Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

ACG32-P01 Room:Convention Hall Time:May 26 18:15-19:30

Classification of the tropical ocean based on time variation of surface parameters

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Because of a rapid decrease of observation buoys in the tropical ocean, continuity of the buoy observation became a big issue to be solved in Tropical Pacific Observing System 2020 (TPOS2020). Therefore, we need to examine optimum array of tropical observation buoys based on the scientific evidence. For this purpose, we need to investigate which buoy can monitor each physical phenomenon in the tropical ocean.

In this study, we use Merged satellite and in situ data Global Daily Sea Surface Temperatures (MGDSST) for sea surface temperature and The Modern-Era Retrospective Analysis for Research and Applications (MERRA) for wind speed and specific humidity. The temporal resolution of the data is daily. The horizontal grid size is 1(lat.)x2(log.). We focus on El Nino, Southern Oscillation and Madden-Julian Oscillation as target physical phenomena in this study. We extract the signal of each physical phenomenon from the data using a time filter. The tropical ocean (30N-30S) was classified by a cluster analysis. To investigate the relation between the time variations of each cluster and each physical phenomenon, we estimate the correlation coefficient between them. As indexes, we use NINO3 for El Nino, Southern oscillation index (SOI) for Southern oscillation and an all season real time multivariate MJO index (Matthew et al, 2004) for Madden-Julian oscillation.

The results of cluster analysis for sea surface temperature and wind speed are illustrated in Figure 1. The time variations of averaged data in clusters C and D located in the tropical Pacific show the high correlation with NINO3. Clusters C and D are also located in the Atlantic Ocean and in the Indian Ocean, respectively. On the other hand, for wind speeds, the correlation between the time variation of NINO3 and that of averaged data in cluster F, which extends from the tropical western Pacific to the tropical eastern Pacific, is higher than that in cluster B correspond to the NINO3 region. The result for specific humidity is similar to that for sea surface temperature. The results about SOI are similar to those about NINO3.

MJO index gives variability of enhanced convection at Maritime Continent and the tropical Pacific Ocean. As the results for wind speed and specific humidity, the correlation between the time variations of MJO indexes and that of averaged data in clusters at Maritime Continent and tropical central Pacific is high. For sea surface temperature, clusters in the Indian Ocean and the tropical western Pacific are high correlation with MJO indexes.

We classified the tropical ocean by using several ocean surface parameters and clarified the relation with remarkable tropical phenomena in this study. Our results give important information from the viewpoint of optimum array of tropical observing buoys. Also our results show the same cluster sometimes exists in the separate basin. It is suggested that the overlooked linkage between two separate regions exists concerning about the tropical phenomena. The results in this study will be important for considering about optimum array of tropical observing buoys and to understand mechanism of the physical phenomena in the tropical Pacific ocean

Keywords: Tropical Ocean, buoy observation, ENSO, Madden-Julian Oscillation

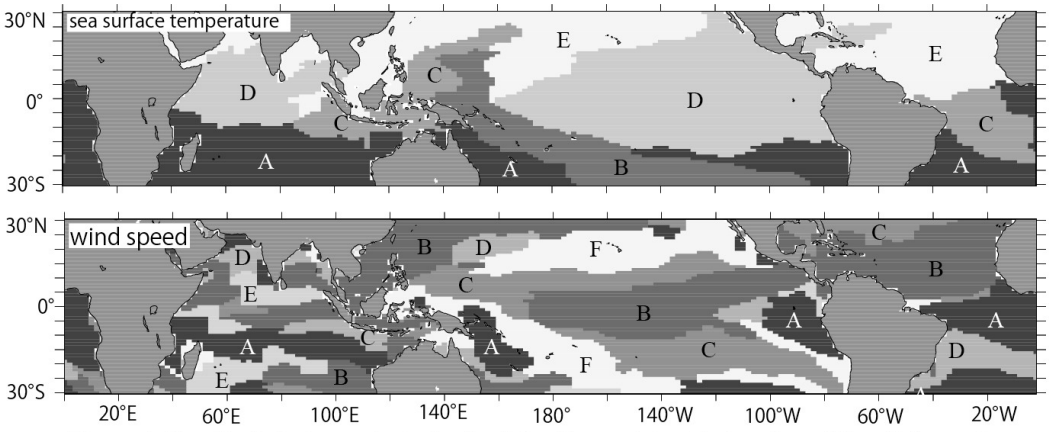

Figure 1. Result of cluster analysis for the data after applying the bandpass filter (3-5 years)

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Interannual variations of barrier layer thickness at the eastern part of the western Pacific warm pool

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This study investigated interannual variations of barrier layer thickness at the eastern part of the western Pacific warm pool (165E-180, 5S-2N) from 2005 to 2013 using Grid Point Value of the Monthly Objective Analysis using the Argo data (MOAA GPV: Hosoda et al. 2008) and Argo float profile data. Several previous observational studies showed that thick barrier layers in the western Pacific warm pool are correlated with eastward displacement of warm pool associated with El Nino (e.g. Maes et al. 2006; Bosc et al. 2009). However, interestingly, although 2012/13 was non-El Nino year, we found anomalous thick barrier layers occurring at the eastern part of warm pool in these years.

To document this anomalous thick barrier layers in detail, we also used Argo float profiles. The analysis indicated that, in agreement with previous studies, thick barrier layers in El Nino year (2006/7, 2009/10) are generated with strong surface freshening. On the other hand, the 2012/13s thick barrier layers are accompanied not by surface freshening but by relatively high salinity near their bottom (90-110dbar). The high salinity is due to the northward expansion of high salinity water originated in the South Pacific. It is hypothesized that strengthening of salinity stratification beneath the mixed layer associated with the stronger advection of the South Pacific water contributes to formation/maintenance of thick barrier layers.

From the above results, it is suggested that not only surface freshening associated with El Nino but also subsurface stratification under the influence of the South Pacific water is important for interannual variations of barrier layer thickness at the eastern part of the western Pacific warm pool.

Keywords: Barrier layer, Western Pacific warm pool, Interannual variations, Argo

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Anomalous Weather Patterns in Relation to Heavy Precipitation Events in Japan during the Baiu season

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Anomalous weather patterns (WPs) in relation to heavy precipitation events during the Baiu season in Japan are investigated using a nonlinear classification technique known as the self-organizing map (SOM). The analysis is performed on daily timescales using the JRA-55 reanalysis to determine the role of circulation and atmospheric moisture on extreme events, and to investigate interannual and interdecadal variations for possible linkages with global-scale climate variability. SOM is simultaneously employed on four atmospheric variables over East Asia that are related to Baiu front variability, whereby anomalous WPs that dominated during the 1958?2011 period are obtained. Our analysis extracts seven typical WPs, which are linked to frequent occurrences of heavy-precipitation events. Each WP is associated with regional variations in the probability of extreme precipitation events.

On interannual time?scales, the El Nino?Southern Oscillation (ENSO) affects the frequency of the WPs in relation to the heavy rainfall events. The warm phase of ENSO results in an increased frequency of a WP that provides a southwesterly intrusion of high equivalent potential temperature at low?levels, while the cold phase provides southeastern intrusion. In addition, the results of this analysis suggest that interdecadal variability of frequency for heavy rainfall events corresponds to changes in frequency distributions of WPs, and are not due to one particular WP.

Keywords: Self-organizing maps, Baiu, Extreme rainfall, Climate variability, El Nino/Southern Oscillation