GOCE LEVEL 2 GRAVITY GRADIENTS

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1. INTRODUCTION

Two of the GOCE Level 2 products are the gravity gradients (GGs) in the Gradiometer Reference Frame (GRF) and the GGs in the Local North-Oriented Frame (LNOF). The GRF is an instrument frame and the GGs are derived from the L1b GGs. The L1b to L2 GG processing involves corrections for temporal gravity variations, outlier detection and data gap interpolation, as well as the external calibration of the GGs using independent gravity field information. Because of the gradiometer configuration, four out of the six GGs - V_{XX}, V_{YY}, V_{ZZ} and V_{XZ} - will have a small error in the Measurement Band (MB), whereas the other two - V_{XY} and V_{YZ} - will have low accuracy. The GRF GGs are rotated to the LNOF that is directly related to the Earth.

2. GRAVITY GRADIENTS IN THE GRF

Fig. 1 shows the spectral density (SD) of one day (1 November 2009) of the GG trace and the V_{ZZ} temporal signals. These are well below the GG errors. Fig. 2 shows the weekly estimated GG scale factors using a global gravity field model as reference (EIGEN-5C). The data period is 31 October 2009 – 26 June 2010. Fig. 3 shows the GG scale factors as determined with terrestrial gravity data (19 January 2010 – 6 June 2010). Tab. 1 summarizes the statistics of the common-mode (CM) and GG scale factors that were estimated simultaneously with a 80x80 degree global gravity field model derived from a combination of GOCE gravity gradient data and GOCE GPS tracking data (1 November 2009 – 16 June 2010).

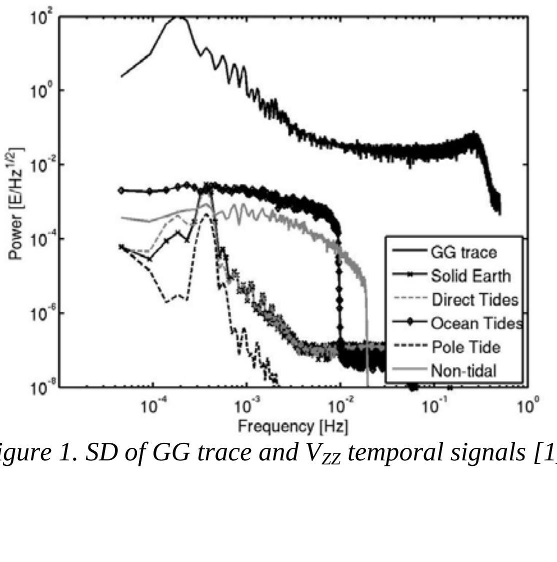

Figure 1. SD of GG trace and V_{ZZ} temporal signals [1]

Table 1. CM and GG scale factors estimated from a combination of GG and GPS tracking data [1]

	Common-mode		
	C_X	C_Y	C_Z
Selected 20-day periods	1.000 ±0.005	0.997 ±0.020	1.000 ±0.004
	Gravity gradients		
	V_{XX}	V_{YY}	V_{ZZ}
Selected 20-day periods	1.005 ±0.007	1.008 ±0.008	1.008 ±0.006

3. GRAVITY GRADIENTS IN THE LNOF

The gravity gradients can be rotated from the instrument to the local north-oriented frame (LNOF). The less accurate gravity gradients are replaced by model gravity gradients derived from a GOCE-only gravity field model. Fig. 4 - 8 show the binned differences between GOCE gravity gradients and different global gravity field models (for 31 October 2009 – 11 January 2010. Differences are large where terrestrial data are poor (EIGEN-5C and EGM2008) or at high latitudes due to trackiness in the GRACE-only solution (ITG-GRACE2010). The V_{YY} anomaly close to the magnetic poles is probably related to a small drift in the differential scale factor that leads to a correlation with cross-track winds. The anomaly largely disappears if the scale factor drift is taken into account.

