

# Satellite altimetry transport estimates of the AMOC along the RAPID 26N mooring array

**Q: Can satellites replace mooring arrays?**

**A:**

- Using geostrophy, upper mid-ocean transport can be calculated directly from satellite altimetry at lower frequency (10 months >) time scales.
- The vertical structure of the horizontal velocity, required for the satellite-derived transport, is constant in time and can be estimated from either the RAPID moorings or hydrographic data
- The satellite-derived methods can be used to reconstruct MOC transport from historical data.

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# Reconstruction of Upper Mid-ocean Transport from Satellite

The upper mid ocean transport ( $T_{umo}$ ) is calculated as follows:

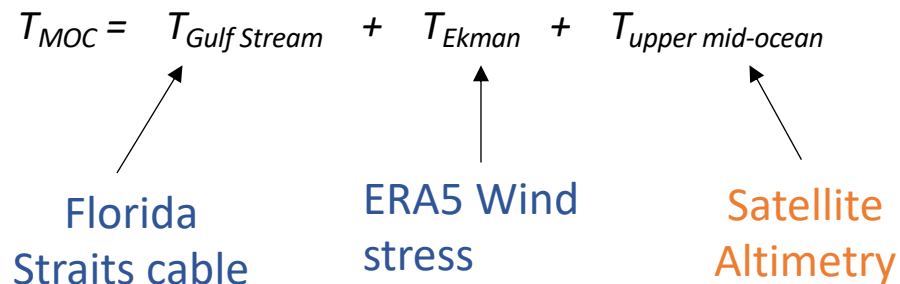
$$T_{UMO} = \frac{g}{f} \int_{-1500}^0 [\eta_E(x, y) * F_E(x, y, z)] dz - \frac{g}{f} \int_{-1100}^0 [\eta_W(x, y) * F_W(x, y, z)] dz$$

Where  $\eta_E(x, y)$  is absolute dynamic topography from satellite altimetry,  $g$  is gravitational acceleration,  $f$  is the Coriolis parameter,  $F(x, y, z)$  is the dominant vertical mode of horizontal velocity calculated from RAPID moorings, and  $W$  and  $E$  subscripts denote the western and eastern end-points of the basin.

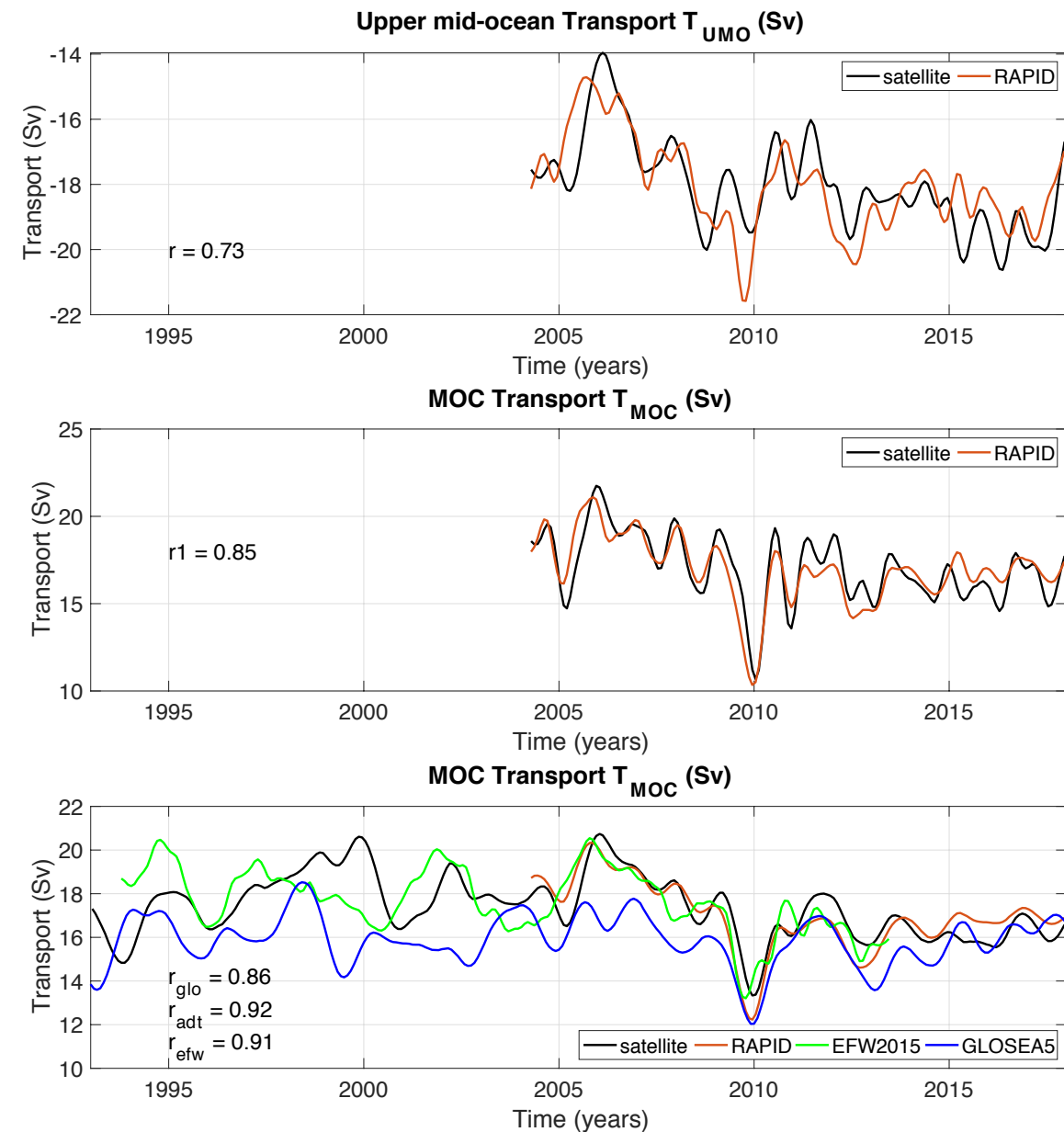
$T_{umo}$  from satellite and RAPID pictured right (top panel). We note a final scale factor and offset are applied to the satellite-derived  $T_{umo}$  to attain the correct transport magnitudes.

# Reconstruction of MOC Transport

Here the MOC transport (middle and bottom panel pictured right) is defined as the sum of the following components:



Acquired from existing datasets. Satellite Altimetry upper mid-ocean transport calculated as defined above.



**Figure 1.** upper panel: Reconstructed  $T_{umo}$  from satellite (black line) and RAPID (orange line). Middle and bottom panel: Reconstructed  $T_{moc}$  from satellite (black line), GLOSEA5 reanalysis (green line), and satellite as in Frajka-Williams (2015) (green line). In the top top panels data has a 10 month Gaussian filter, and in the bottom panel filter is 18 months. Units in Sv. Statistically significant (at 95% level) correlations comparing each index to the RAPID transports indicated in each subplot.