Covariability between surface wind stress and sea surface temperature in the mid-high latitudes of Southern Hemisphere

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The mid-high latitudes of the Southern Hemisphere (SH) are known as the strongest surface-wind area in the entire oceans. A dominant variability in the SH is characterized by a seesaw pattern between the mid and high latitudes, called the Southern Annular Mode (SAM) (Thompson and Wallace, 2000), which suggests that climate patterns affect the westerly wind, eddy, and sub-Antarctic sea ice (e.g. Hogg et al., 2015; Morioka et al., 2017; Cerrone and Fusco 2018). The relationship between the surface wind stress and sea-surface-temperature (SST) is considered to be a key factor for air-sea interaction over the global ocean. For example, SST perturbations induce perturbations in the surface wind stress, with enhanced stress over warm water and reduced stress over cooler water. Focus in previous studies has been on the Southern Ocean, the Southern Atlantic Ocean, and the Agulhas Return Current (O’ Neill et al., 2003; 2005; 2012). However, the detailed relationship between the surface wind stress and oceanic field in the SH still remains unclear. In this study, we investigate relationships between the surface wind stress and SST in the SH using new satellite-based data with high resolution in time and space.

As a preliminary analysis, we make intercomparison between the data sets of surface wind stress and SST by reanalysis data and satellite-derived data. As described in previous studies, the wind stress has maximum along the axis of the Antarctic Circumpolar Current (about 40S-50S, ACC), associated with shifts in the meridional direction. Next, we apply the spatially low-pass filter and high-pass filter to surface wind stress curl, divergence, and SST fields. The spatial structures found remarkably in the wind stress field are closely related to the SST field around about 35S-60S in the mid-high latitudes of the SH. Further work will be also examined in detail for each oceanic sector (Pacific, Atlantic, and Indian).

Keywords: Surface Wind Stress, Sea Surface Temperature, Observation data, temporal and spatial variability

