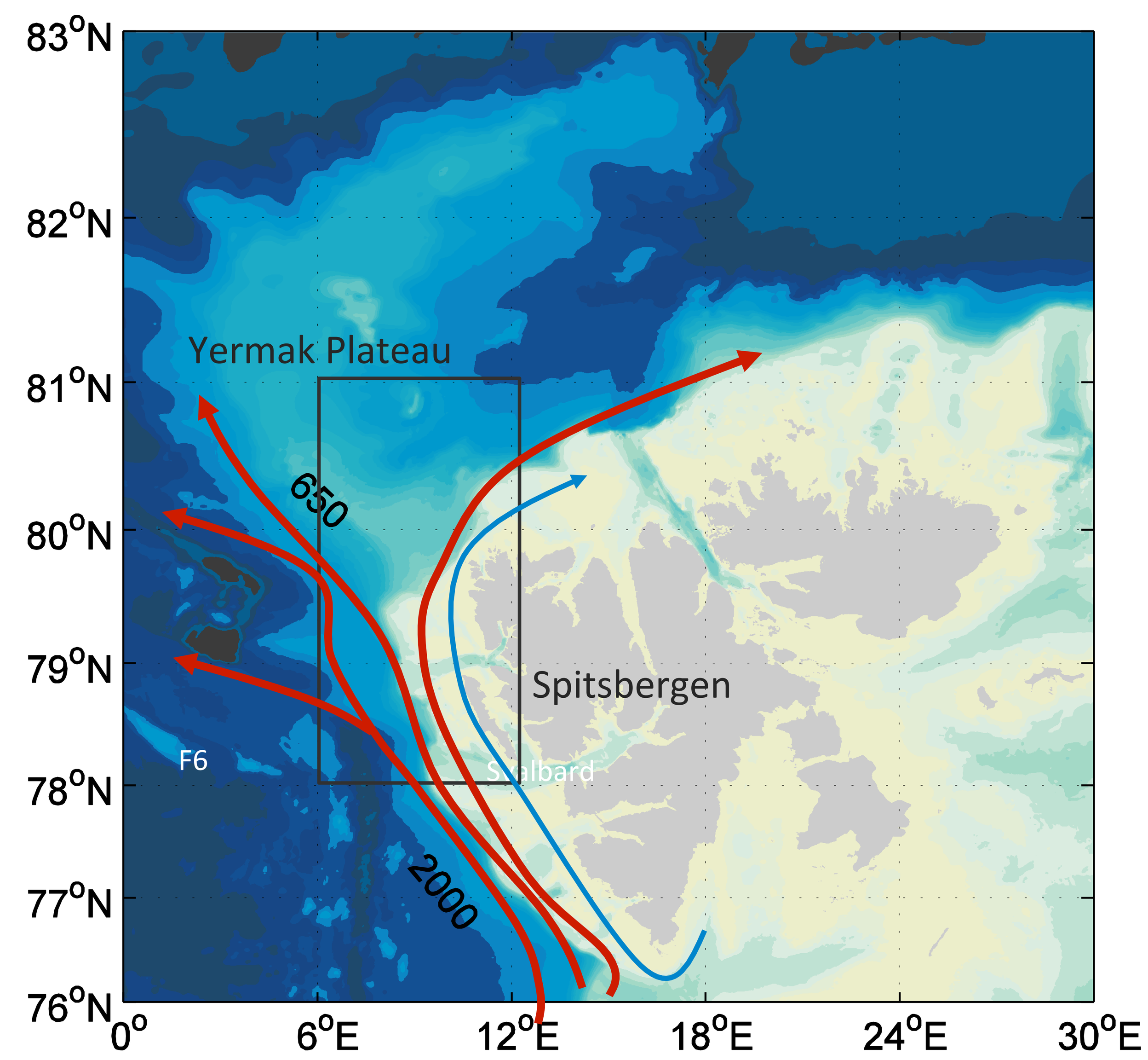
REMOTE SENSING OF OCEAN CIRCULATION IN EASTERN FRAM STRAIT

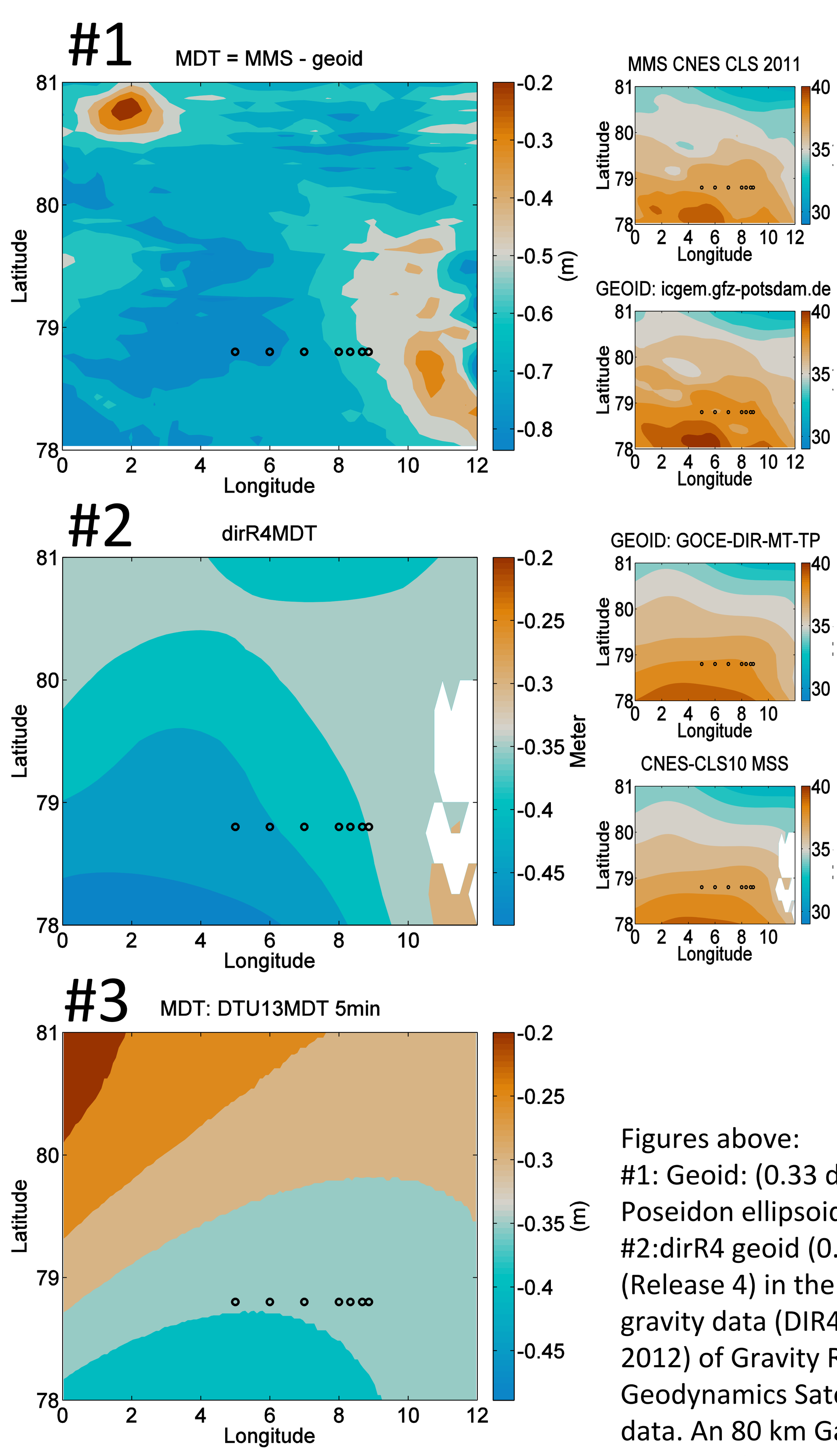
– PART OF THE REOCIRC PROJECT (13823)

Eli Anne Ersdal[1], Stefan Muckenhuber[2], Frank Nilsen[1], Ragnheid Skogseth[1]
[1]The University Centre in Svalbard, [2] Nansen Environmental and Remote Sensing Center
Contact: elie@unis.no, stefan.muckenhuber@nersc.no

