FIRST SESSION OF ASEAN CLIMATE OUTLOOK FORUM (ASEANCOF-1)

3-5 DECEMBER 2013, CENTRE FOR CLIMATE RESEARCH SINGAPORE,
METEOROLOGICAL SERVICE SINGAPORE

Consensus Statement and Meeting Report

Summary of Consensus Statement

A consensus outlook for the boreal winter monsoon season over Southeast Asia was developed via an expert assessment of the available information from observations and seasonal prediction systems, at the first session of the ASEAN Climate Outlook Forum (ASEANCOF-1). Both dynamical and statistical models were used in preparing the outlook. In this season there is a marked geographical variation in the predictability demonstrated by the dynamical models, particularly for rainfall. The eastern parts of the region have relatively high skill levels but the skill is significantly less over mainland Southeast Asia and there is very little skill over the Sumatra, Malay Peninsula and the western Sarawak/ Kalimantan regions.

There are currently no strong sea surface temperature (SST) signals in the Nino3.4 region of the tropical Pacific Ocean and the Indian Ocean Dipole (IOD) is marginally negative. The western tropical Pacific SSTs have been warm throughout 2013 and in the central and southeastern tropical Pacific there are currently weak cold anomalies. This overall SST pattern in the Pacific is maintained in many of the dynamical model forecasts for the coming season. Over much of the region there is agreement between a number of the dynamical model forecasts for both temperature and rainfall, and this response is broadly consistent with the tropical Pacific SST pattern.

Normal to above normal rainfall is expected over most of the southern parts of Southeast Asia. On the other hand, over the northern parts of Southeast Asia, which is a climatologically dry region during this season, normal to slightly below normal rainfall can be expected. Generally above normal temperature conditions are expected over the whole Southeast Asia region, with enhanced probabilities over the southern parts of the region. Normal to slightly above normal temperature conditions can be expected over the northern parts.

For more information on the boreal winter monsoon outlook and further updates on the national scale, the relevant National Meteorological and Hydrological Service (NMHS) should be consulted.

Note: For the purpose of this climate outlook, we define:
1.Northern parts of Southeast Asia to include Cambodia, Laos, Myanmar, Thailand and Vietnam.
2.Southern parts of Southeast Asia to include Brunei, Indonesia, Malaysia, Philippines and Singapore.

1. Introduction

Regional Climate Outlook Forums (RCOFs) have been operational in many parts of the world with the aim to provide collaboratively developed and consensus-based seasonal climate outlooks and related information on a regional scale. Based on the initiative from the World Meteorological Organization (WMO) Regional Association for Asia and Southwest Pacific and with strong support from the ASEAN Sub-Committee on Meteorology and Geophysics (ASCMG), the ASEAN Climate Outlook Forum (ASEANCOF) was established and the Meteorological Service Singapore (MSS) offered to host the inaugural session.

The first session of ASEANCOF (ASEANCOF-1) was held in Singapore at the Centre for Climate Research Singapore (CCRS), a newly established centre under MSS, from 3-5 December 2013. Representatives from the ASEAN countries of Brunei, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam attended the meeting. In addition, representatives from the WMO Global Producing Centres of Long Range Forecasts (GPCs) also attended, namely Beijing Climate Centre (BCC), European Centre for Medium-Range Weather Forecasting (ECMWF), Japan Meteorological Agency (JMA), UK Met Office (UKMO) and the WMO Lead Centre for Long Range Forecast Multi-Model Ensemble (WMO LC-LRFMME), as well as the APEC Climate Centre (APCC).

ASEANCOF-1 started with a brief opening ceremony, with an address by Mr Choi Shing Kwok, the Permanent Secretary of the Ministry of the Environment and Water Resources, Government of Singapore. Welcome Remarks were also given by Ms Wong Chin Ling, Director-General of MSS and Dr Rupa Kumar Kolli, the Officer-in-charge of Climate Prediction and Adaptation Branch in WMO.

Professor Chih-Pei Chang, from the US Naval Postgraduate School, was an invited speaker and opened the first session with an overview of the scientific prospects for seasonal forecasting in the boreal winter monsoon season. All participant countries and global centres represented gave presentations on the systems that they employ in making seasonal forecasts.

The Forum session reviewed the current climate conditions in Southeast Asia and the current state of large-scale circulation features such as the El Niño/Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD). Multiple forecasts for December to February were also presented by the ASEAN and global centre participants, and these formed the input to the expert assessment leading to the consensus outlook.

In the user requirements session, Dr Arjunapermal Subbiah, the director of the Regional Integrated Multi-hazard Early Warning System for Africa and Asia (RIMES), gave a presentation on the user requirement for seasonal forecasts, and Dr Rupa Kumar Kolli from WMO gave a presentation on the implementation of the Global Framework for Climate Services (GFCS). Ahead of the ASEANCOF meeting, a questionnaire titled: 'Priority needs for dynamical-model climate prediction: Questionnaire for suppliers of climate forecast services in the ASEAN region' was circulated to the ASEAN region's NMHSs. Nine of the ten ASEAN countries responded and a summary of the results was presented and discussed at the meeting. The results are summarised in section 5 below. A final session on the future of ASEANCOF led to further recommendations on various aspects of the RCOF process in Southeast Asia (see section 6 below).

