

Supplement Figures

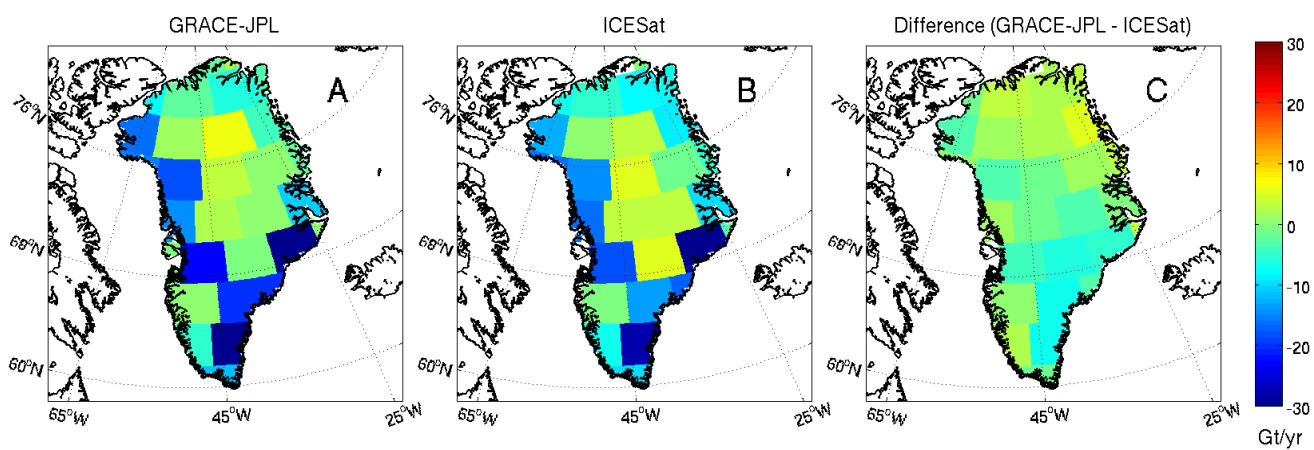


Figure S1. Spatial representation of trend in surface mass from 2003-2009 as estimated from (A) GRACE-JPL and (B) ICESat altimetry (Csatho et al., 2014), and (C) the difference of (GRACE-JPL - ICESat).