4. ACKNOWLEDGEMENT

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5. REFERENCE

[1] Bouman J, Fiorot S, Fuchs M, Gruber T, Schrama E, Tscherning CC, Veicherts M, Visser P (2011) GOCE gravitational gradients along the orbit, J Geod, doi: 10.1007/s00190-011-0464-0

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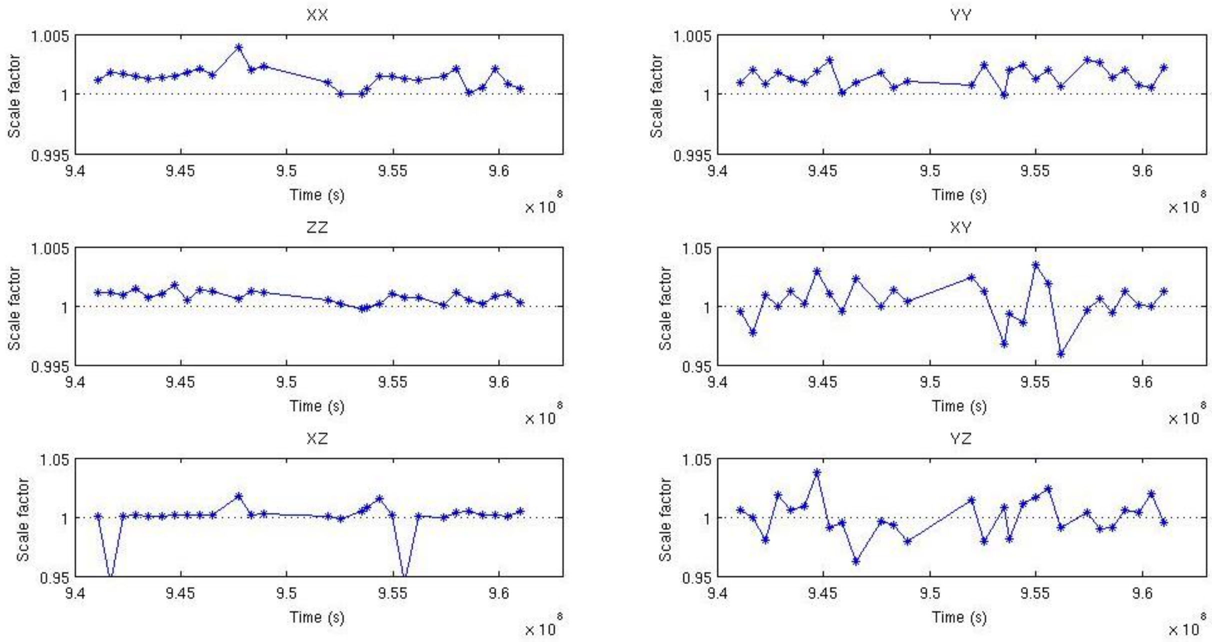

Figure 2. Weekly GG scale factors estimated with EIGEN-5C [1]