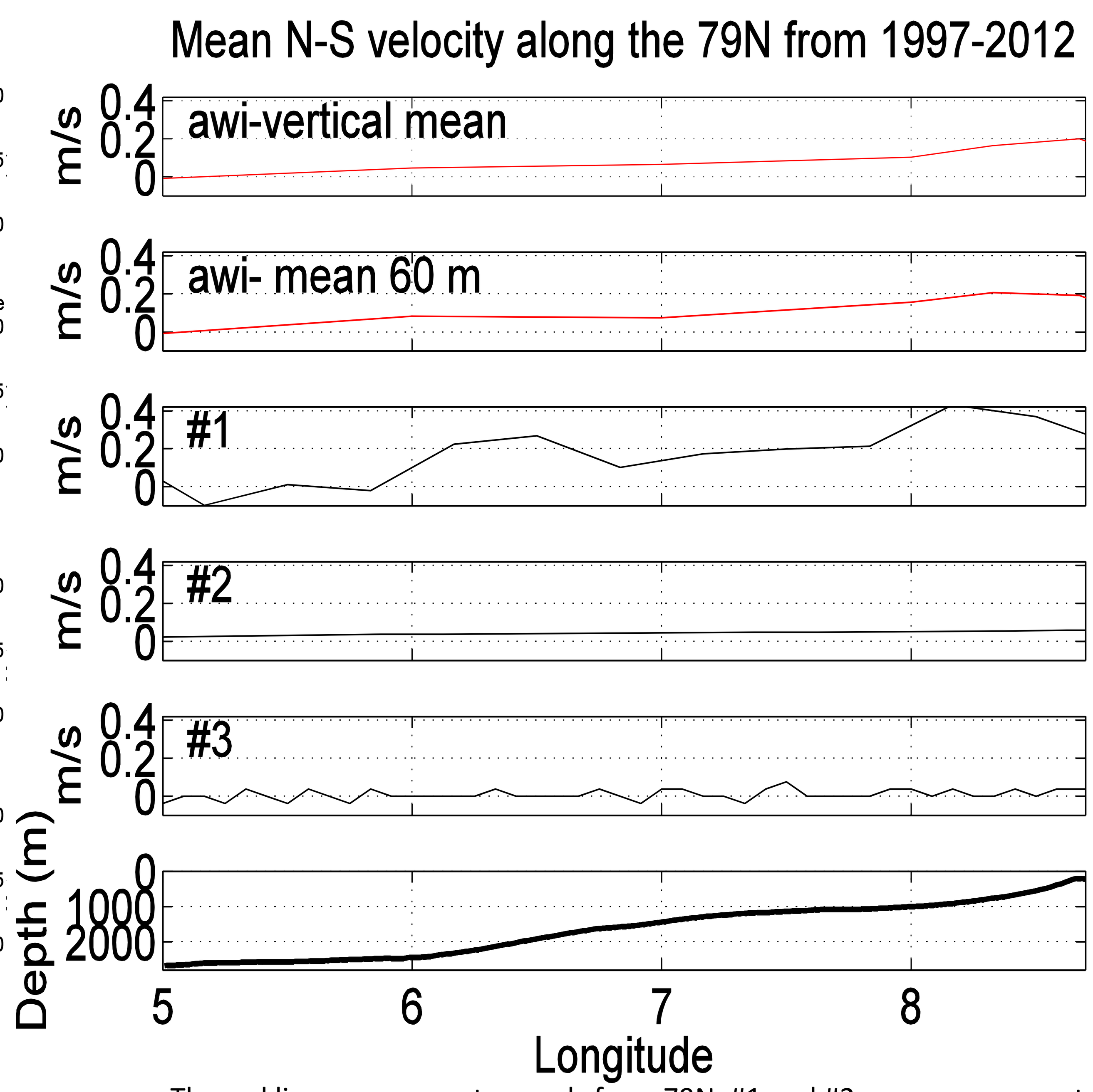


Abstract

In the Fram Strait, the West Spitsbergen Current (WSC) is topographically guided and flows barotropically along the Barents Sea margin and the West Spitsbergen Shelf-break (WSS). We focus on the Svalbard branch that follows the WSS-slope, crosses the Yermak Plateau and reaches the Arctic Ocean. The geostrophic velocity of the WSC is estimated in the cross section along N 79 in the Fram Strait, shown with **o** on the figures below. This result #1 has been compared with a 15 year long this current meter record in the same section. The satellite measurements show a mean barotropic velocity of 19.8 ± 10.4 cm/s while the current meters show a mean barotorpic current of 9.2 ± 6.4 cm/s. The barotropic current estimated from satellite data is dominated by the mean sea surface (MSS) and the geoid, and is too strong compared to the measured current. Even though the magnitude of the current is too big, both time series show the same seasonal signal with a maximum current during winter time. The strongest current is also found in the same location. The space mission by GOCE has provided us with new data and they are presented in #2 and #3. The physical properties of the current is not represented.



The **o** in the figures shows the positions of the AWI moorings.

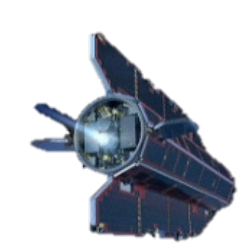


The red lines are current records from 79N. #1 and #2 are mean current calulated from the adt and #3 the current calculated from the mdt.

