Multidecadal Variations of the Effects of the Quasi-Biennial Oscillation on the Climate System

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Supplementary Material
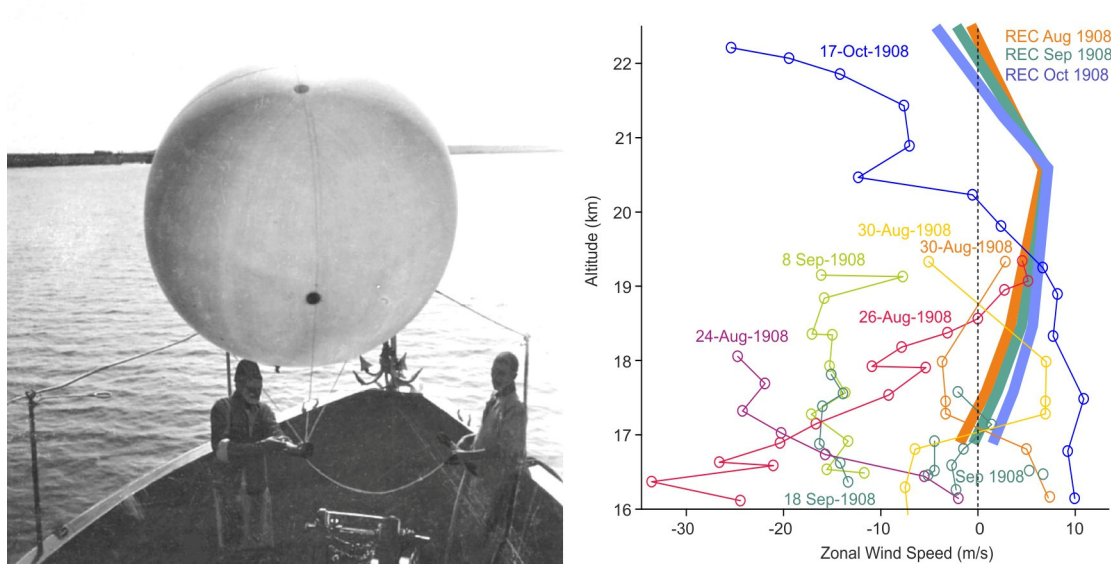
Fig. S1. (left) Registering balloon measurements on Lake Victoria during Berson's East Africa expedition. (right) Stratospheric zonal wind in the profiles from Berson's expedition. Also indicated are corresponding winds from the reconstructed QBO ("REC").
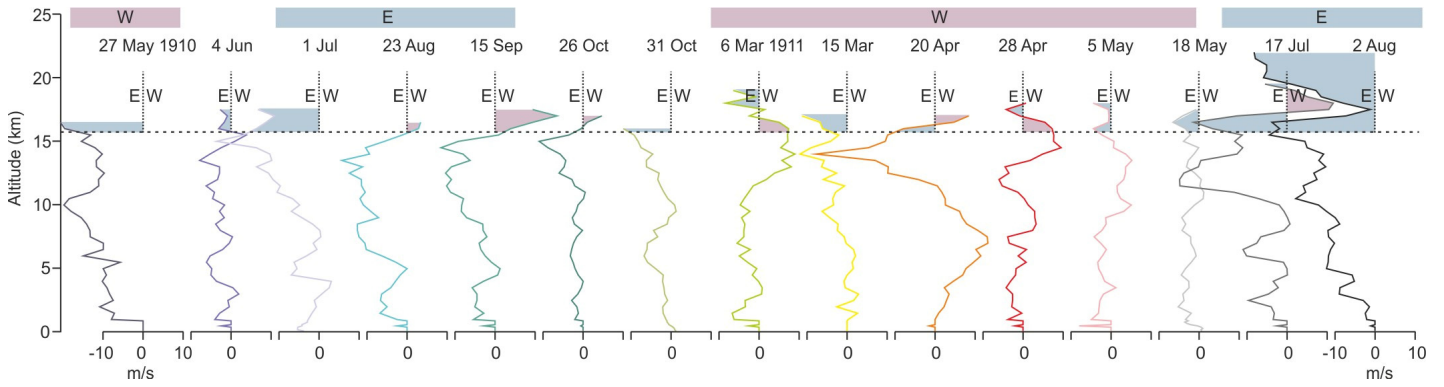
Fig. S2. Profiles of zonal wind from Batavia, 1910-1911. The QBO phase in the top line refers to the reconstructed QBO at 90 hPa.