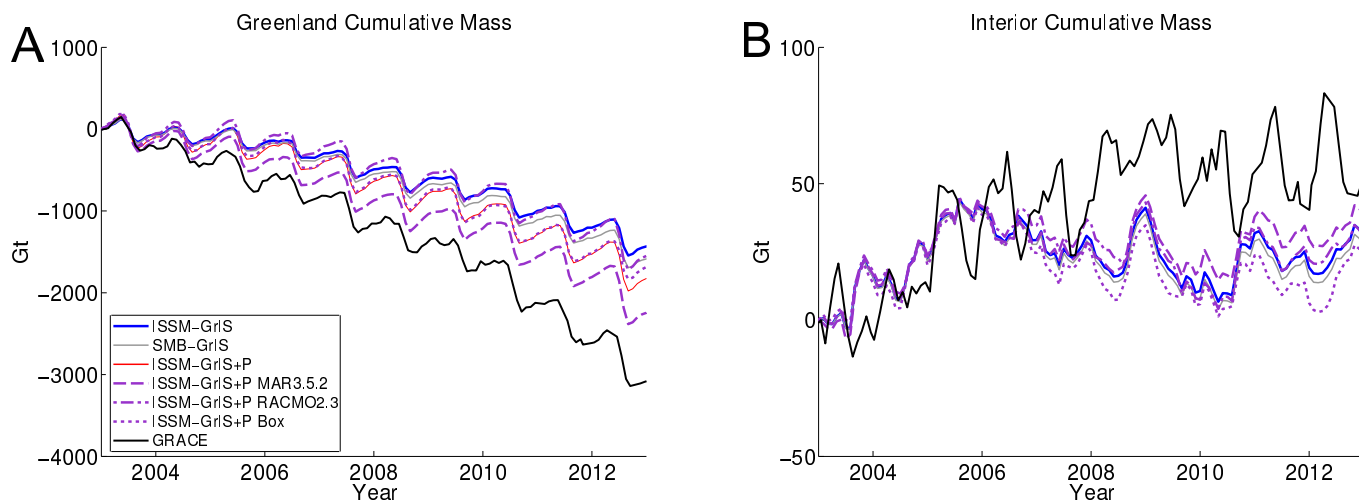


Figure S2. Cumulative mass from 2003-2012 for (A) all of Greenland and (B) the Greenland Interior, comparing observations from GRACE (GRACE-JPL), with model outputs: ISSM over the Greenland Ice Sheet (ISSM-GrIS), SMB anomalies over the Greenland Ice Sheet (SMB-GrIS), ISSM-GrIS with mass from the periphery (ISSM-GrIS+P), and ISSM-GrIS+P for each individual SMB forcing (ISSM-GrIS+P MAR3.5.2, ISSM-GrIS+P RACMO2.3, ISSM-GrIS+P BOX).

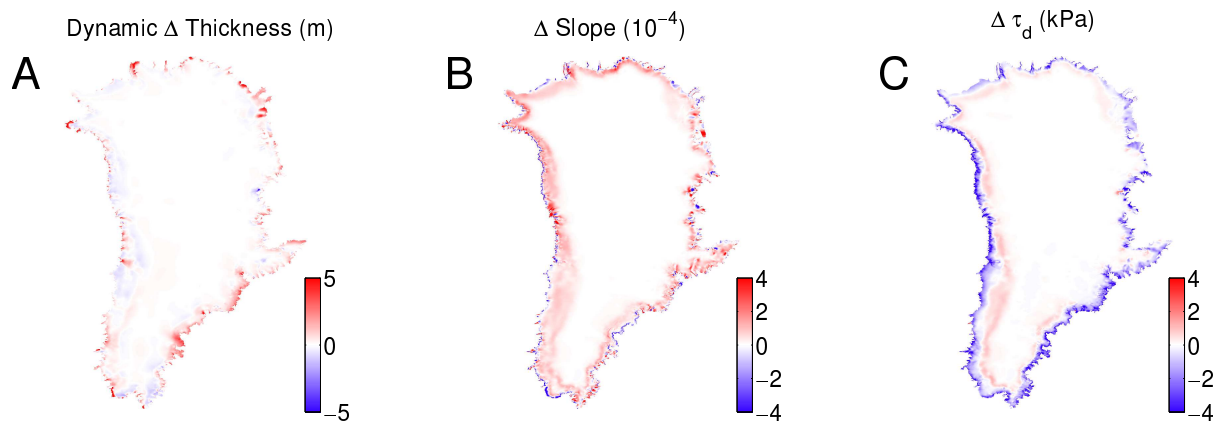


Figure S3. (A) Total dynamic thickness change (difference between the cumulative mass contribution from the SMB forcing anomalies and the total thickness change) simulated by ISSM Greenland (2003-2012); (B) change in surface slope during the simulation; and (C) change in the magnitude of the driving stress over the same period. Model output is presented as the mean of three different ISSM simulation runs (forced with BOX, MAR, and RACMO).

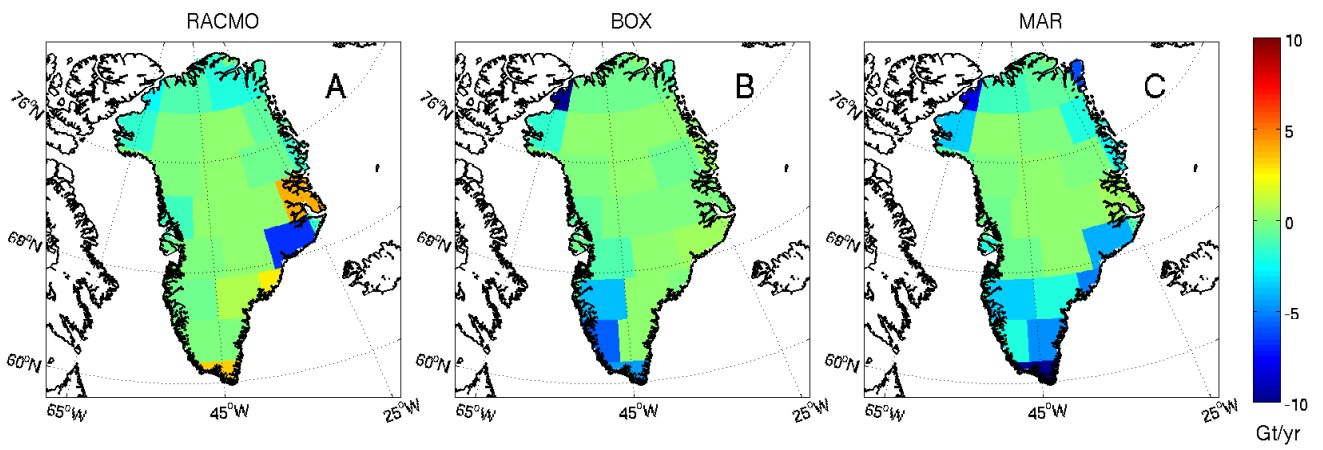


Figure S4. Spatial representation of trend in surface mass for the Greenland periphery as estimated from (A) RACMO, (B) BOX, and (C) MAR.

