Twenty-five years of Mercator ocean reanalysis GLORYS12 at Drake Passage: performance and ACC total volume transport

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Introduction

Velocities from the 25-year GLORYS12 reanalysis (1/12°) were compared with satellite altimetry derived velocities and in-situ measurements from the DRAKE (2006-2009, Provost et al., 2011) and cDrake (2007-2011, Chereskin et al., 2009) experiments.



- As the comparison were satisfactory, we use GLORYS12 to examine:
- mean velocities and EKE at different depths
- Antarctic Circumpolar Current (ACC) total volume transport across three sections in DP (S1, S2 and S3)

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SLA assimilation in GLORYS12:

Example along track # 104 (section S2):

Differences (c): No temporal trend nor significant interannual variations over 25 years





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Surface velocities (GLORYS12 and satellite altimetry)

- (a) Mean surface geostrophic velocities (from GLORYS MDT)
- (b) Differences between velocities derived from CNES-CLS13 MDT (Rio et al., 2014) (1/4°) and GLORYS12 mean surface geostrophic velocities
- GLORYS12 EKE (c) > altimetry EKE (d) due to ≠ spatial resolution (model: 1/12° gridded altimetry: ¼°) and ageostrophic motions



Water column: comparison with DRAKE mooring data (2006-2009)

Mean velocities and variance ellipses

- Amplitude of mean velocity differences between observations and GLORYS12 are small (< 2 cms-1)
- **GLORYS12** underestimates velocity variability above the continental slope off Tierra de Fuego (by 5 cm² s⁻²)
- Correlations GLORYS12/obs. velocities: r= 0.5



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Water column: comparison with DRAKE mooring data (2006-2009)

Mean and std over S2

- 4 bands of bottom-reaching eastward flow: SAF, PF SACCF-N and SACCF-S.
- Westward deep velocities () in the center of the Yaghan Basin : deep recirculation. (Ferrari et al., 2012)



Near the seafloor: comparison to cDrake current-meters (2007-2011)

Mean velocities and variance ellipses 50 m above seaflor:

- **GLORYS12** features similar mean and variances to **obs**
- Variance ellipses of the velocity differences (obs GLORYS12) are small
- Correlations GLORYS12 /observed velocities significant (r=0.4 above 99% CL)



GLORYS12 mean velocities and eke at depths (25 years)



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25-year mean velocities at different depths

- 3 jets: SAF, PF and SACCF
- Permanent cyclonic recirculation in the Yaghan Basin at depths

- EKE maxima above sea floor depressions (> 4000 m)
- EKE decreases with depth to a minimum of 170 cm² s⁻² at 2500-3000 m
- EKE peaks up to more than 200 cm² s⁻² at 3800 m and below



25-year EKE at different depths

ACC total transport in Drake Passage from GLORYS12

- Mean ACC transport (average of 3 sections S1, S2 and S3): 155 ± 3 Sv, std=7 Sv
- No significant long-term trend
- Low frequency modulation with low annual means during 2006-2011 (DRAKE and cDrake experiments)
- Significant energy peaks at 50, 27, 180 and 360 days.



Perspectives: BACI proposal submitted to OSTST call 2020



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Thank you!!!

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