**Template for Project Reports for the GEWEX GHP Meeting**

*A4 page size; 1-inch margins; Arial or Helvetica 10 pt for text.*

**Full Panel, Project or Working Group Name (Acronym):** Monsoon Asian Hydro-Atmosphere Scientific Research and Prediction Initiative (MAHASRI)

**Reporting Period: September 2013 – December 2014**

**Starting date:** Tentative approval in January 2006, at the GEWEX-SSG18 at Dakar, and the final approval by the GEWEX-SSG19 at Honolulu in January 2007.

**End date:** March 31, 2016 (End of JPFY2015)

**URL:** http://mahasri.cr.chiba-u.ac.jp/wiki/index.php/Main\_Page

**Chair(s) and term dates:** Jun Matsumoto, term until March 31, 2016

## 1) Panel activities over the last year

・Science highlights

1. The formation mechanism of cold season heavy rainfall/flood (HRF) events in Southeast Asia surrounding the South China Sea was extensively examined. The important roles of the location and time of the development of the mother cold surge vortexes, flow types of cold surge, and multiple interactions with succeeding cold surges were found (Chen et al, 2014a, 2014b).
2. The long-term changes of extreme rainfalls in the Philippines and Southeast Asia were examined, and their statistical relationship with global warming and ENSO was clarified (Villafuerte et al., 2014a, 2014b, 2014c).
3. Dynamics of intraseasonal variations in the summer monsoon season in Bangladesh region and the important role of large-scale (Tibetan Plateau, Gangetic Plain) and regional-scale (Meghalaya, Chittagong Hill Tracts, Arakan Mountains) topography on them were revealed (Fujinami et al., 2014, Hatsuzuka et al., 2014) .
4. Researches on 2011 severe Thailand flood have been progressed. Role of tropical cyclones on the severe 2011 Thailand flood and that on interannual variation of Thailand rainfall was revealed (Takahashi et al., 2014), the effect of dam operation on the inundation area was successfully simulated by using combing a distributed global water resources model with and catchment-based macro-scale floodplain model (Mater et al., 2014), and the sub-basin wide storage of 2011 flood water in the mountainous watersheds in the Chao Phraya River basin was revealed (Yokoo et al., 2014).
5. Future increase of runoff in the Chao Phraya River Basin in Thailand was estimated based on GCM climate projections (Kotsuki et al. 2014, Watanabe et al., 2014).
6. Rainfall driven diurnal variations of water level was discovered in the Chiliwung River, West Java, Indonesia (Sulistyowati et al., 2014).
   * Science issues
7. Past and future changes of extreme rainfall
8. Multi-scale interactions on intra-seasonal, synoptic, and diurnal cycles, and mid-latitude-tropical interactions on monsoon heavy rainfall
9. Atmospheric and hydrological processes of severe floods and their predictions
10. Decadal or multi-decadal changes of ENSO and monsoon rainfall
11. Importance of coastal rainfall on water and energy cycle in the maritime continent
12. Interannual and long-term variations of regional monsoon onset and withdrawal
13. Role of land use changes on monsoon onset
14. Effective dam operation for both flood mitigation and drought prevention
    * New projects/activities put in place last year
15. Organize international session in JpGU (Japan Geoscience Union) meeting in Japan.
16. New collaboration with ACRE (Atmospheric Circulation Reconstructions over the Earth) Southeast Asia on data rescue in Southeast Asian region has started. Also started Japanese data rescue project on Asian monsoon rainfall for the JPFY 2014-2018.
17. Collaboration with CORDEX Asia has expanded.
    * Workshops and meetings held

October 26-27, 2013: AMY Open Science Conference at Zhuhai, China

October 28-November 2, 2013: The 5th WMO International Workshop on Monsoon at Macau and Hongkong, China

January 13-14, 2014: The 4th Global Precipitation Measurement (GPM) Asia Workshop on Precipitation Data Application Technique and The 2nd International Workshop on CMIP5 Model Intercomparisons for Future Projections of Precipitation and Climate in Asia at Tokyo, Japan

March 6-7, 2014: IMPAC-T Final Symposium at Bangkok, Thailand

March 17-19, 2014: The Third International Workshop of Climatic Changes and Their Effects on Agriculture in Asian Monsoon Region (GRENE-CAAM Workshop) at Bali, Indonesia