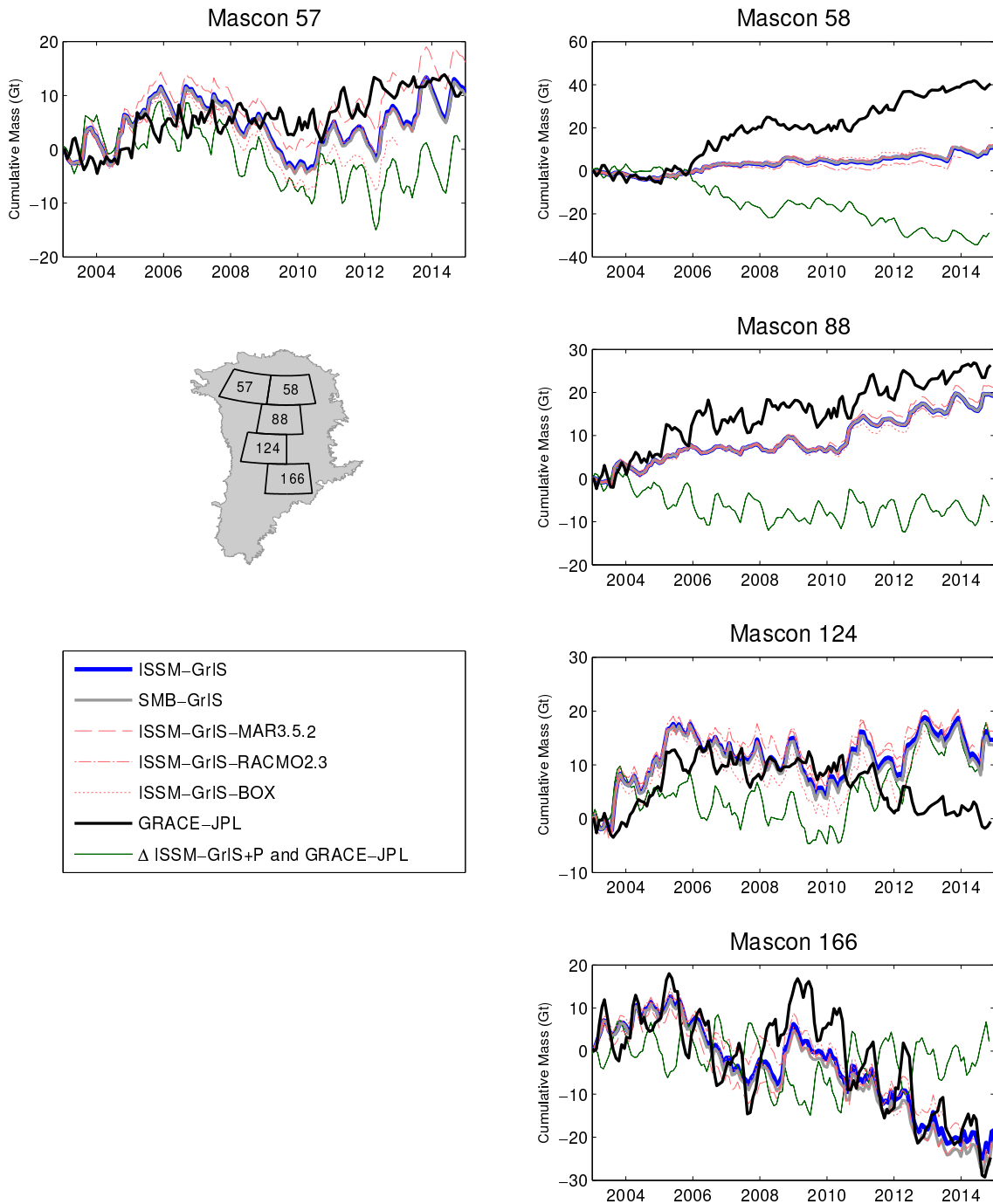


Figure S5. Interior mascons, total cumulative mass timeseries for GRACE-JPL, SMB-GrIS, and ISSM model results. Also included is the residual between GRACE-JPL and ISSM-GrIS (green).