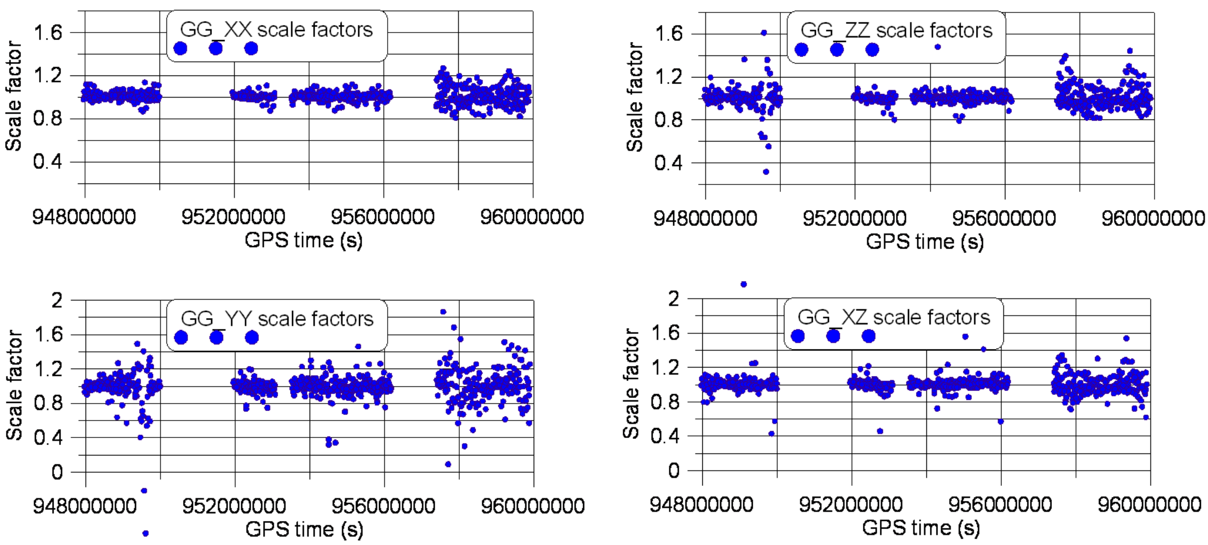

Figure 3. GG scale factors estimated with terrestrial gravity data [1]

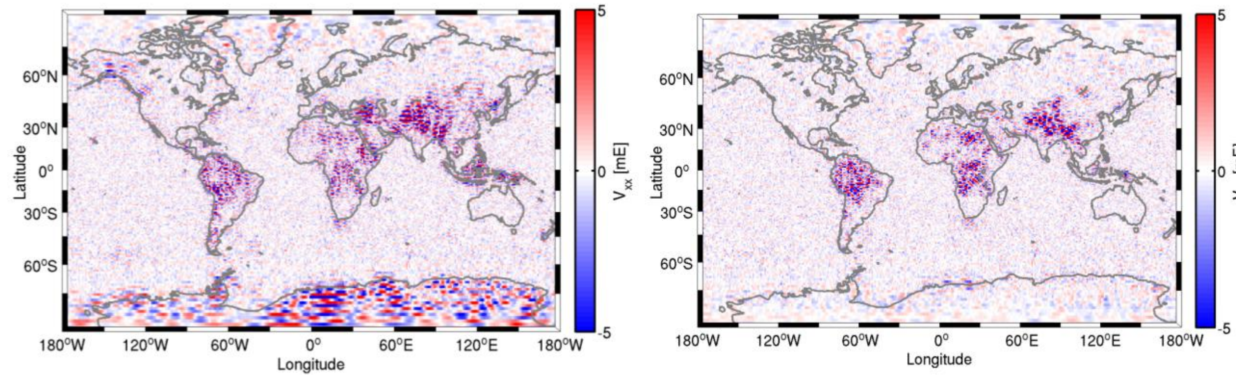

Figure 4. V_{XX} binned averaged differences 31 October 2009 to January 2010: Left panel GOCE – EIGEN-5C; Right panel GOCE – EGM2008. After [1]