April 7-10, 2014: **MAIRS Open Science Conference 2014 - Future Earth in Asia at Beijing, China**

April 27-May 2, 2014: JpGU at Yokohama, Japan International session “Asian monsoon Hydroclimate”

May 20-22, 2014: International ASEAN SACA&D Conference and Workshop 2014 (IASCW-2014) at Bogor, Indonesia

May 27-28, 2014: ACRE Southeast Asia Workshop at Bangi, Malaysia

July 2-3, 2014: Takio Murakami Memorial Symposium on Tropical Meteorology and Monsoon at Honolulu, Hawaii USA

July 28-August 1, 2014: AOGS2014 at Sapporo, Japan “AMY Session”

August 11-12, 2014: The 3rd International Workshop on CORDEX-East Asia at Seogwipo, Jeju, Korea. Hosted by Monsoon Asia Integrated Regional Study (MAIRS) and National Institute of Meteorological Research (NIMR)

November 17-21, 2014: The 1st WCRP/CORDEX Workshop in Southeast Asia at Bogor, Indonesia

* Please highlight issues which GHP needs to consider or for which advice is sought.

MAHASRI will end in JPFY2015 (March 2016), we have started planning of the follow-on project(s).

GHP support and advice are needed for the coming project planning.

## 2) Planed panel activities for next year

* + Planed new scientific activities:

1. Completion of AMY Re-analysis, release of in-situ AMY data, and conduct researches using these data sets.
2. Lightning activities in monsoon region will be explored by newly obtained in-situ observation data.
3. Role of aerosol on Asian monsoon variations will be analysed by satellite data.
   * Planed workshops or meetings:

March 3-4, 2015: Japanese domestic workshop on MAHASRI and beyond

March 10-12, 2015: The fourth International Workshop of Climatic Changes and Their Effects on Agriculture in Asian Monsoon Region (GRENE-CAAM Workshop) at Hanoi, Vietnam

May 24-28, 2015: JpGU International session “Asian monsoon Hydroclimate” at Chiba, Japan

August 2-7, 2015: AOGS AS session “AMY” at Singapore

August 2-7, 2015: APHW HS session “Asian monsoon hydroclimate” at Singapore

March 2-4, 2016 (Planned): International Science Conference on MAHASRI

* Please highlight foreseen risks for the panel/project activities next year and which mitigation strategies are in place.

Most of the related funding projects terminated in March 2014. Some new projects are now under planning.

## 3) Contributions to the GEWEX Science Questions

For each of the GEWEX grand science questions provide in bullet points the activities carried out or planed in the near future. Please highlight important results for the GEWEX Science questions and provide references to the relevant papers.

* GSQ1: Observations and Predictions of Precipitation

1. Real-time monitoring of precipitation and water level observations in Chao Phraya River Basin in Thailand has been available on the following web pages as a result of IMPAC-T activities. Quasi-real time hydrological simulation has conducted utilizing these data (Hanasaki et al., 2014).

http://impact-www.eng.ku.ac.th/

http://impact-di.eng.ku.ac.th/Telemetry/

http://impact-www.eng.ku.ac.th/chaophraya-auto/

1. Real-time wind profiler data in Indonesia related with HARIMAU activities are available on the following web-pages.

http://www.rish.kyoto-u.ac.jp/radar-group/blr/pontianak/data/

http://www.rish.kyoto-u.ac.jp/radar-group/blr/biak/data/

http://www.rish.kyoto-u.ac.jp/radar-group/blr/manado/data/

The past HARIMAU datasets are available in the following webpage.

http://www.jamstec.go.jp/iorgc/harimau/observation.html#data

1. MAHASRI and AMY data are open to public through the DIAS (Data Integration and Analysis System) in Japan.

http://dias-dss.tkl.iis.u-tokyo.ac.jp/ddc/search?lang=ja&ex=true&ex=jdc&ex=jalter&ex=nipr& k=AMY&k\_tit=&k\_con=&k\_abs=&map\_n=90&map\_w=-180&map\_e=180&map\_s=-90&map \_g=true&map\_type=encloses&tp\_type=between

1. Various precipitation products have been evaluated regionally in Southeast Asia (Choudhury et al., 2013, Kotsuki and Tanaha 2013, Ngo-Duc et al., 2013, Ono et al., 2013, Takahashi 2013, Veerachen et al., 2014).
2. Regional differences of raindrop size on the islands of the Indonesian Maritime Continent and the effect of island size on them were detected (Marzuki et al., 2013).