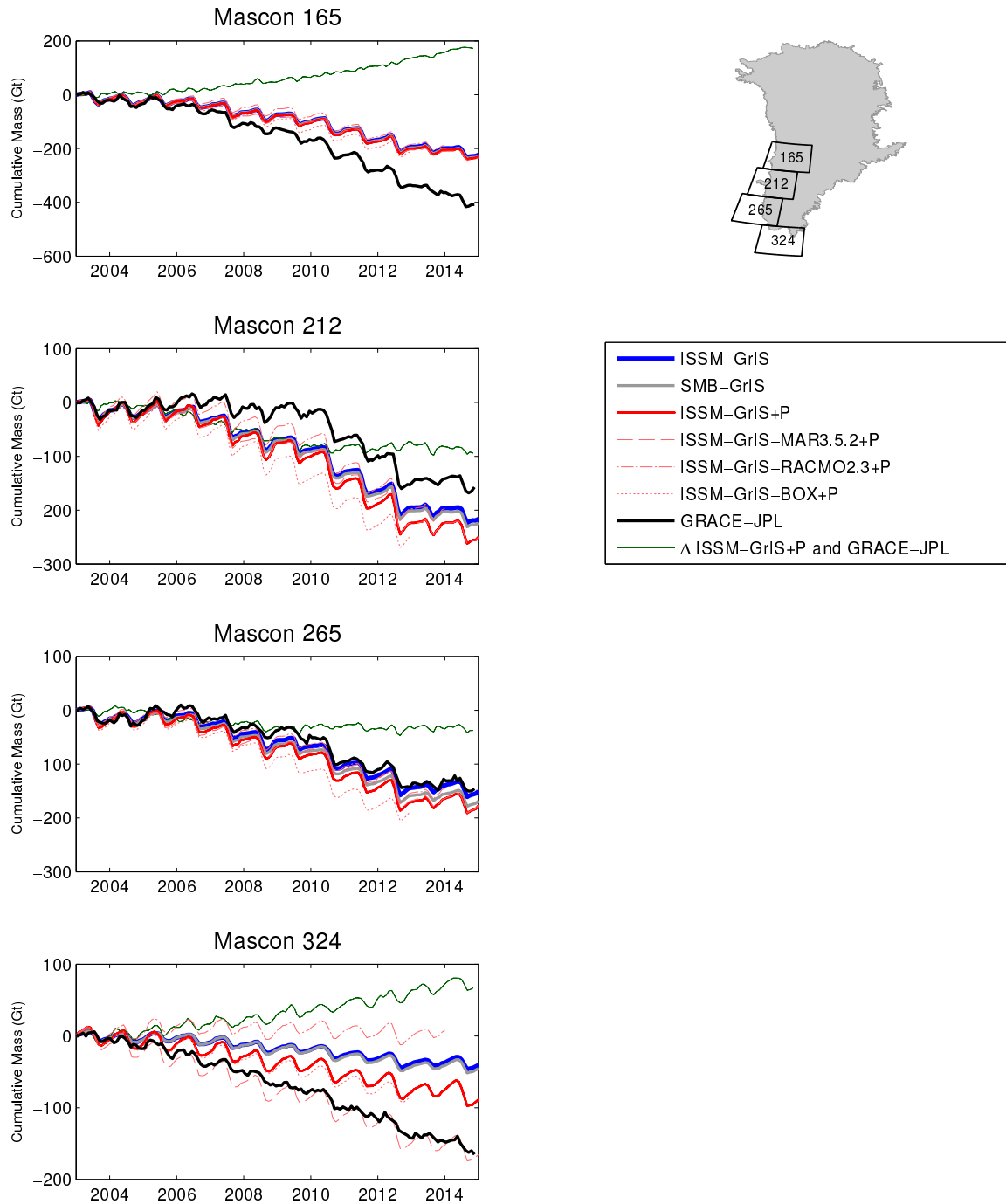


Figure S6. Southwest mascons, total cumulative mass timeseries for GRACE-JPL, SMB-GrIS, and ISSM model results with and without the periphery. Also included is the residual between GRACE-JPL and ISSM-GrIS+P (green).

