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

ACG06-01 Room:101A Time:May 26 11:00-11:20

Quick water cycle over the Indonesian maritime continent: An ”AM radio” hypothesis

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High-resolution observations with radars and other hydrometeorological instruments have been installed and operated since JEPP-HARIMAU (FY2005-09) and SATREPS-MCCOE (FY2009-13) projects by Japan-Indonesia collaborations.

The most important result is that over the Indonesian maritime continent (IMC) all of landward (sea wind) water-vapor transport, rainfall and seaward (river) water transport have diurnal cycles, which suggest a very quick hydrologic cycle. In other words the water budget is almost balanced and reset every day, and is probably closed locally almost within a river basin, although the cycling (e.g. rainfall) amount is changed each day/area dependent on the diurnal-cycle (sea-land breeze circulation) amplitude controlled directly by sea-land heat/water contrast (affected by longer/larger scale climate such as cold surges and ENSO/IOD).

This situation is just like an AM radio, in which an input signal modifies the output amplitude but generates no interactions/modifications in the carrier wave frequency itself. Therefore, the concept/strategy of hydrometeorological observations/predictions over IMC must be somewhat different from those in mid-latitudes where synoptic-scale space-time continuity is most important. Namely, over the IMC, observations arranged in each area/basin and predictions restarted each day (with many recalculations analyzed statistically) would be more effective than in mid-latitudes.

Keywords: Indonesian maritime continent, cloud convection, water cycle, diurnal cycle, HARIMAU, MCCOE

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ACG06-02 Room:101A Time:May 26 11:20-11:35

MJO role on Intraseasonal variation of stable isotope of Precipitation in Indonesia Maritime Continent

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MJO (Madden-Julian Oscillation) is one of the disturbances for Asian Monsoon in the Maritime Continent Area. Intraseasonal variability of precipitation in the Indonesia Maritime Continent (IMC) is mainly due to The Madden-Julian Oscillation (MJO), cold surge, or other synoptic scale disturbance. This study examined the relationship between MJO and stable isotope in precipitation over the IMC. Observation and simulation model data from isotope circulation model was used. From 2001 - 2009, 10 main MJO events were detected and 6 of the event occurred at Boreal Winter season (Asian Monsoon). Temporal and spatial analysis from simulated stable isotopes model reveals that isotopic variation is correlated to MJO event in different phase for different stations. Generally, δ^{18}O in precipitation became lighter in most observation station at phase 3, 4 and 5 at western part of IMC, and phase 4, 5, and 6 at north east part of IMC. Spatial distribution of δ^{18}O in precipitation for each MJO phase show that mainly MJO governed δ^{18}O variability in intraseasonal timescale for IMC area. Further investigation showed clear signal of MJO in δ^{18}O was observed at Bukit Tinggi (GAW) station only; it is confirmed with result from Isotope Circulation Model (ICM). When MJO is in active phase (enhanced) precipitation in western part of IMC, precipitable water was came from Indian Ocean and South IMC Ocean.

Keywords: asian monsoon disturbance, stable isotope, Madden Julian Oscillation, moisture transport analysis

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ACG06-03 Room:101A Time:May 26 11:35-11:50

Relative role of the ocean for interannual and decadal variations in summer monsoon onset over the South China Sea

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In this study, we reveal a difference of mechanisms with interannual variation a 15-years variation in the South China Sea Summer Monsoon (SCSSM) onset. The SCSSM onset occurs in active convections over the South China Sea (SCS), when convections are active over the Philippine Sea (PS). Variations in the SCSSM onset are affect by the variations in the convective activities over SCS and PS. The increase in the sea surface temperature (SST) over the Western Pacific in recent years causes the more active convection over the PS, therefore the SCSSM onset is advanced in 15-years variation as already pointed out by Kajikawa and Wang (2012).

Moreover, we elucidate the relation between the SCSSM onset date anomaly and aggregated SST over the SCS from January to March. The correlation is good between the SCSSM onset date anomaly and the aggregated SST over SCS, while a poor relation founds between the 15-years variation oriented signal in onset date and the SST in SCS. When SCSSM onset date is delayed, the aggregated SST in SCS has tend to high temperature. On the other hand, the correlation is good between the 15-years variation in the SCSSM onset date and the aggregated SST over the PS. The SST anomalies over the SCS are influenced by the frequencies and strength of cold surges during boreal winter. Strong and longer cold surges bring the lower SST over the SCS. The cold surges are brought about the anticyclone over the Eastern Eurasian continent. An arctic sea-ice decline instigates the high-pressure deviation over the Eurasian Continent. Then relatively lower land surface temperature in middle latitude, and bring the cold surge over the SCS.

Keywords: summer monsoon, onset, South China Sea

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ACG06-04 Room:101A Time:May 26 11:50-12:05

Climatological seasonal changes of rainfall and circulation in the Philippines

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Climatological seasonal changes of rainfall and lower tropospheric circulation in the Philippines were analyzed by utilizing 5-day mean TRMM 3B-42 and station rainfall data provided by PAGASA, and ERA-Interim wind data for the period 1998-2013. In particular, climatological onset and withdrawal processes of the southwest monsoon were investigated.