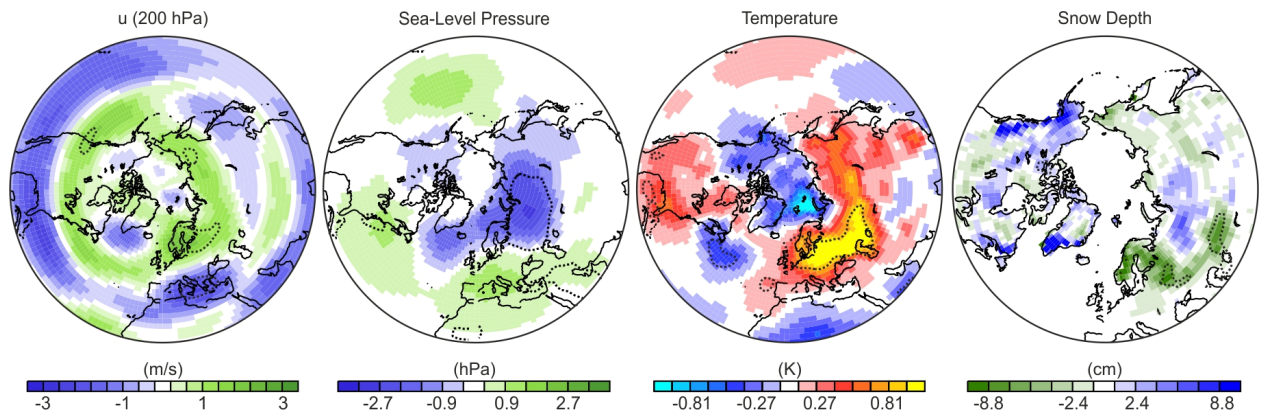
Fig. S3. Composite fields for easterly minus westerly QBO phases of 200 hPa zonal wind, sea-level pressure, SAT, and snow cover. Dashed lines indicate differences that are significant at the 95% confidence level (t-test).
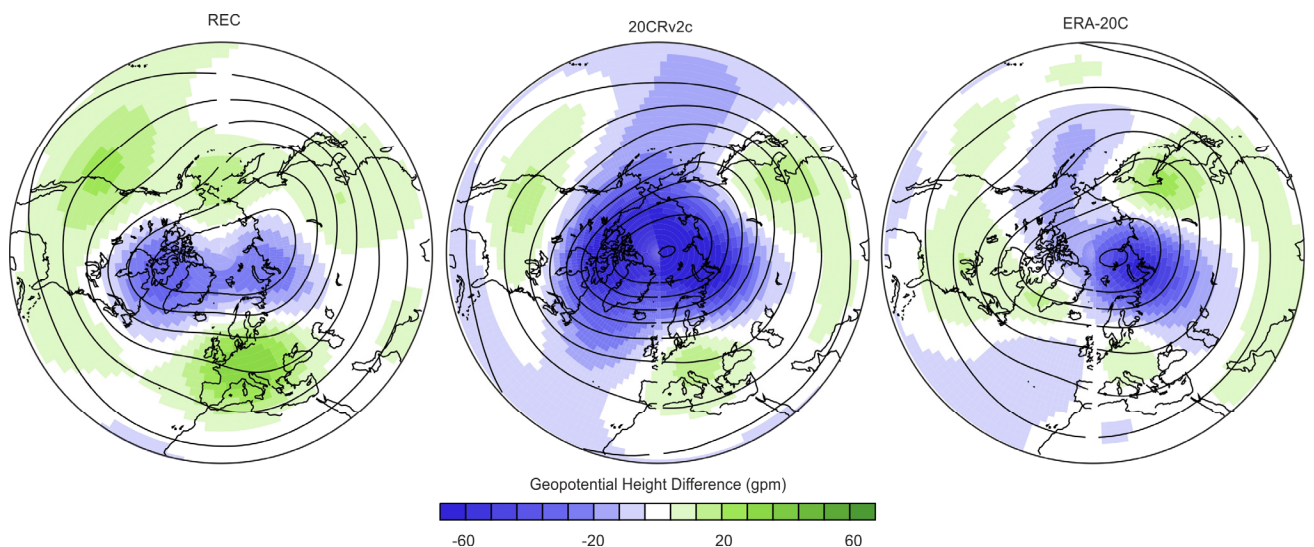
Fig. S4. Composite fields for easterly minus westerly QBO phases for 100 hPa geopotential height in Jan.-Mar., 1908-1957 in reconstructions, 20CRv2c, and ERA-20C. Contours (spacing is 200 gpm) indicate climatology.
