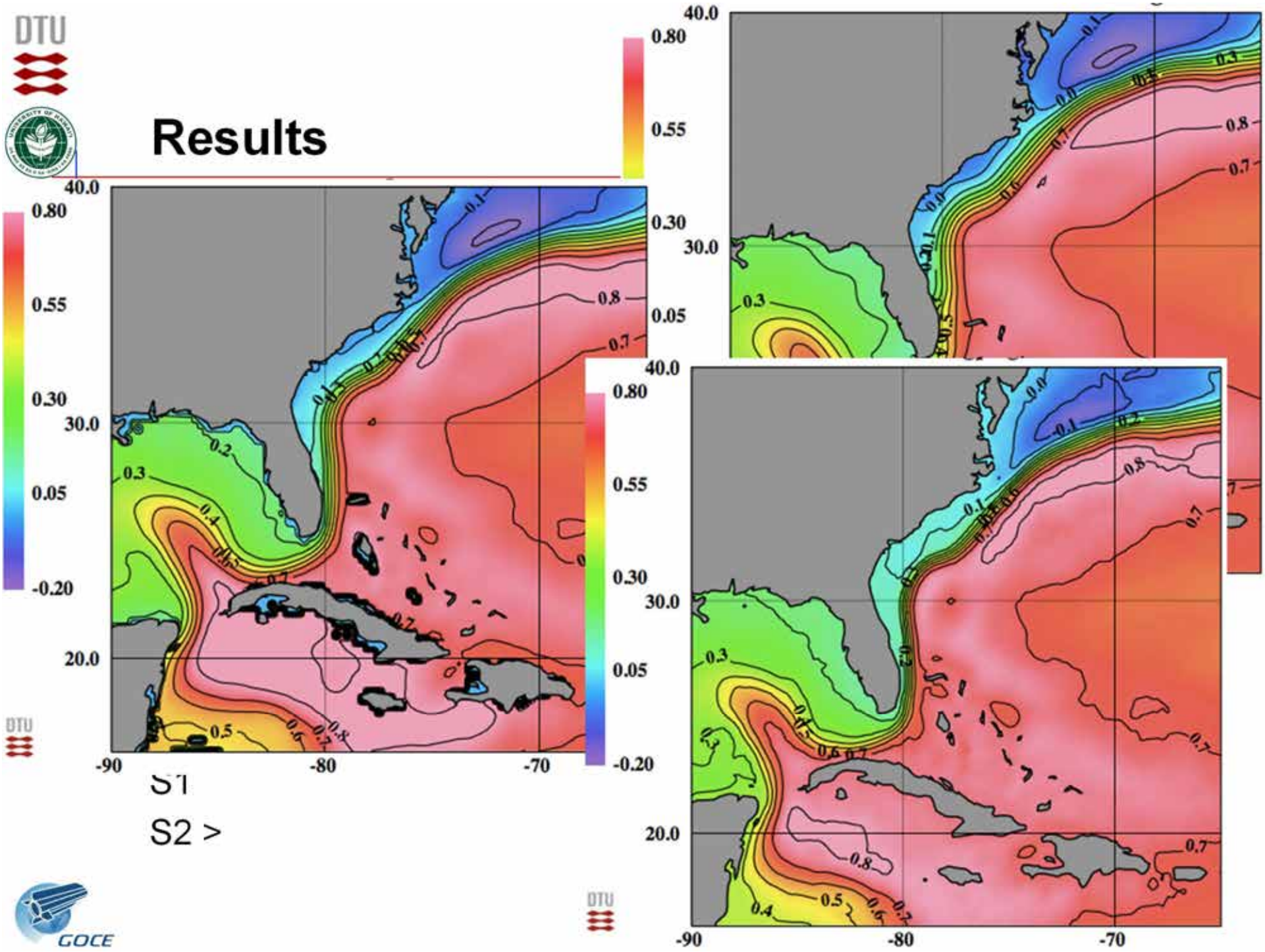
DTU17MDT >



S1

S2 >

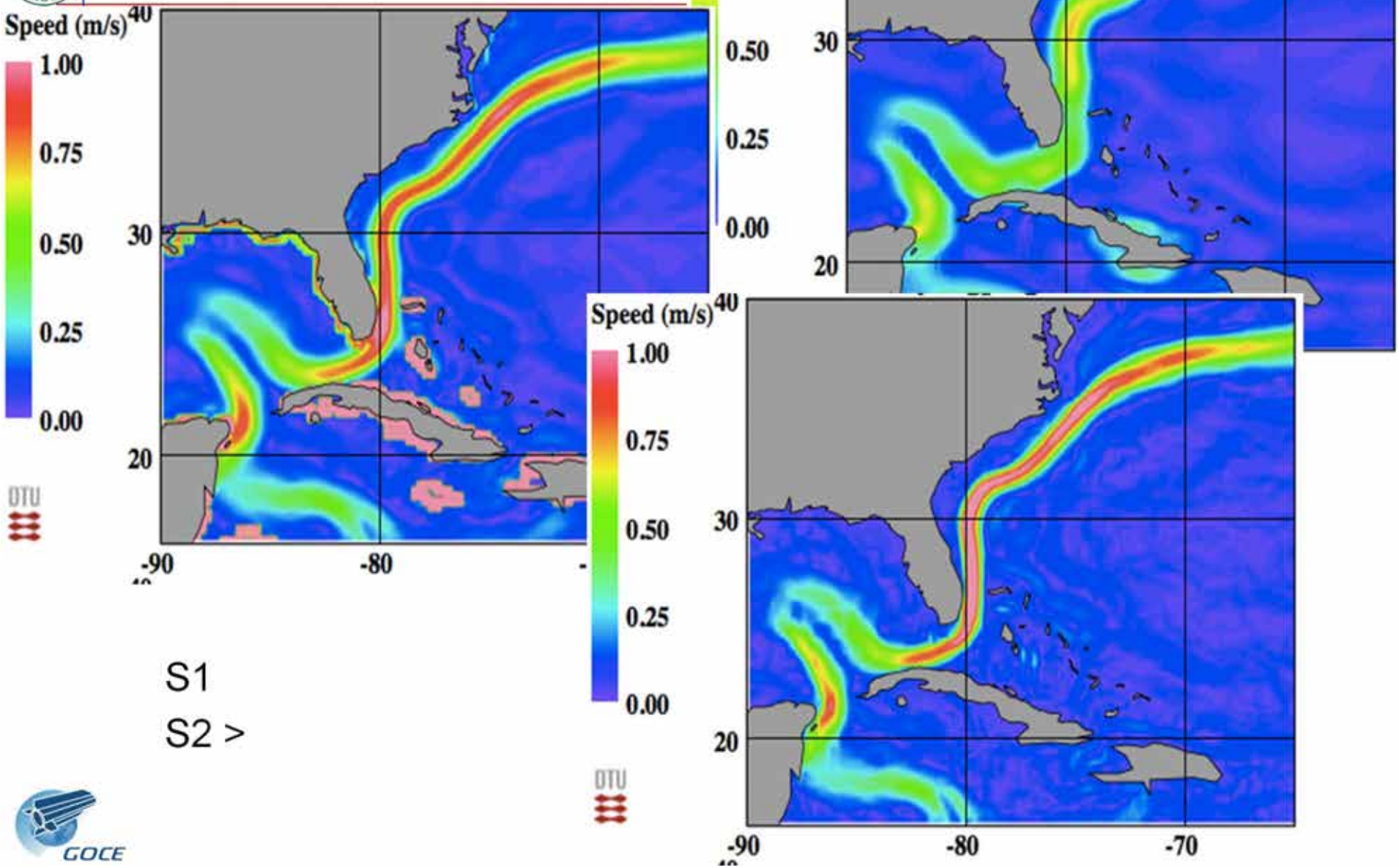
Results



S1

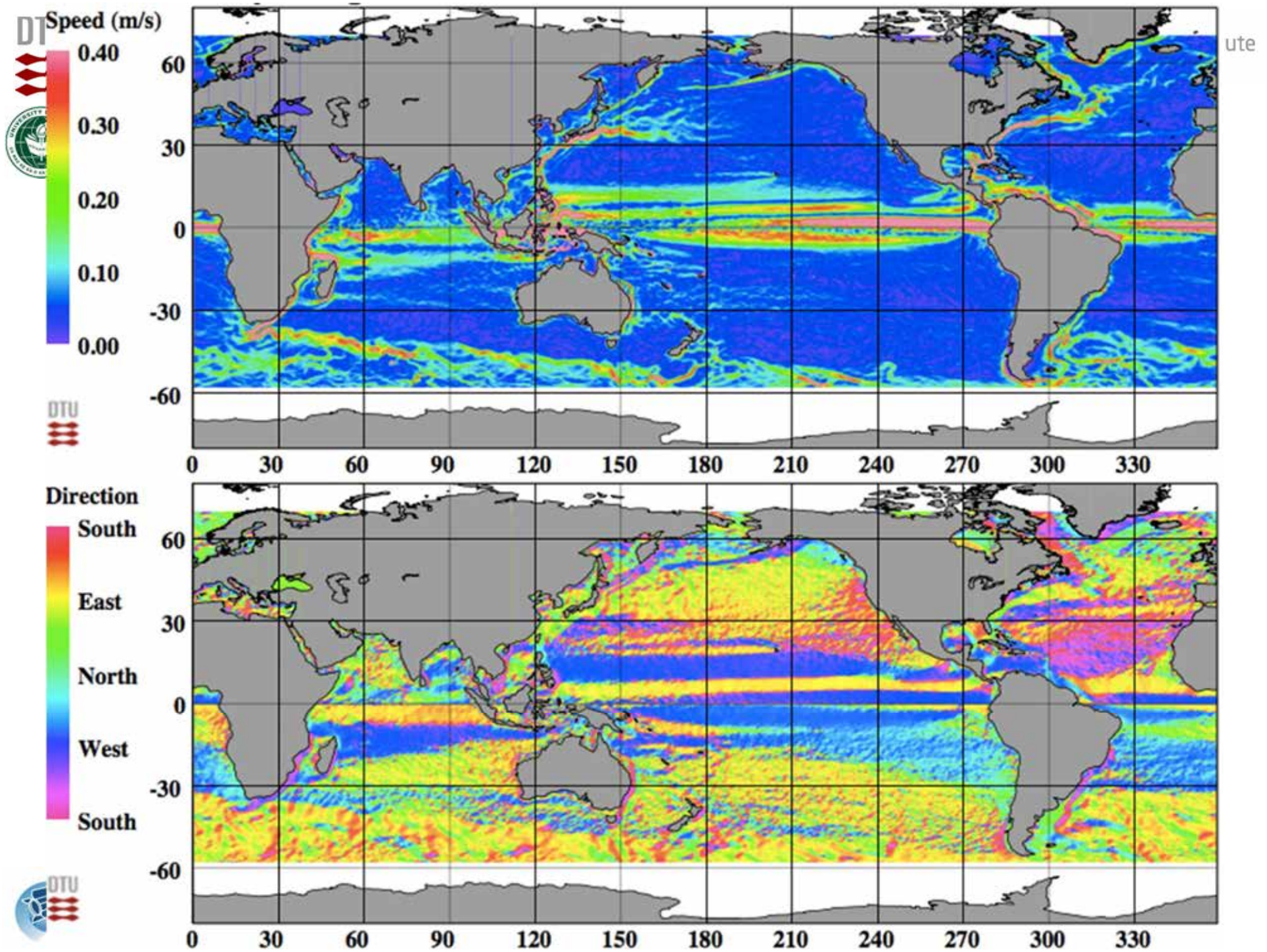
S2 >

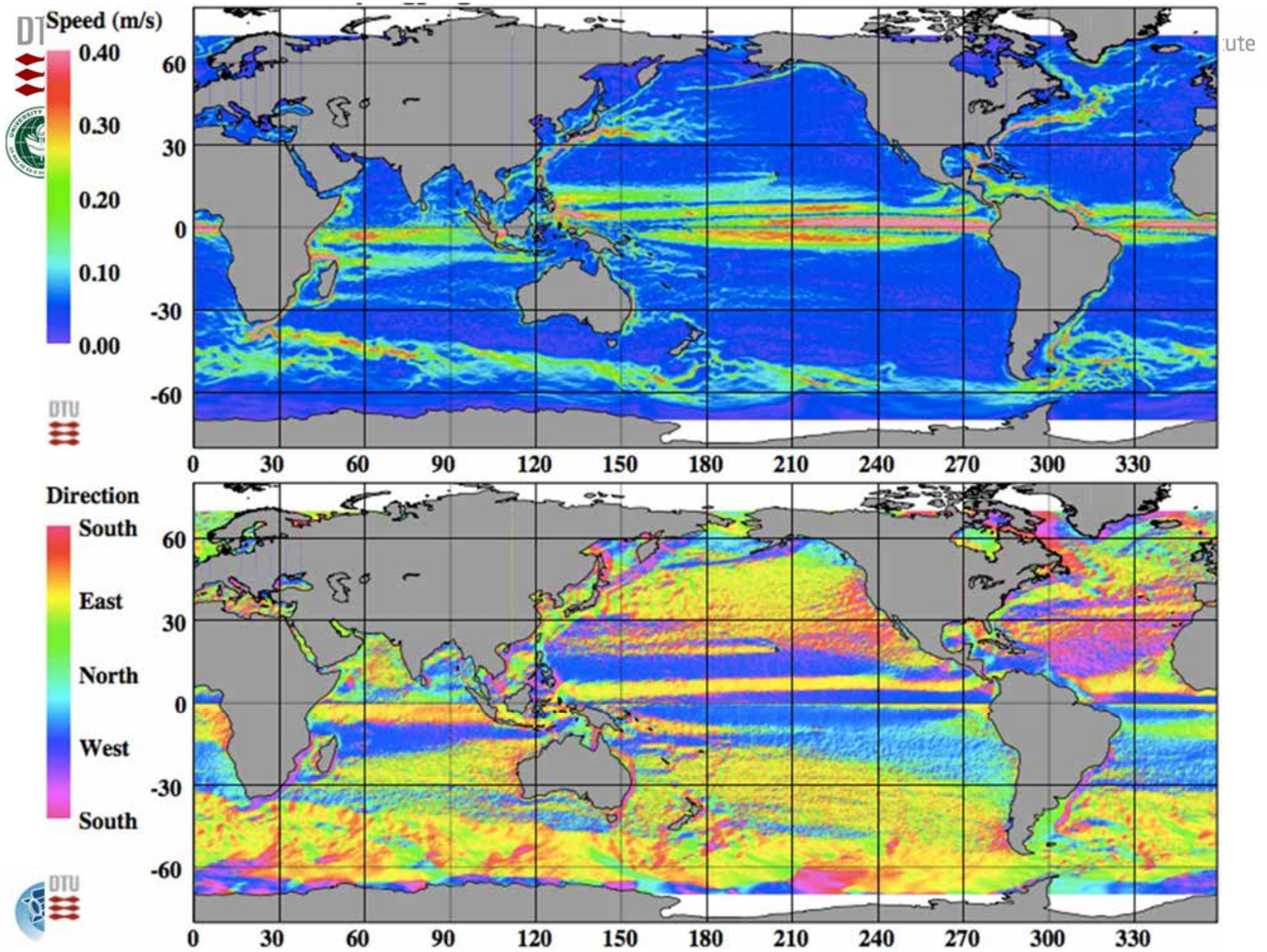
Results



S1

S2 >


Speed (m/s)
0.40
0.30
0.20
0.10
0.00
DTU
60
30
0
-30
-60
0
30
60
90
120
150
180
210
240
270
300
330
Direction
South
East
North
West
South
DTU


Speed (m/s)
0.40
0.30
0.20
0.10
0.00
60
30
0
-30
-60
0
30
60
90
120
150
180
210
240
270
300
330
Direction
South
East
North
West
South
60
30
0
-30
-60
0
30
60
90
120
150
180
210
240
270
300
330

Summary

Preliminary versions of an MDT combining the geodetic DTU17MDT with drifter mean velocities have been derived.

Still need to:

- Assess errors,
- Experiment with weights and regularization/smoothing,
- Compare solutions,
- Converge toward a joint model.