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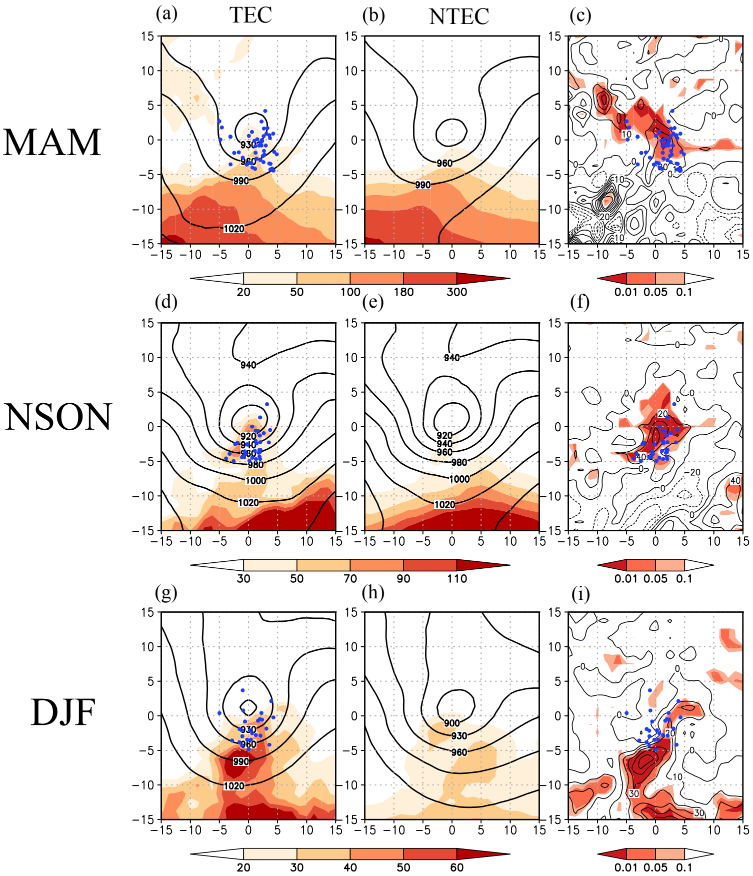

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Figure. 1. Horizontal distribution of CAPE (color shading; J kg^{-1}) for TECs in (a) MAM, (b) NSON, and (g) DJF. (b), (e) and (h): As in (a), (d) and (g), but for NTECs. (c), (f) and (i): The *p* values for differences between TECs and NTECs. Contour lines in left and middle panels indicate geopotential height at 900 hPa with an interval of 30 m, and those in right panels show differences in CAPE between TECs and NTECs, respectively. Note that the contour interval in (c), (f), and (i) are 10 J kg^{-1}. Blue dots indicate the locations of tornadoes with respect to the cyclone center. The unit of numerals on the axes is degree.

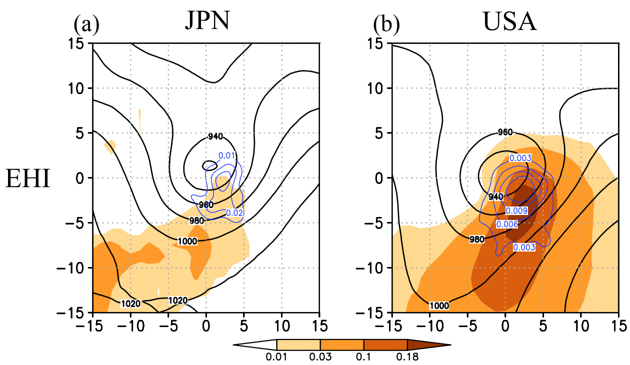

Figure. 2. Horizontal distributions of EHI (color shading) for TECs in (a) JPN and (b) USA in MAM. Black contour lines indicate geopotential height at 900 hPa (m) with an interval of 20 m. Blue contour lines indicate kernel density estimates for distributions of tornado with respect to the TEC centers.

- This study used the JRA-55 reanalysis dataset to analyze the structure and environment of extratropical cyclones (ECs) that spawned tornadoes (tornadic ECs: TECs) between 1961 and 2011 in Japan.
- Our comparison of the structures and environmental parameters of TECs and non-tornadic ECs (NTECs) in each season indicates that CAPE for TECs in all seasons is larger than that for NTECs. Thus, thermodynamically more unstable environments seem to be important for tornado occurrences.
- A comparison of TECs between Japan and the United States (US) shows that SREH and CAPE are noticeably larger in the US. It is suggested that these differences occur because TECs in the US (Japan) develop over land (ocean), which exerts more (less) surface friction and diurnal heating.