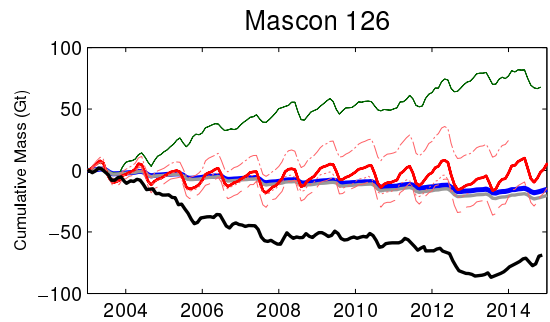
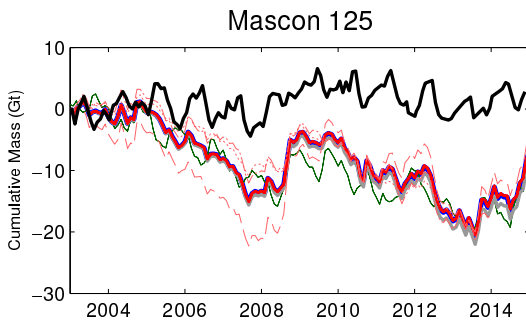
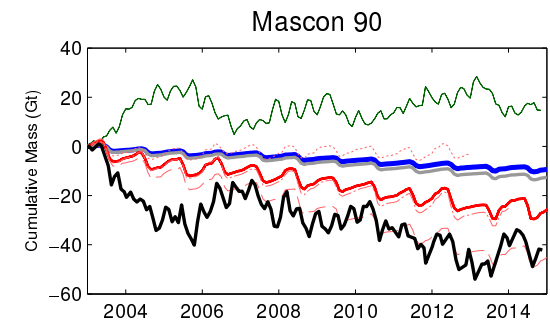
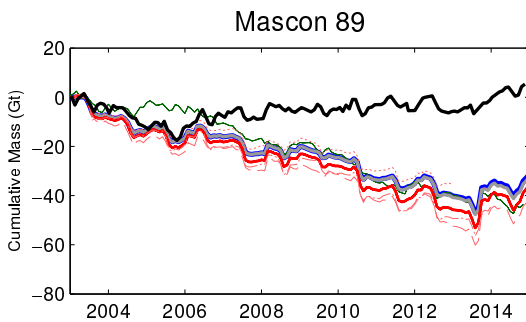
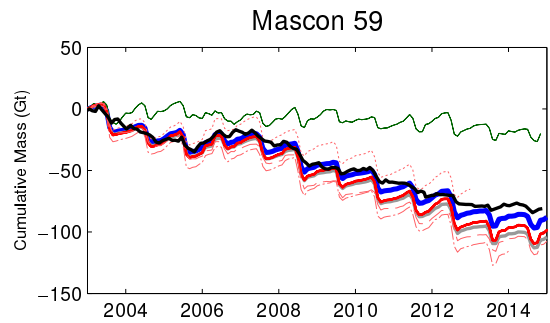
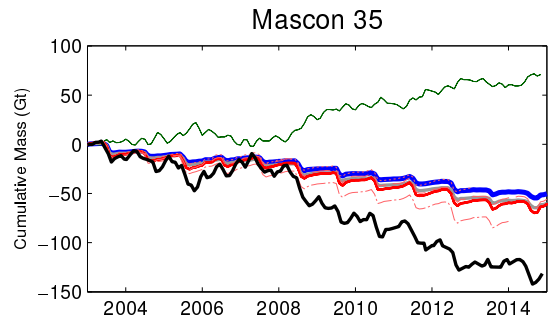
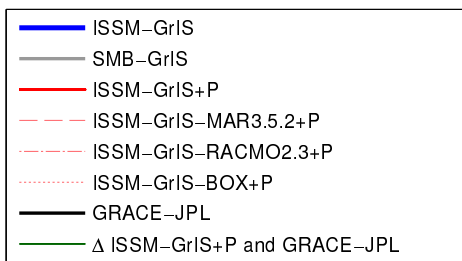
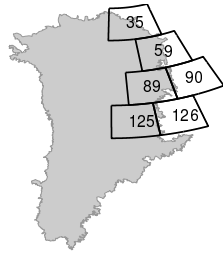


Figure S7. Same as Fig. S6 but for Northeast mascons.