It was found that the onset of southwest monsoon occurred abruptly in mid-May. It started from the north in the Philippines both in rainfall and wind, which showed a peculiar feature in this region. After the onset, anti-cyclonic flow from the Pacific high was predominant, and it changed into cyclonic flow in mid-June. Easterlies still remained in the south until early July, afterwards SW monsoon covered the whole country and enhanced from late July.

Southwest monsoon began to retreat from the north in mid- September, and fully retreated from the southern tip of the Philippines in late October.

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Keywords: monsoon, seasonal changes, monsoon onset, monsoon withdrawal, rainy season

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ACG06-05 Room:101A Time:May 26 12:05-12:25

Long-term Regional Precipitation Disparity in Northwestern China and Its Driving Forces

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Precipitation in Northwestern China (NW China) is characterized by salient regional differences. Yet, the long-term regional precipitation disparity in NW China still remains insufficiently-explored. In the present study, we base on historical documentation to derive the fine-grained precipitation indices of two macro regions in NW China between AD580 and 1979 to (1) determine the multi-decadal to centennial regional precipitation disparity in NW China; and (2) find the major driving forces behind it. Wavelet analysis is applied. Our results show that there is significant regional discrepancy of precipitation change in NW China over extended period. Besides, the association between the regional precipitation disparity in NW China and various modes of atmospheric circulation (Asian Summer Monsoon, Arctic Oscillation, Pacific Decadal Oscillation, and North Atlantic Oscillation) is significant and characterized by a regime shift during the transition from the warm episode to the Little Ice Age in the 14^{th} century. Most importantly, the $\sim$180 to 240 year cycle of the El Niño-Southern Oscillation is found to be the most prominent pacemaker of regional precipitation disparity in NW China at the long-term temporal scales. Our findings help to demonstrate which atmospheric circulation is primarily responsible for the long-term regional precipitation disparity in NW China, which may have important implications for water resource management there.

Keywords: precipitation, moisture, atmospheric circulations, Asian Summer Monsoon, El Nino-Southern Oscillation, Northwestern China

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ACG06-P01 Room:Convention Hall Time:May 26 18:15-19:30

Future Projection of Himalayan Monsoon Season Precipitation by CMIP5 Models under Warming Climates

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I. Introduction: Livelihood of the Himalayan people depends largely upon precipitation. Any variability on its regular pattern exacts profound social and economical costs.

In response to increasing anthropogenic forcing, the global monsoon precipitation is expected to amplify over most of the global region [1]. However, the response varies from region to region owing to various factors such as topography, forcing etc. [2]. Recent studies found that monsoon precipitation over India is likely to increase under the global warming scenario with enhanced variability [3, 4]. Similarly, it has also been found that precipitation over the Himalaya particularly over Nepal is poorly comparable with all India rainfall [5]. Since, study on precipitation over the world's unique geographical region, Himalaya under warming scenario is very limited, this study is aimed to investigate the future precipitation change over the Himalaya.

II. Models, Data and Methodology: We employed 26 general circulation models (GCMs) participating in Coupled Model Intercomparison Project Phase 5 (CMIP5) to evaluate their skill in simulating present monsoon season (June-September) precipitation (MSP) climatology (1979-2005) over Himalaya (20-35 ^{0}N latitude and 75-94 ^{0}E longitude). The skill of the models was judged based on their ability to represent annual cycle, spatial pattern and variability using Taylor diagram. Global Precipitation Climatology Project Version 2.2 monthly data was used for the model evaluation. The best model was selected whenever normalized standard deviation (STD) lies in 0.8-1.2, correlation coefficient (CC) $>$0.5 and centered root mean square (RMS) difference $<$1. To assess the future change, simulations from Representative Concentration Pathway 2.6 (RCP2.6), 4.5 (RCP4.5) and 8.5 (RCP8.5) of selected best models of 2070-2099 were compared with the historical runs of 1970-1999. Monthly precipitation of each model from one ensemble (r1i1p1) run was used.

III. Results and Discussions: All the models reproduced annual cycle of mean precipitation over the Himalaya more or less accurately with CC is greater than 0.7. Among them, only 13 models met the criteria mentioned in section II for reproducing annual cycle. We found that simulating the spatial pattern over the complex terrain became a major challenge for the models. Out of the 26 GCMs, only nine of them were comparatively better than others to reproduce spatial pattern with high CC, less variability and error. Likewise, simulation of the STD of MSP was also found to be a problematic one. Taylor diagram of MSP indicated that only nine models performed relatively well. Our analysis revealed that neither of the models performed equally to simulate all three matrices used in this study. Thus, only five models; HadGEM2-ES, MPI-ESM-LR, MPI-ESM-MR, NorESM1-M and NorESM1-ME were selected based on their skill to simulate all three matrices. Ensemble projections of the best models under RCP8.5 scenario indicated that MSP might be increased by 11 % compared to present climatology with amplified variability over heavy rainfall zone. Multi-model mean annual cycle of monthly precipitation showed the enhancement of monthly precipitation during monsoon season.

IV. Conclusion: Precipitation over the Himalaya simulated by 26 GCMs was evaluated. No model was found to simulate all aspects of MSP equally. Relatively, high resolution earth system models performed better than the low resolution models. Ensemble mean of five reliable models projected that the MSP will increase over the Himalaya in future warmer climate with enhanced variability over the heavy precipitation zones.

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Keywords: Monsoon precipitation, Future projection, CMIP5, Himalaya