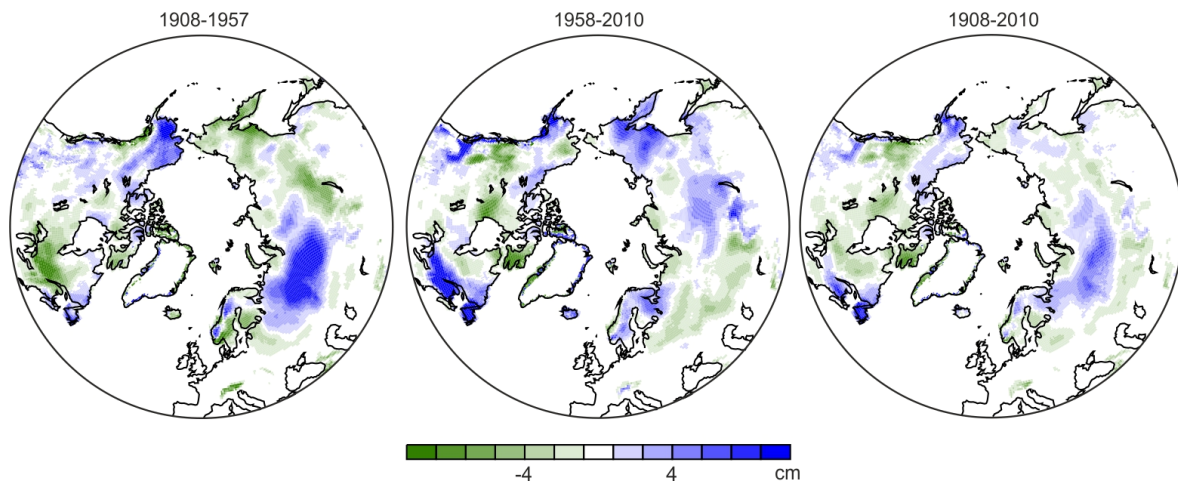
Fig. S5. Composite fields for easterly minus westerly QBO phases for snow depth in ERA-20C for (left) 1908-1957, (middle) 1958-2010 and (right) 1908-2010.
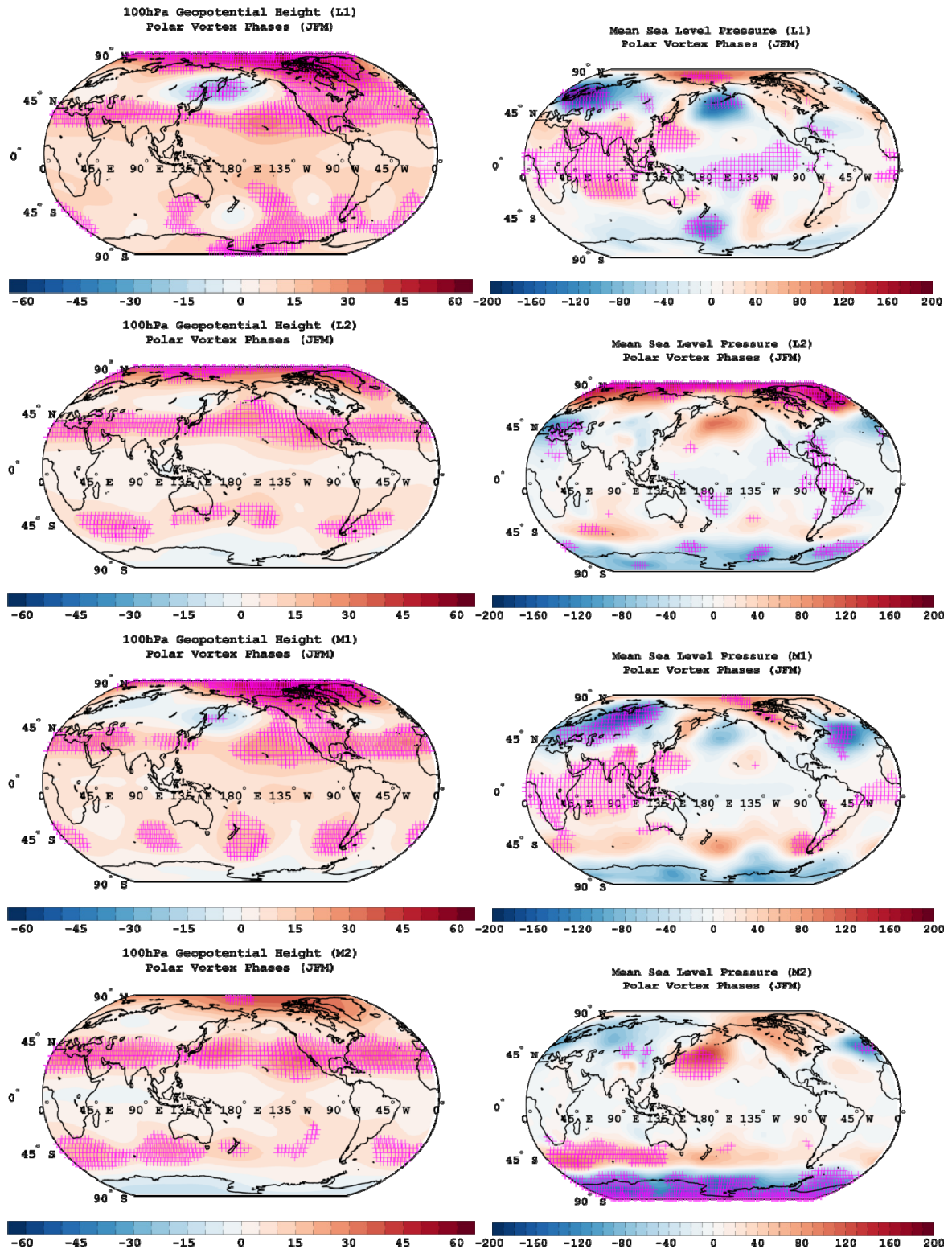
Fig. S6. Composite fields of (left) 100 hPa geopotential height and (right) sea-level pressure for easterly minus westerly QBO