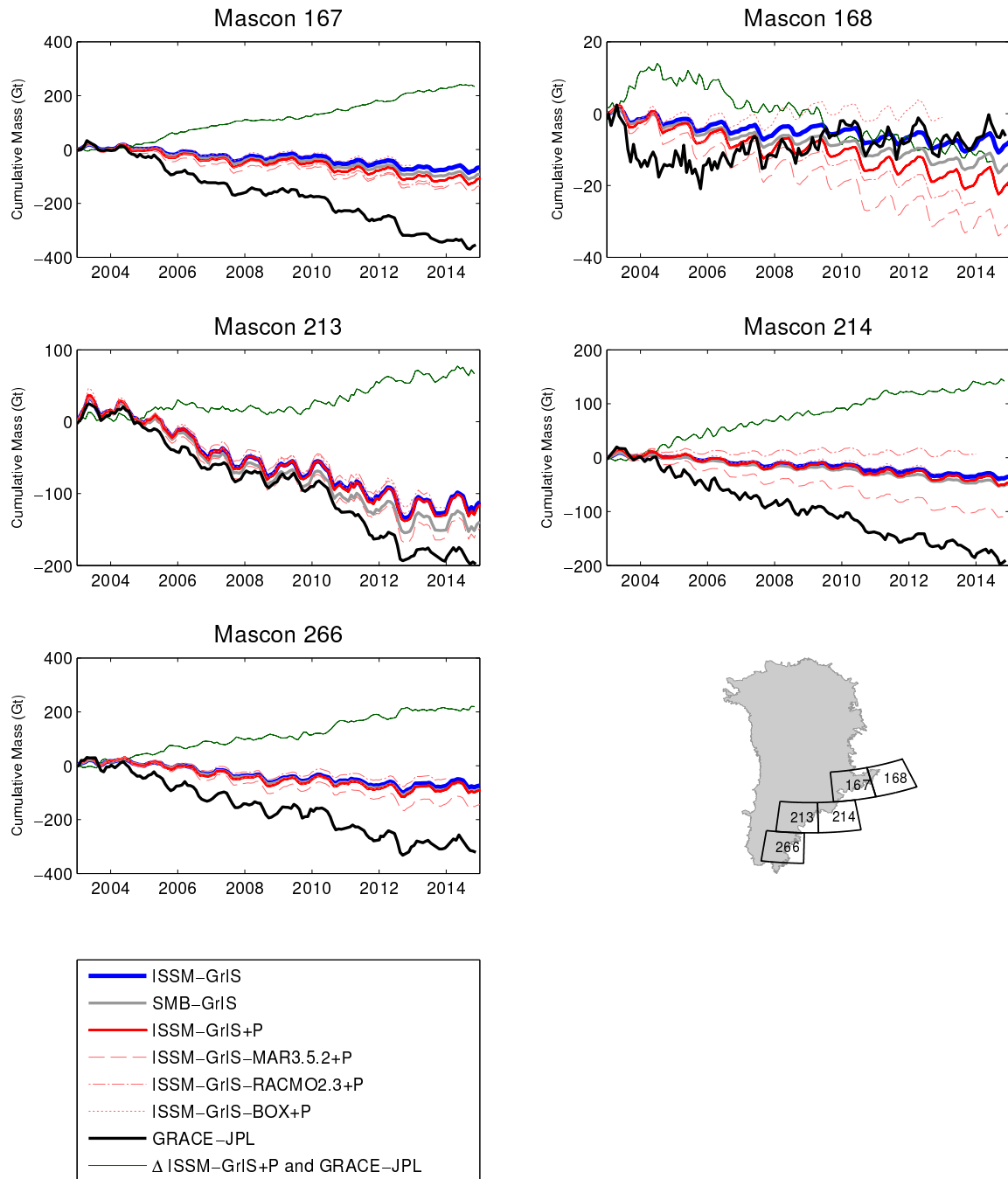


Figure S8. Same as Fig. S6 but for Southeast mascons.