Figures above:
#1: Geoid: (0.33 degree grid) is calculated with the ICGEM geoid model with a reference to the TOPEX/ Poseidon ellipsoid. The MSS uses in this approch is MSS_CNES_CLES2011
#2:dirR4 geoid (0.25 degree grid) is estimated from the latest release of GOCE gravity model data (Release 4) in the mean tide system and reference to topex ellipsoid. The Release 4 direct approach gravity data (DIR4) is based on 28 months (01-11-2009 to 01-08-2012) of GOCE data, 9 years (2003 to 2012) of Gravity Recovery and Climate Experiment (GRACE) data, and 25 years (1985-2010) of Laser Geodynamics Satellites (LAGEOS) data. dirR4MDT is estimated from dirR4 geoid and CNES_CLS10 MSS data. An 80 km Gaussian filter is used.
#3: MDT downloaded from the DTU space.

About REOCIRC - Remote Sensing of Ocean Circulation and Environmental Mass Changes.

This project will apply state of the art instrumentation and theory to study ocean circulation and heat fluxes towards the Arctic Ocean. We aim to obtain high precision water **level estimates and therefore a more precise ocean circulation** pattern in the eastern Fram Strait towards the Arctic Ocean. Our main objective is to study the absolute dynamic topography (ADT) of the West Spitsbergen Current (WSC) by taking advantage of advances in satellite gravimetry (GOCE) and altimetry, and provide ground truth for satellite gravity solutions (GRACE) from in-situ ocean bottom pressure measurements.