phases from the FUPSOL simulations (top to bottom: F13, F14, F23, F24) for Jan.-Mar. Hatching denotes differences that are significant at the 95% confidence level (t-test).
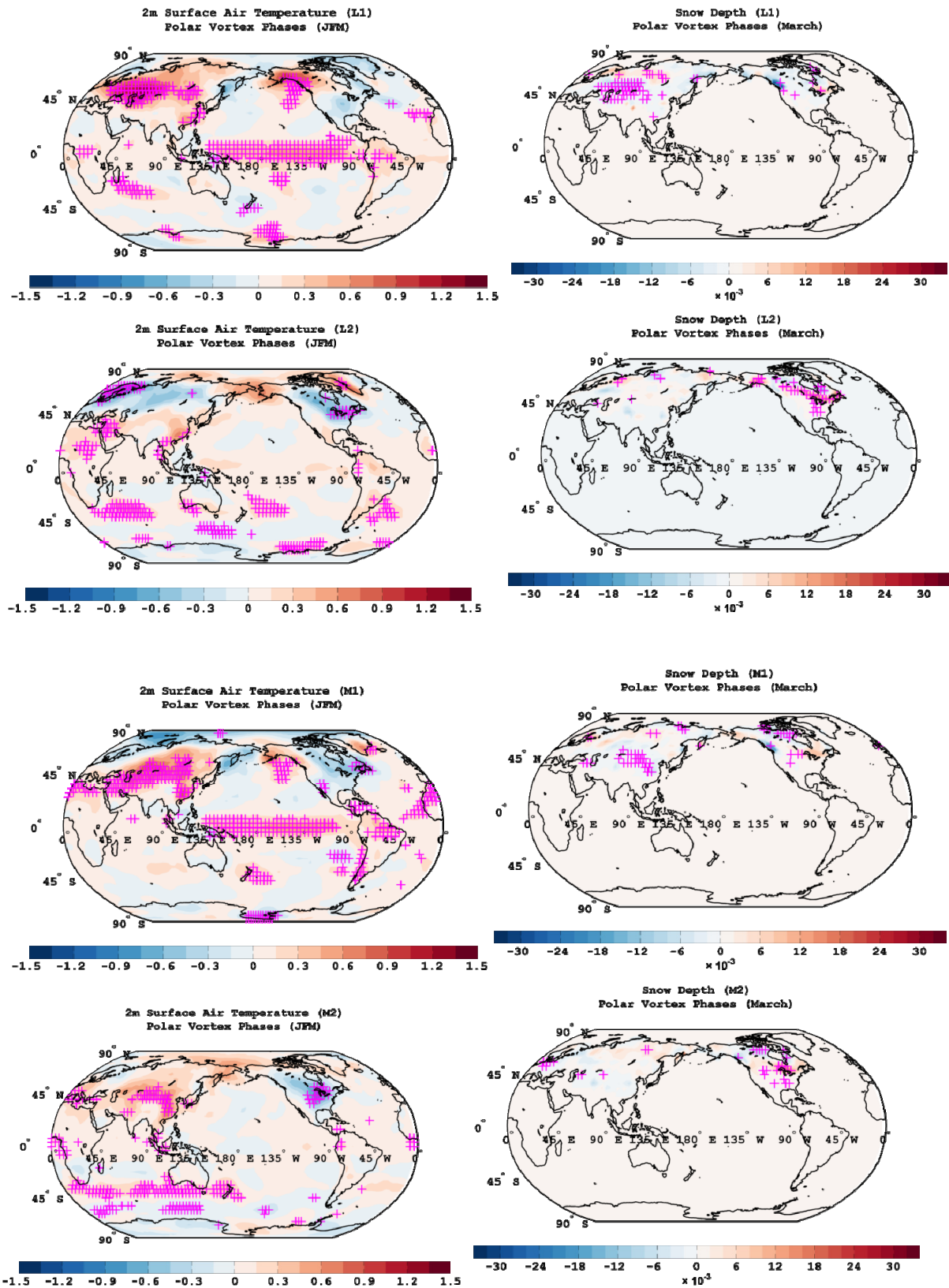
Fig. S7. Composite fields of (left) 2 m temperature and (right) snow depth for easterly minus westerly QBO phases from the FUPSOL simulations (top to bottom: F13, F14, F23, F24) for Jan.