Trends and interannual variations of rainfall over the Indonesian maritime continent

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Trend and interannual variations of rainfall amount and rainfall extremes over Sulawesi and the Maluku Islands in the eastern Indonesian maritime continent (IMC) were investigated using surface daily rainfall data at 23 stations during 1972–2012. Tendencies towards wetter conditions seen in the rainfall extremes are predominant features in the eastern IMC in accordance with increasing trend of the relative proportion of total rainfall amount from heavy rainfall. The interannual variations of the rainfall extremes were closely related to ENSO phases. The wetter (drier) condition is associated with La Niña (El Niño) event, especially for wet days at more than 90% of the stations. Heavy rainfall events increase during La Niña years at more than 60% of the stations. On the other hand, Villafuerte and Matsumoto (2015) described that a decreasing trends of annual rainfall amount and heavy rainfall were dominant in most parts of the IMC, except the eastern part using a gauge-based gridded rainfall dataset during 1951-2007. Decreasing trends of rainfall amount were also reported over Java Island in the western IMC that might be related to the weakening of the Asian winter monsoon (e.g., Aldrian and Djamil, 2008; Hamada et al. 2012). At the meeting, we will discuss temporal and regional differences of the trends and influence of ENSO over the whole maritime continent by analyzing the surface rainfall datasets for the older period (oldest record started from the middle of 19th Century) and the entire region of the IMC.

Keywords: Maritime continent, Rainfall variability , Trends

Decadal-scale variation of the typhoon recurvature latitude

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The long-term variation of typhoon recurvature latitude was estimated based on the analysis of typhoon trajectory patterns via the Gaussian process regression technique. Since typhoon trajectory patterns affect the risks of typhoon-related hazards, it is important to model its variation. In this study, long-term variations in typical typhoon trajectory patterns were analysed simultaneously with seasonal variations. The results indicate decadal or longer meridional oscillations of typhoon recurvature points that are distinguishable from seasonal variations. Background wind field variations seemed to be consistent with the variations of the typhoon latitude recurvature after 1990, but the correspondence was poor before 1990. These results suggest that for at least the two decades after 1990, the typhoon recurvature latitude was associated with a long-term oscillation mode. The poor correlation before 1990 might suggest that meridional variations of the typhoon recurvature latitude were primarily related to central Pacific rather than the eastern Pacific warming. However, further investigation will be required to attain a conclusive answer.

Keywords: typhoon, long-term variation

Dynamical response of the North Pacific Ocean to the tropical variability and its predictability

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While teleconnections from the tropical Pacific to the North Pacific sea surface temperature are well known, the dynamical response of the North Pacific Ocean to the tropical atmosphere-ocean variability is not well investigated. Based on observed and reanalysis data, we investigate this link through a correlation analysis using the indices of Nino3, Nino3.4, and El Nino Modoki Index (EMI). The simultaneous correlation maps of the wind-stress curl indicate that the signal associated with EMI in the eastern North Pacific is stronger than the counterparts with Nino3 and Nino3.4. Responding to these signals in wind-stress curl, sea surface height (SSH) anomalies develop following EMI, but almost no SSH responses are found to Nino3 and Nino3.4. As El Nino Modoki lasts for a longer period than canonical El Nino, the stronger wind-stress curl signal to EMI drives the ocean more persistently, and induces substantial SSH signals. The induced SSH signals propagate westward to the western boundary region around 35N and affect intensity and/or latitude of the Kuroshio Extension. Predictability of this process will be also discussed.

Keywords: Teleconnection, El Nino, Kuroshio Extension

Relationship between upper ocean heat content in the Japan Sea and volume transport through the Tsushima Strait

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This study investigates the relationship between the upper (0-300m) ocean heat content (OHC) in the Japan Sea and the volume transport of the Tsushima Warm Current passing through the Tsushima Strait to the Japan Sea. We analyze a new high-resolution long-term ocean reanalysis data named FORA-WNP30 (Four-dimensional variational Ocean ReAnalysis for the western North Pacific over 30 years), in which the realistic ocean variation is reconstructed by an eddy-resolving 4DVAR ocean data assimilation system in the Meteorological Research Institute (MRI). Both the OHC and volume transports through the straits, that connect the Japan Sea to neighboring seas (the East China Sea and the Okhotsk Sea) and the Pacific Ocean, exhibit positive trends during recent 30 years. The spatial pattern of the trend in the OHC has three local maxima in the eastern part of Japan Sea, northeast of the Oki Islands in the southern part of the Japan Sea, and east of the Korea Peninsula. This feature is consistent with previous observational studies. The local maxima of the trend in the OHC are associated with changes in the flow pattern of the Japan Sea. In particular, the OHC signal at the northeast of the Oki Islands accompanies a warm eddy structure. Variation of low-pass filtered volume transport through the Tsushima Strait is largely in phase with variations of the OHC in the Japan Sea on interannual to decadal time scales, implying that the volume transport through the Tsushima Strait is one of causes for the OHC variations. However, the phase of variation of heat content at the northeast of the Oki Islands does not match with that of the volume transport well. Warm and cold eddy structures tend to appear alternately at the northeast of the Oki Islands on interannual time scale. It implies that the variation of the OHC at the northeast of the Oki Islands is affected by not only that of the volume transport but also dynamical adjustment related to the eddy structures.

Keywords: Japan Sea, Ocean Heat Content, volume transport, interannual variation, decadal variation

Influence of the Gulf Stream on the hemispheric-scale coupled atmosphere-ocean-sea ice system

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In this study, we artificially changed the path of the Gulf Stream in a global coupled GCM by slightly modifying the bottom topography around the Florida Peninsula and investigated the response of the hemispheric-scale coupled atmosphere-ocean-sea ice system.
When the narrow channel east of the Florida Peninsula is deep enough in the model, the Gulf Stream takes a realistic path around the peninsula (otherwise the Antilles Current is enhanced unrealistically), but it overshoots northward in comparison to the case with the shallower channel. As a result, positive sea surface temperature (SST) anomalies are found around the Gulf Stream "Extension" (after it separates from the east coast of the North America) and in the Barents Sea. This is consistent with the observed fact that northward shift of the Gulf Stream Extension induces positive SST anomaly in the Barents Sea. On the other hand, SST around Japan increases as opposed to the previous studies that warm anomaly in the Barents Sea brings cold anomaly over Eastern Eurasia. In our model, decrease of sea ice in the Arctic Ocean caused by the modification of bottom topography creates negative sea-level pressure anomaly that elongates along the entire Arctic rim, which may induce northward shift of the atmospheric circulation in the lower Troposphere and the subtropical gyre in the North Pacific, and hence, positive SST anomaly around the Kuroshio Extension.