* GSQ2: Global Water Resource Systems

1. By combing a distributed global water resources model with anthropogenic interventions (H08) and catchment-based Macro-scale Floodplain (CaMa-Flood) model, impacts of reservoir operation to 2011 severe flood in the Chao Phraya RFiver basis were well simulated, and new dam operation scheme has developed (Mateo et al., 2014).

* GSQ3: Changes in Extremes

1. Recent increase of heavy rainfall extremes in Central Vietnam and Central Philippines, and decrease in the equatorial maritime continent is statistically attributed to the global warming. Their interannual changes are also attributed to ENSO, while decadal variations are not related with PDO (Villafuerte et al., 2014b, 2014c).

* GSQ4: Water and energy cycles

1. Evapotranspiration (ET) over a diverse land use area in northern Thailand was successfully estimated by long-term eddy covariance measurements since 2003. The interannual variation in ET reflects the response of the land surface to meteorological events and land use/cover changes (LUCC), and the effect of rainfall variation on ET was greater than that of LUCC (Kim W.S. et al., 2014).
2. Long-term changes of winter precipitation in Northeast Japan and their relationship with Asian winter monsoon and the sea surface temperature over the Japan Sea have been revealed (Sato and Sugimoto, 2013).

## 4) Activities contributing to the WCRP Grand Challenges as identified by the JSC

* Improved understanding of the interactions of clouds, aerosols, precipitation, and radiation and their contributions to climate sensitivity

1. Interannual variations of aerosol optical depth (AOD), cloud effective radius (CER), and precipitation were analyzed for 2000−2012 based on El Niño-Southern Oscillation phases during September–October–November (SON) and December–January–February (DJF). Interannual variations in AOD and CER in SON in the Maritime Continent were found to be asymmetrical by stronger aerosol-cloud interactions under drier conditions (Yamaji and Takahashi, 2014).
2. Regional climatic effects according to different estimations of biogenic volatile organic compounds were analysed during the Asian summer monsoon (Kim H.J. et al., 2014).

* Cryosphere response to climate change (including ice sheets, water resources, permafrost and carbon)

Little activities

* Science underpinning the prediction and attribution of extreme events

1. On the attribution of extreme daily rainfall events in the Philippines and Southeast Asia, global warming affect for increasing extreme rainfall in wider regions in the Indochina Peninsula, in particular, in its eastern part, and central Philippines has statistically shown (Villafuerte et al, 2014b and 2014c).

* Provision of skillful future climate information on regional scales (includes decadal and polar predictability)

1. Future changes (increase) of river runoff in the Chao Phraya River Basin in Thailand were estimated based on GCM results (Hanasaki et al. 2014, Watanabe et al., 2014).

* Regional Sea-Level Rise

Little activities

* Past and future changes in water availability (with connections to water security and hydrological cycle)

1. Dam operation scheme for reduction of both drought and flood has been proposed in the two major dams in the Chao Phraya River Basin, Thailand (Mateo et al., 2014).
2. Future changes of ground water resources in northern Thailand have estimated based on GCM-based climatic projection in 2026-2040 (Pratoomchai et al., 2014).

## 5) Cooperation with other GHP and WCRP projects (CLIVAR, CliC, SPARC), outside bodies (e,g. IGBP) and links to applications

* Collaboration with CLIVAR/AMMP through Asian Monsoon Year (AMY) 2007-2012 Project, endorsed by WCRP-JSC. Open Science Conference was held in October 2014. Since the release of AMY re-analysis has been delayed, its activity will continue until 2015.
* Collaboration with Monsoon Asian Integrated Regional Study (MAIRS) Project, endorsed by ESSP. Interaction has been expanded trough CORDEX activities. MAIRS is now developing new plan under the Future Earth.
* Collaboration with Asian SPARC related community has been explored.

