Climatology of potential temperature lapse rate [K km−1], defined as the vertical gradient of potential temperature between 700 and 1000 hPa, calculated from (top) CFES and (bottom) AFES for (left) DJF and (right) JJA.

While wind stress positively correlates with SST only around the SST fronts such as the mid-latitude western boundary current (WBC) regions in CFES, both CFES and AFES well reproduced positive correlation between wind stress derivatives and SST gradients all over the world ocean. It is found that coupling coefficients between wind stress derivatives and SST gradients do not have their maxima over the WBCs including the Agulhas Return Current and their spatial patterns strongly reflect large-scale wind field in both CFES and AFES. While previous studies have focused on static stability effects on spatial and seasonal variability of area-averaged coupling coefficients, this study suggests that the variability of the coupling coefficients can also be attributed to large-scale variability of wind, and we need to distinguish between the contributions to coupling coefficients from the local efficiency of vertical momentum transfer and those from the large-scale available momentum.

3.4. Agulhas Return Current Region

Figure 5. Coupling coefficient between downwind SST gradient and wind stress divergence [Pa K−1]. Climatology of SST is also plotted in contours and the interval is 1 K.

Figure 8. Same as in Fig. 5 but for coupling coefficient between SLP Laplacian and wind stress divergence [Pa m−1].

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Figure 6. Same as in Fig. 5 but for coupling coefficient between downward SST gradient and wind stress divergence [Pa K−1].

Figure 7. Same as in Fig. 5 but for coupling coefficient between crosswind SST gradient and wind stress curl [Pa K−1].

Figure 9. Same as in Fig. 5 but for coupling coefficient between SLP Laplacian and wind stress curl [Pa m−1].

Figure 10. Same as in Fig. 3 but for high-pass filtered wind stress curl [Pa m−1].

Figure 11. Same as in Fig. 3 but for high-pass filtered wind stress divergence [m2 s−2].

Figure 12. Same as in Fig. 3 but for high-pass filtered wind stress curl [m2 s−2].