-Mar. Hatching denotes differences that are significant at the 95% confidence level (t-test).
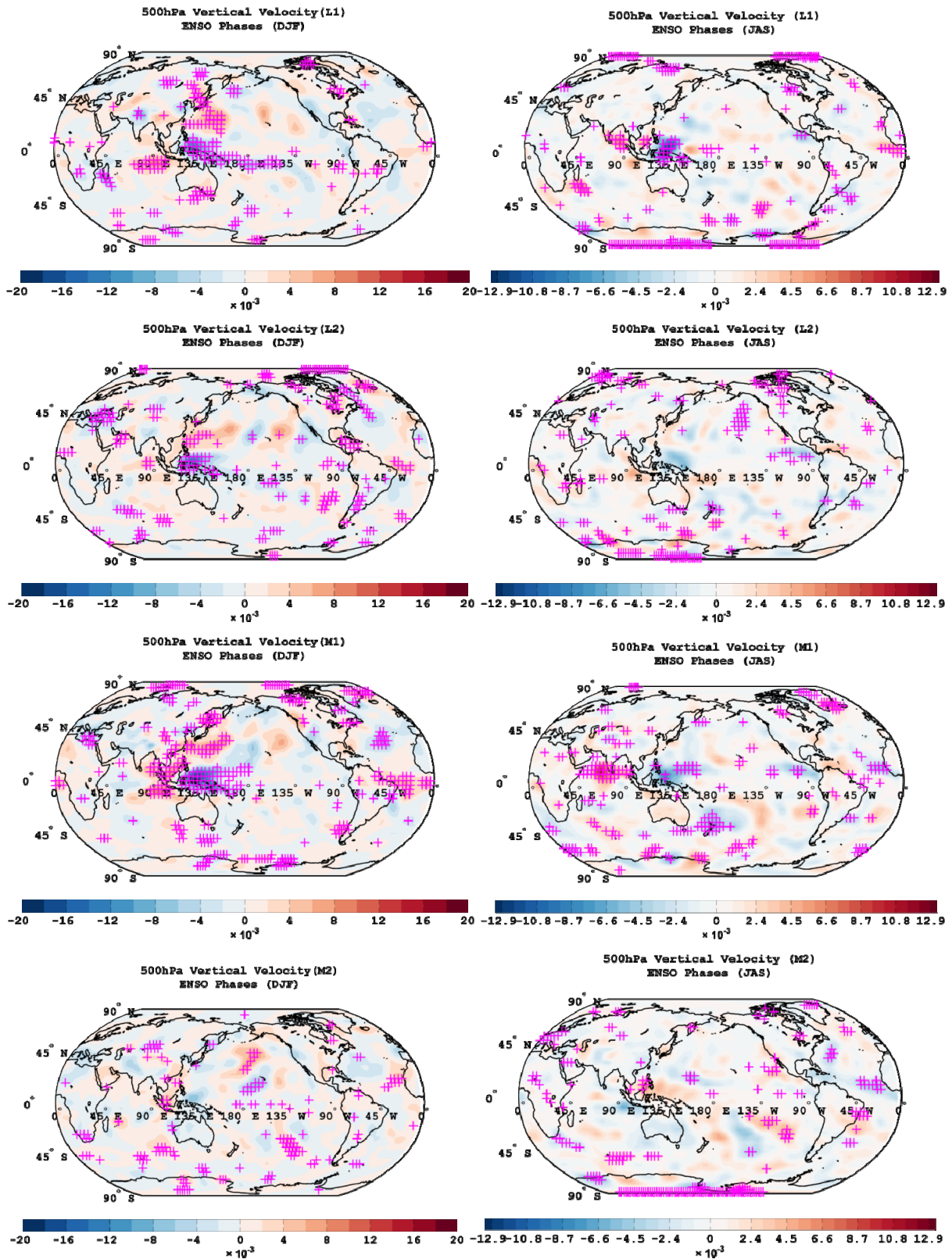
Fig. S8. Composite fields of 500 hPa omega for easterly minus westerly QBO phases from the FUPSOL simulations (top to bottom: F13, F14, F23, F24) for (left) Dec.-Feb and (right) Jun.