## 6) List of key publications

* Chen, T.-C., Tsay, J.-D., Alpert, J. andMatsumoto, J. 2014a: Development and formation mechanism of the Southeast Asian winter heavy rainfall events around the South China Sea: Part I – Formation and propagation of cold surge vortex. Journal of Climate (Accepted).
* Chen, T.-C., Tsay, J.-D. J. andMatsumoto, J. 2014b: Development and formation mechanism of the Southeast Asian winter heavy rainfall events around the South China Sea: Part II – Multiple interactions*.* Journal of Climate(Accepted).
* Choudhury, A., Terao, T., Murata, F. and Hayashi, T., 2013: Seasonal variations of temperature and rainfall characteristics in the northeastern part of Bangladesh around Sylhet. J. Agrofor. Environ., 6, 81-88.
* Dzung, N.L., Matsumoto, J. and Ngo-Duc, T. 2014. Climatological onset date of summer monsoon in Vietnam. International Journal of Climatology, 34, 3237-3250, DOI: 10.1002/joc.3908
* Fujinami, H., T. Yasunari and A. Morimoto, 2014: Dynamics of distinct intraseasonal oscillation in summer monsoon rainfall over the Meghalaya-Bangladesh-western Myanmar region：Covariability between the tropics and mid-latitudes, Clim. Dyn. 43, 2147-2166, DOI: 10.1007/s00382-013-2040-1.
* Hanasaki, N., Saito, Y., Chaiyasaen, C., Champathong, A., Ekkawatpanit, C., Saphaokham, S., Sukhapunnaphan, T., Sumdin. S., and Thongduang, J. 2014: A quasi-real-time hydrological simulation of the Chao Phraya River using meteorological data from the Thai Meteorological Department Automatic Weather Stations. Hydrological Research Letters, 8, 9-14.
* Hatono, M., Noda, K., Kim, H., Somchai Baimoung, Yoshimura, K., Oki, K. and Oki, T. 2014: Conversion of surface water coverage to water volume using satellite data. Hydrological Research Letters, 8, 15-19.
* Hatsuzuka, D, T. Yasunari and H. Fujinami, 2014: Characteristics of low pressure systems associated with intraseasonal oscillation of rainfall over Bangladesh during boreal summer, Mon. Wea. Rev., DOI: 10.1175/MWR-D-13-00307.1 (in press).
* Hsu, H.-H., Zhou, T.-J. and Matsumoto, J. 2014. East Asian, Indochina and Western North Pacific Summer Monsoon - An Update, Asia-Pacific Journal of Atmospheric Science 50: 1-24, DOI:10.1007/ 13143-014-0027-4.
* Kim, H.J., Takata, K., Tanaka, K., Yamashima, R., Matsumoto, J., Saito, K., Takemura, T. and Yasunari, T. 2014. Regional climatic effects according to different estimations of biogenic volatile organic compounds during the Asian summer monsoon. Asia-Pacific Journal of Atmospheric Sciences 50: 45-68, DOI:1007/ 13143-014-0027-4
* Kim, W.S., Komori, D., Cho, J., Kanae, S. and Oki. T. 2014: Long-term analysis of evapotranspiration over a diverse land use area in northern Thailand. Hydrological Research Letters, 8, 45-50.
* Kotsuki, S. and Tanaka, K. 2013: Uncertainties of precipitation products and their impacts on runoff estimates through hydrological land surface simulation in Southeast Asia. Hydrological Research Letters, 7 79-84.
* Kotsuki, S., Tanaka, K. and Watanabe, S. 2014: Projected hydrological changes and their consistency under future climate in the Chao Phraya River Basin using multi-model and multi-scenario of CMIP5 dataset. Hydrological Research Letters, 8 27-32.
* Marzuki, M., H. Hashiguchi, M. K. Yamamoto, S. Mori, and M. D. Yamanaka, 2013: Regional variability of raindrop size distribution over Indonesia, Ann. Geophys., 31, 1941–1948.
* Mateo, C.M., Hanasaki, N., Komori, D., Tanaka, K., Kiguchi, M., Adisorn Champathong, Thada Sukhapunnaphan, Yamazaki,D. and Oki,,T. 2014. Assessing the impacts of reservoir operation to flood plain inundation by combining hydrological, reservoir management, and hydrodynamic models. Water Resources Research***, 50,*** 7245–7266.
* Ngo-Duc, T., Matsumoto, J., Kamimera, H. and Bui, H.H. 2013: Monthly adjustment of Global Satellite Mapping of Precipitation (GSMaP) data over the VuGia–ThuBon River Basin in Central Vietnam using an artificial neural network. Hydrological Research Letters, 7, 85–90.