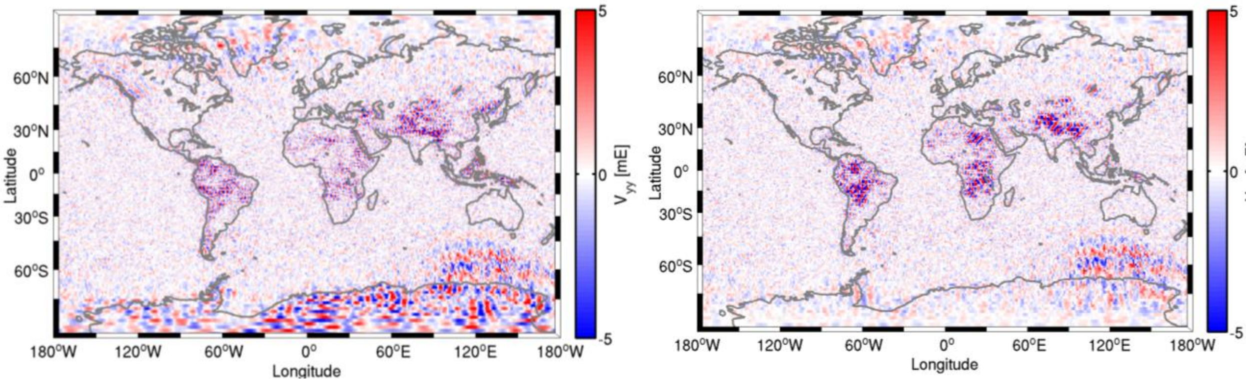

Figure 5. V_{YY} binned averaged differences 31 October 2009 to January 2010: Left panel GOCE – EIGEN-5C; Right panel GOCE – EGM2008. After [1]

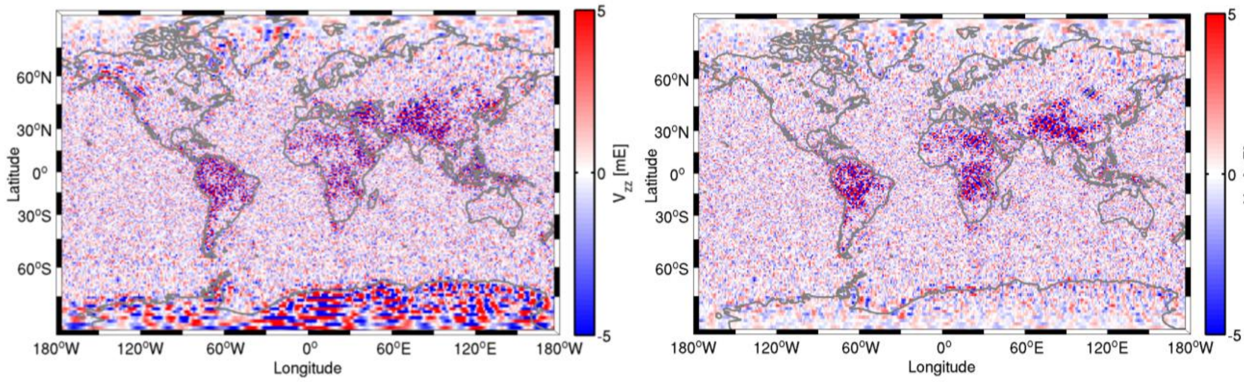

Figure 6. V_{ZZ} binned averaged differences 31 October 2009 to January 2010: Left panel GOCE – EIGEN-5C; Right panel GOCE – EGM2008. After [1]