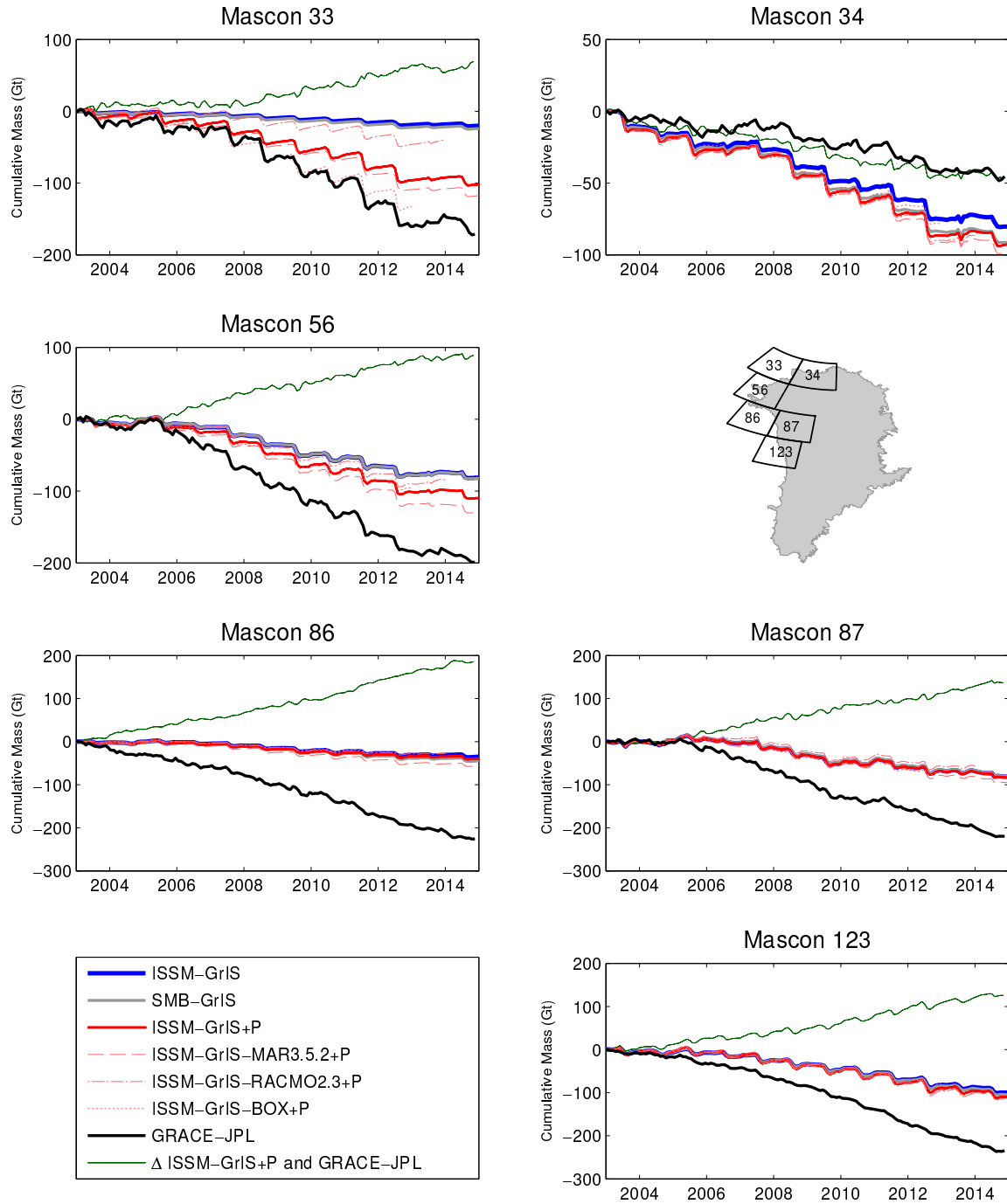


Figure S9. Same as Fig. S6 but for Northwest mascons.