-Aug. Hatching denotes differences that are significant at the 95% confidence level (t-test).
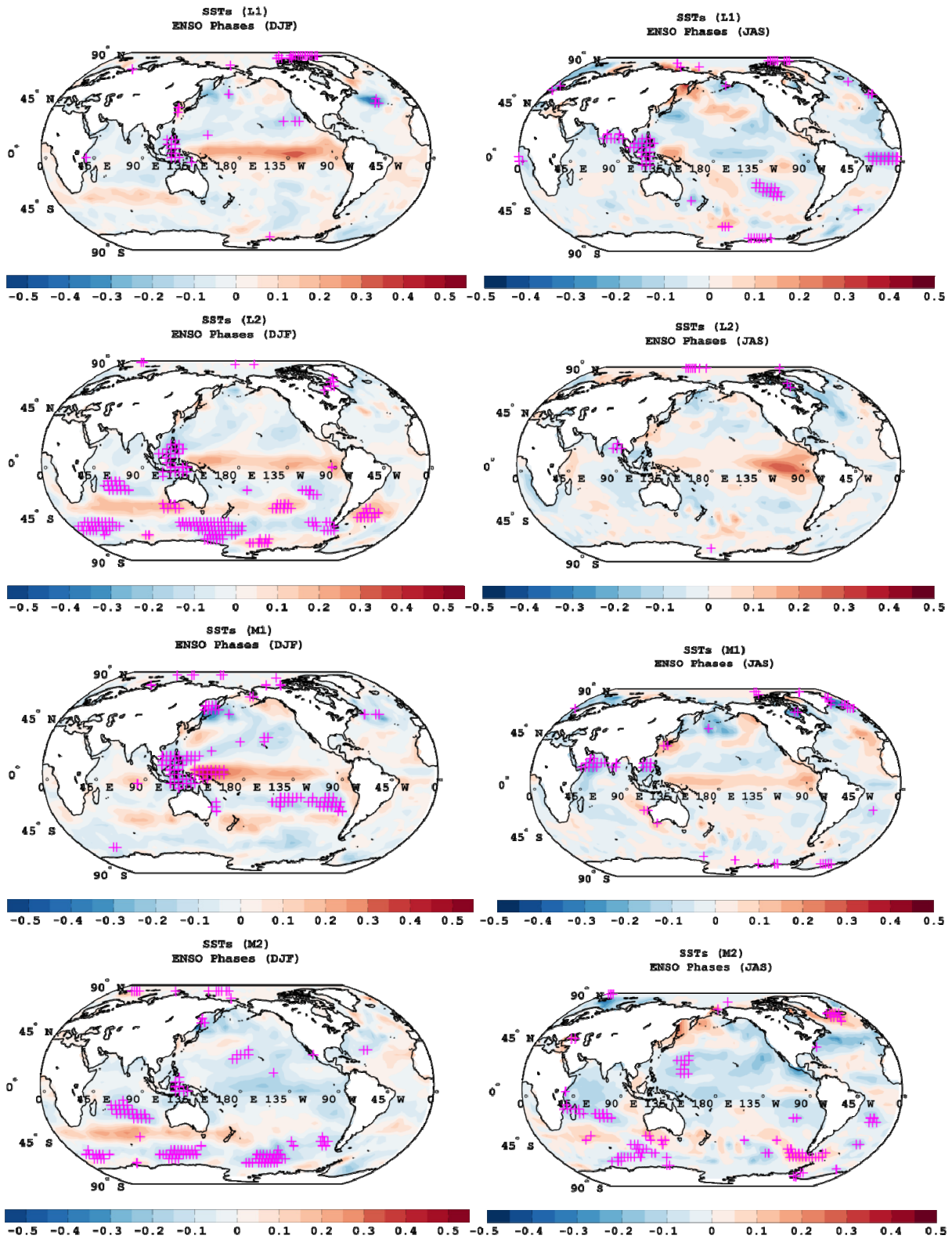
Fig. S9. Composite fields of sea-surface temperatures for easterly minus westerly QBO phases from the FUPSOL simulations (top to bottom: F13, F14, F23, F24) for (left) Dec.-Feb and (right) Jun.-Aug. Hatching denotes differences that are significant at the 95% confidence level (t-test).