* Ono, K., Kazama, S., Gunawardhana, L.N. and Kuraji, K. 2013: An investigation of extreme daily rainfall in the Mekong River Basin using a gridded precipitation dataset. Hydrological Research Letters, 7, 66-72.
* Pratoomchai, W., Kazama, S., Hanasaki, N., Ekkawatpanit, C. and Komori, D. 2014: A projection of groundwater resources in the Upper Chao Phraya River basin in Thailand. Hydrological Research Letters, 8, 20-26.
* Ryo, M., O.C.V. Saavedra, S. Kanae, T. Dang, 2014: Temporal downscaling of daily gauged precipitation by application of a satellite product for flood simulation in a poorly gauged basin and its evaluation with multiple regression analysis, J. Hydrometeorology, 15, 563-580.
* Sato, T., and S. Sugimoto, 2013: A numerical experiment on the influence of the interannual variation of sea surface temperature on terrestrial precipitation in northern Japan during the cold season. Water Resour. Res., 49, 7763-7777, doi:10.1002/2012WR013206
* Sulistyowati, R., R. I. Hapsari, F. Syamsudin, S. Mori, S., T. Oishi and M. D. Yamanaka, 2014: Rainfall-driven diurnal variations of water level in the Ciliwung River, West Jawa, Indonesia. SOLA, 10, 141-144.
* Takahashi, H.G.,2013: Orographic low-level clouds of Southeast Asia during the cold surges of the winter monsoon. Atmos. Res., 131, 22-33, doi:10.1016/j.atmosres.2012.07.005.
* Takahashi, H.G., Fujinami, H., Yasunari, T., Matsumoto, J. Somchai Baimoung 2014. Role of tropical cyclones along the monsoon trough in the 2011 Thai flood and interannual variability. Journal of Climate (Accepted).
* Villafuerte II, M.Q., Matsumoto, J., Akasaka, I., Takahashi, H.G., Kubota, H. and Cinco, T.A. 2014a: Long-term trends and variability of rainfall extremes in the Philippines. Atmospheric Research 137: 1–13, DOI:10.1016/j.atmosres.2013.09.021
* Villafuerte II, M.Q., Matsumoto, J. and Kubota, H. 2014b. Changes in extreme rainfall in the Philippines (1911–2010) linked to global mean temperature and ENSO, International Journal of Climatology , DOI:  10.1002/joc.4105
* Villafuerte II, M.Q., and Matsumoto, J. 2014c. Significant influences of global mean temperature and ENSO on extreme rainfall in Southeast Asia. Journal of Climate(Accepted).
* Watanabe, S., Hirabayashi, Y., Kotsuki, S., Hanasaki, N., Tanaka, K., Mateo, C.M., Kiguchi, M., Ikoma, E., Kanae, S. and Oki, T. 2014: Application of performance metrics to climate models for projecting future river discharge in the Chao Phraya River basin. Hydrological Research Letters, 8, 33-38.
* Watcharee Veerakachen, Mongkol Raksapatcharawong and Seto, S. 2014: Performance evaluation of Global Satellite Mapping of Precipitation (GSMaP) products over the Chaophraya River basin, Thailand, Hydrological Research Letters, 8,  
  39-44.
* Weerayuth Pratoomchai, Kazama, S., Hanasaki, N., Chaiwat Ekkawatpanit and Komori, D. 2014: A projection of groundwater resources in the Upper Chao Phraya River basin in Thailand. Hydrological Research Letters, 8 20-26.
* Yamaji, M. and H. G. Takahashi, 2014: Asymmetrical interannual variation in aerosol optical depth over the tropics in terms of aerosol-cloud interaction, SOLA, 10, (in press)
* Yamashima, R., Matsumoto, J., Takahashi, H.G., Takata, K., and Yasunari, T. 2014. Impact of historical land use changes on the Indian summer monsoon onset, International Journal of Climatology, (Accepted).
* Yamazaki, D., T. Sato, S. Kanae, Y. Hirabayashi, P.D. Bates, 2014: Regional flood dynamics in a bifurcating mega delta simulated in a global river model, Geophys. Res. Lett., 41, 3127-3135, 10.1002/2014 GL059744.
* Yokoo, Y., Chaiwut Wattanakarn, supinda Wattanakarn, Vorapod Semcharoen, Kamol Promasakha na Sakolnakhon, and Suttisak Soralump, 2014: Storage under the 2011 Chao Phraya River flood: An interpretation of watershed-scale storage changes at two neighboring mountainous watersheds in northern Thailand. Hydrological Research Letters, 8 1-8.