Changes in Marine Fog over the North Pacific in Warmer Climates

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Marine fog, which occurs in an atmospheric layer that touches the ocean, frequently prevails over the mid-latitude ocean. Therefore, marine fog is one of the most prominent phenomena which are related directly to air-sea interaction in the mid-latitudes. Most marine fog over the North Pacific is advection fog; warm surface air transported by southerly wind over the cold ocean is cooled by the sea surface and the water vapor is condensed into fog. This presentation shows the changes in the occurrence of marine fog over the summer North Pacific in warmer sea surface temperature (SST) and the mechanism that is revealed by using the CMIP5 multi-model data (based on atmospheric model simulations where SST is given).

It was revealed that there is a clear relationship between the changes in marine fog occurrence in the North Pacific and the changes in the North Pacific high-pressure system accompanied by changes in horizontal wind patterns. For instance, when SST is increased, the North Pacific high-pressure system is weakened. Consequently, marine fog decreases due to weakening of southerly wind in the western North Pacific and increases due to strengthening of southerly wind in the eastern North Pacific (Fig. 1). Most CMIP5 models indicate similar changes, and thus these changes must be reliable. If time permits, we also discuss marine fog changes in another ideal climate where CO2 concentration is increased without changes in SST.

Keywords: marine fog, mid latitude, climate change, air-sea interaction, CMIP5

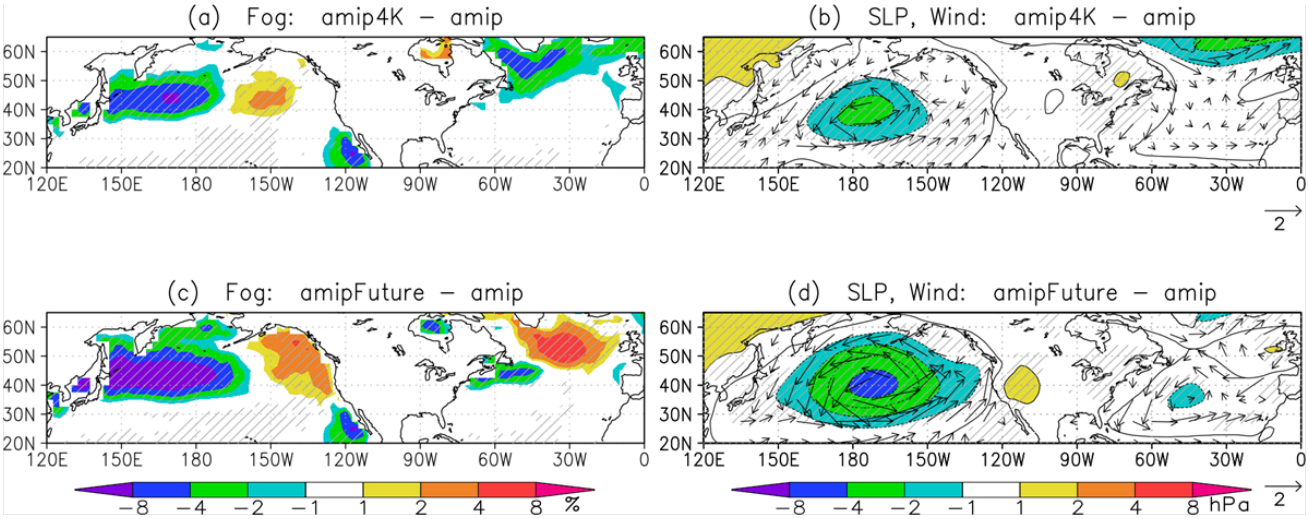

Figure 1: Changes in (a, c) marine fog occurrence (%) and in (b, d) sea level pressure (shade; hPa) and 1000 hPa wind (arrows; m s^{-1}) for July. The CMIP5 multi model ensemble means of changes from (a, b) amip to amip4K, and (c, d) amip to amipFuture simulated by 10 models (1979–2008) are shown. Hatching denotes areas in which more than 80% of models exhibit changes with the same sign. (amip4K: AMIP with SST increased by 4 K with uniform perturbations. amipFuture: AMIP with SST increased by 4 K with a composite pattern obtained from CMIP3 models.)