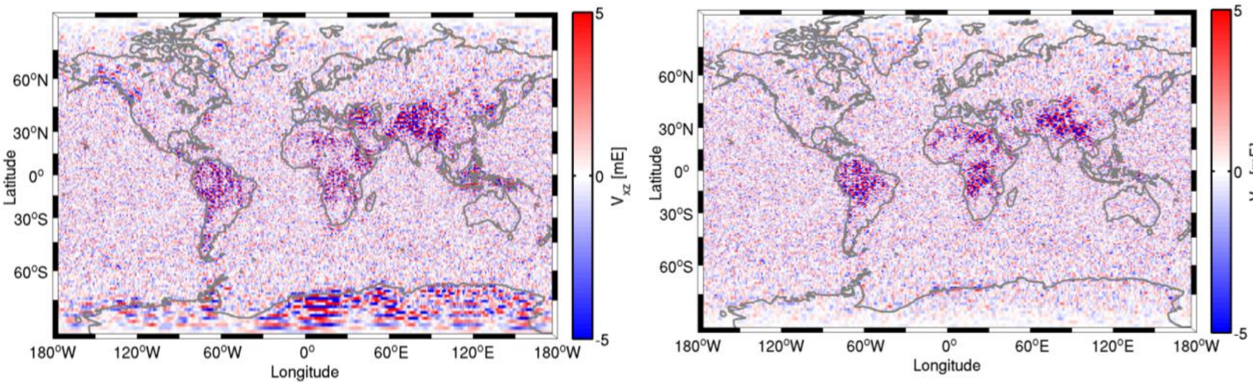

Figure 7. V_{XZ} binned averaged differences 31 October 2009 to January 2010: Left panel GOCE – EIGEN-5C; Right panel GOCE – EGM2008. After [1]

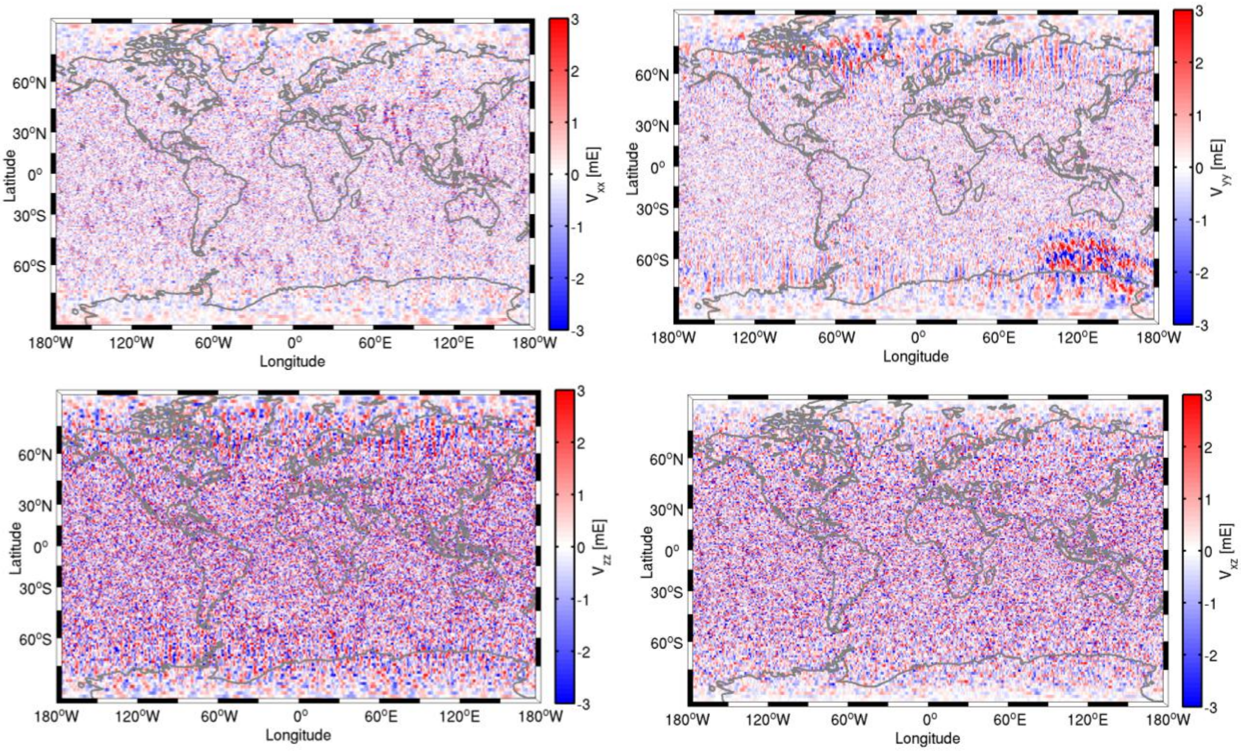

Figure 8. V_{XX} , V_{YY}, V_{XZ} and V_{ZZ} binned averaged differences 31 October 2009 to January 2010 (clockwise): GOCE – ITG-GRACE2010. After [1]