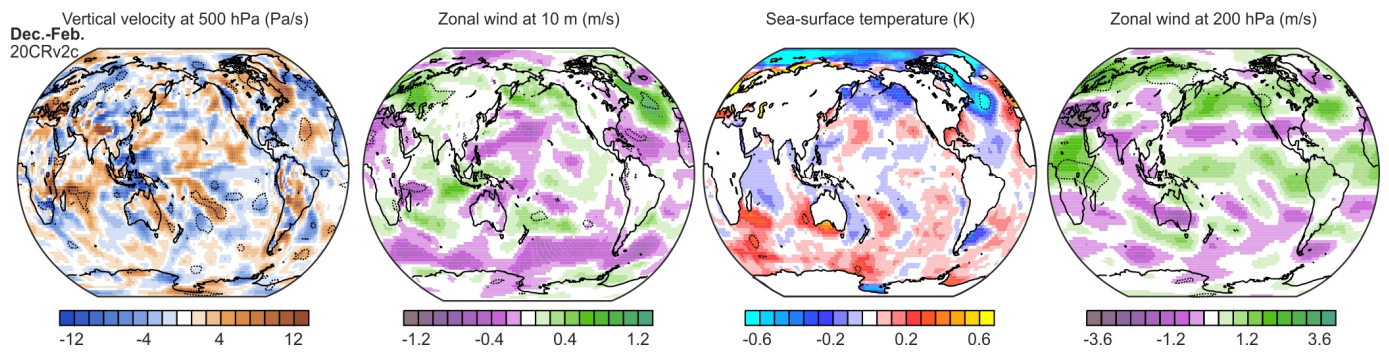
Fig. S10. Composite fields for easterly minus westerly QBO phases for (left) 500 hPa vertical velocity, 10 m zonal wind, SST, and 200 hPa zonal wind for boreal winter in 20CRv2c. Dashed lines indicate differences that are significant at the 95% confidence level (t-test).