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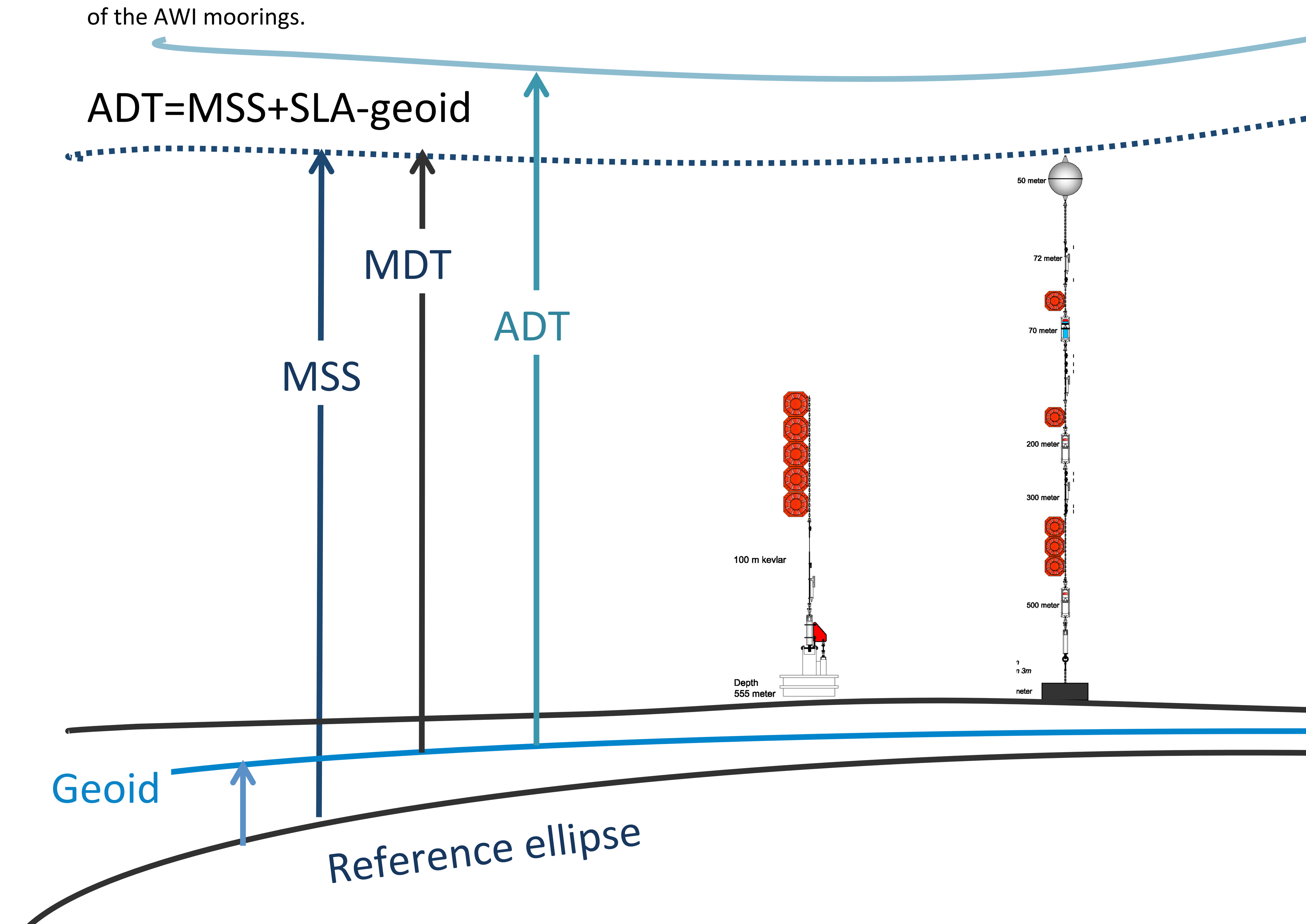
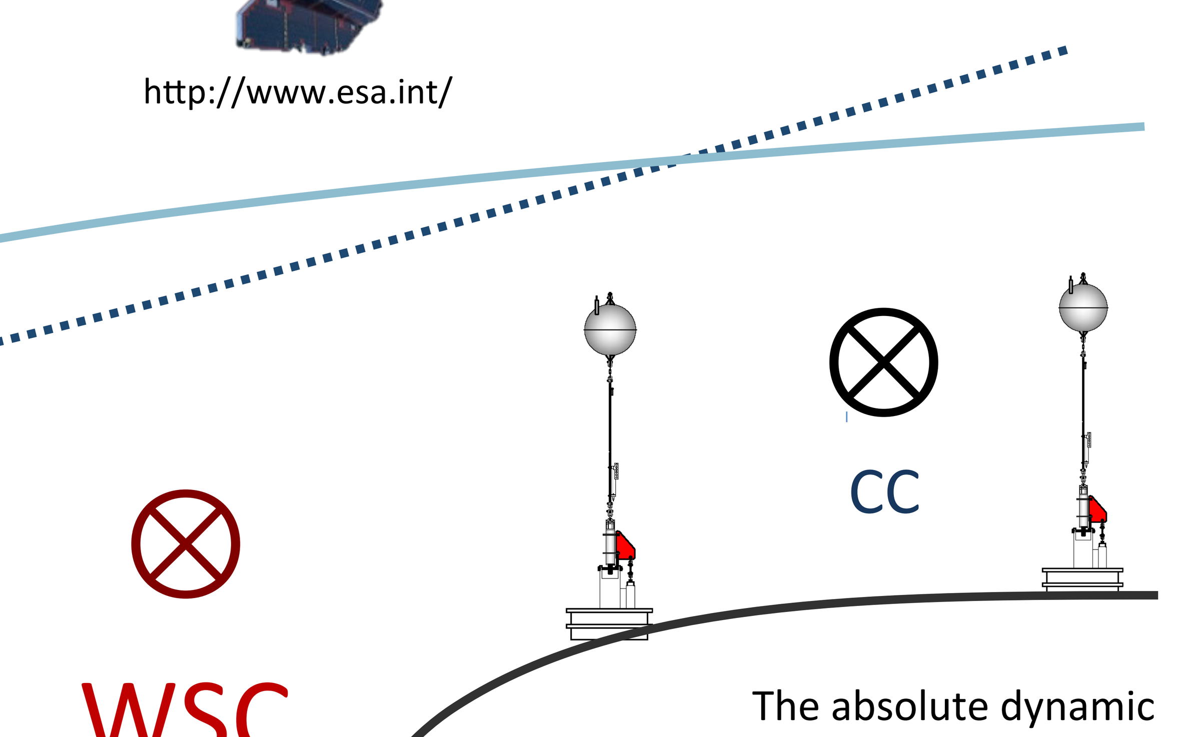


$$v_s = \frac{1}{\rho_0 f}\frac{\Delta ADT}{\Delta x}$$

$$v_s = \frac{1}{\rho_0 f}\frac{\Delta p}{\Delta x}$$

$$V(z) = v_s + \frac{g}{\rho_0 f}\int_z \frac{\partial \rho}{\partial x}dz$$



The absolute dynamic topography (ADT) is derived from mean sea surface (MSS), sea level anomaly (SLA) and the geoid. The ADT can be seen as the tilt of the sea surface and hence, one can derive the barotropic component of the geostrophic flow from space. By introducing the thermal wind equation, the baroclinic current forced by horizontal density differences is included. The total current is found by combining the surface current, v_s and the baroclinic part, see eq.