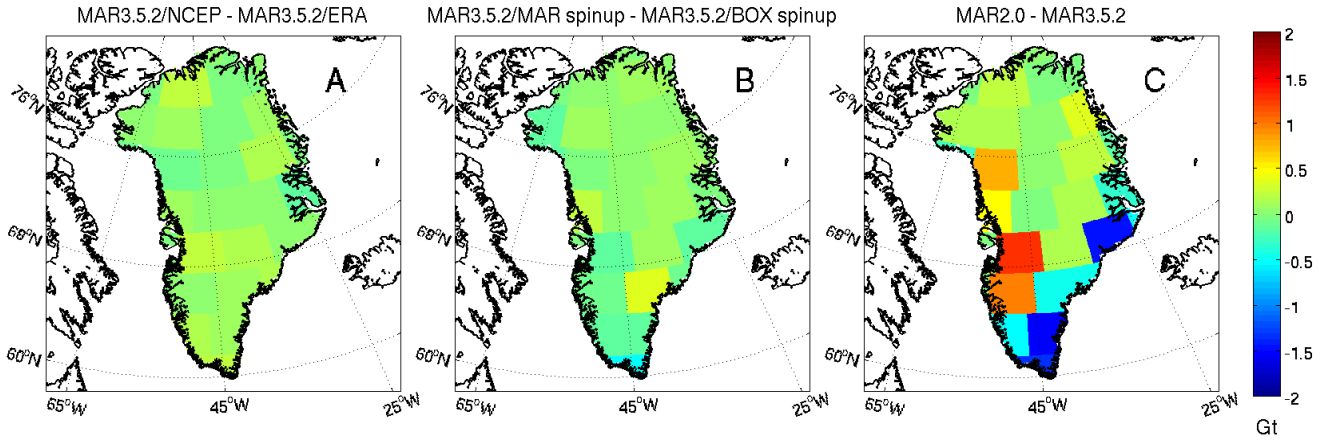


Figure S10. Spatial representation of differences in mean annual amplitude from 2003-2012 between various combinations of model spinup and the ISSM-GrIS MAR3.5.2 presented in the manuscript (i.e. MAR3.5.2 forced by ERA-I reanalysis and BOX SMB used as the reference relaxation climatology, \overline{SMB}). Comparison runs include: (A) ISSM-GrIS MAR3.5.2, where MAR3.5.2 is forced with NCEP1 reanalysis; (B) ISSM-GrIS MAR3.5.2, where MAR3.5.2 SMB is used for \overline{SMB} ; and (C) ISSM-GrIS MAR2.0, where MAR2.0 SMB (forced with ERA-I reanalysis) is used for \overline{SMB} . Results are less sensitive to variations in RCM forcing (A) and choice of spinup product (B) than to RCM version (C).

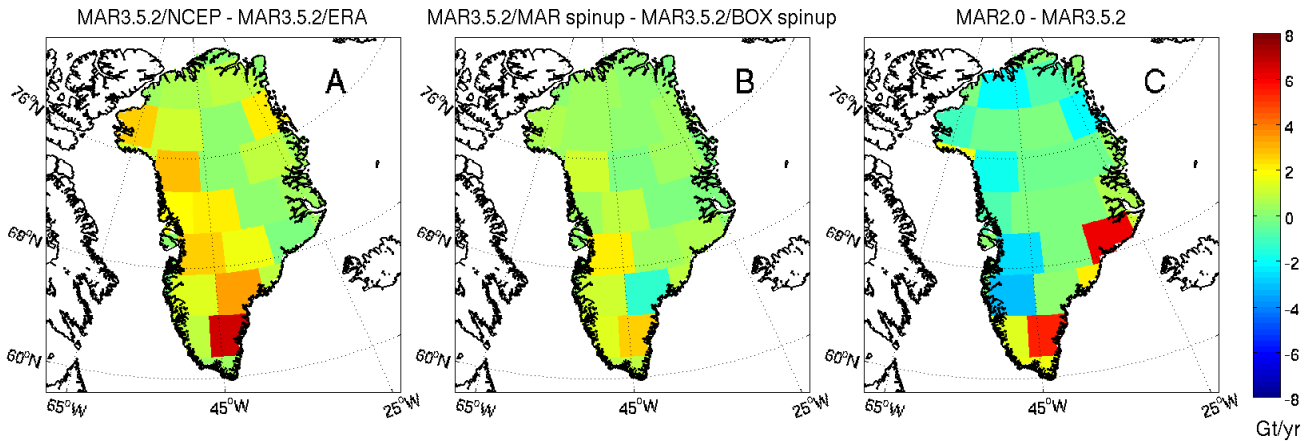


Figure S11. Spatial representation of differences in mass trend from 2003-2012 between various combinations of model spinup and the ISSM-GrIS MAR3.5.2 presented in the manuscript (i.e. MAR3.5.2 forced by ERA-I reanalysis and BOX SMB used as the reference relaxation climatology, \overline{SMB}). Comparison runs include: (A) ISSM-GrIS MAR3.5.2, where MAR3.5.2 is forced with NCEP1 reanalysis; (B) ISSM-GrIS MAR3.5.2, where MAR3.5.2 SMB is used for \overline{SMB} ; and (C) ISSM-GrIS MAR2.0, where MAR2.0 SMB (forced with ERA-I reanalysis) is used for \overline{SMB} . Results are less sensitive to choice of spinup product (B) than to variations in RCM forcing (A) or to RCM version (C).