ASEANCOF-1 was co-sponsored by WMO through funds provided by the United States Agency for International Development (USAID). Technical and logistical coordination was carried out by the Centre for Climate Research Singapore.

2. Potential for Seasonal Forecasting in Southeast Asia

Southeast Asia may be divided geographically into Mainland Southeast Asia and the Maritime Continent, with the two sub-regions overlapping the Malay Peninsula. The wet season in Mainland Southeast Asia starts in May, which actually marks the earliest onset of the Asian summer monsoon. As the season progresses into summer, monsoon rainfall covers the entire Mainland Southeast Asia and also western and southern Philippines. This is followed by a gradual transition with the monsoon convection marching southeastward to the Maritime Continent, where rainfall reaches annual maximum during the boreal winter. The spring transition is much more abrupt. The two sub-regions may therefore be identified with the summer and winter monsoon regimes, respectively, with the demarcation at the equator[1]. However, the two rainfall regimes are not symmetric, with the winter regime intruding into the summer regime on the windward side of coastlines and mountains, where winter monsoon surges produce heavy rainfall. Therefore, high interest in seasonal winter forecast is shared by all countries in the region.

A significant part of the skill in seasonal forecasts in climate models is rooted in ENSO[2], with the largest area of skillful forecast in the Maritime Continent where the effects of ENSO through anomalous Walker circulation and atmosphere-ocean feedback are well known. Thus, the prospect of useful operational seasonal forecasts is more promising in this region than in many other regions around the globe.

The complex terrain of islands of different sizes and mountains interspersed among the surrounding seas creates significant local-scale variations of weather and climate and their relationships with ENSO. The variations are due to the interactions between the seasonal-reversing winds and the local terrain, which are the primary mechanism for convective rainfall in both summer and winter monsoons[1]. The complexity of these variations is largest during the winter monsoon, when the relationship between rainfall and ENSO is weakest[3-5]. The situation is further complicated by the baroclinic systems in mid-latitude Asia, which drive the winter monsoon winds and surges that interact with synoptic scale disturbances and Madden-Julian Oscillations (MJO)[6]. These factors make the winter monsoon seasonal forecast both challenging and scientifically interesting.

3. Evaluation of Current Climate Conditions and Indices

Surface temperatures in recent months over the Southeast Asia region are warm compared to a 1971-2000 reference period. This is consistent with the trend in global warming over the last 40 years. There are geographical variations in the magnitude of the warming over the region but the pattern is not consistent between the different global datasets that are available, even those primarily derived from ground stations. This emphasises the need for better monitoring in the region. For most of 2013, Southeast Asia has been wetter than average, other than over the eastern part of Mainland Southeast Asia where it has been drier. Looking at more recent months, the rainfall signals are inconsistent between the different global datasets and this again points to the need for improved regional monitoring.

The western tropical Pacific SSTs have been warm throughout 2013 and in the central and southeastern tropical Pacific, there are currently weak cold anomalies. This overall pattern in part reflects the current negative phase of the Pacific Decadal Oscillation (PDO). Both the Nino3.4 and IOD indices are weakly negative. Atmospheric circulation diagnostics suggest a small strengthening of the Walker Circulation across the Pacific, which is consistent with the current SST pattern.

4. Consensus Outlook for the Northeast Monsoon Rainfall over Southeast Asia

A wide range of forecasts using dynamical models, statistical models and analog techniques were presented during the Forum session. For the December to February period, most of the dynamical forecasts showed a continuing warm west Pacific and marginally cold anomalies in the equatorial and southeastern tropical Pacific. There was a broad similarity in the patterns of both forecast temperature and rainfall from the dynamical models for the period. These patterns were clearly delineated in both the WMO-LC-LRFMME and the APCC multi-model forecasts. The existence of a clear signal is at first sight surprising because the Nino3.4 and IOD indices are forecast to be neutral. A number of the models, however, do maintain the current pattern of a warm west and cold southeastern tropical Pacific and the consistent rainfall among the models response was hypothesized to be in response to this pattern.

The WMO-LC-LRFMME and the APCC multi-model forecasts, which showed considerable consistency, were taken as the starting basis for the consensus forecast. In the Sumatra, Malay Peninsula and western Sarawak/Kalimantan regions, where the correlation between rainfall and ENSO was found to be weak in previous studies[6], the skill of the dynamical models is very low for rainfall and the forecast was modified in this region on the basis of statistical models. Following discussion of the forecast in the Forum, some refinements were made and the following forecast was agreed upon. The forecast, with tercile probabilities assigned, is illustrated in Figures 1 and 2 below.

For the upcoming boreal winter (December-January-February) season, normal to above normal rainfall is expected over most of the southern parts of Southeast Asia. On the other hand, over the northern parts of Southeast Asia, which is a climatologically dry region during the Northern Hemisphere winter season, normal to slightly below normal rainfall can be expected.

Generally, above normal temperature conditions are expected over the whole Southeast Asia region for boreal winter, with enhanced probabilities over the southern parts of the region. Normal to slightly above normal temperature conditions can be expected over northern parts.

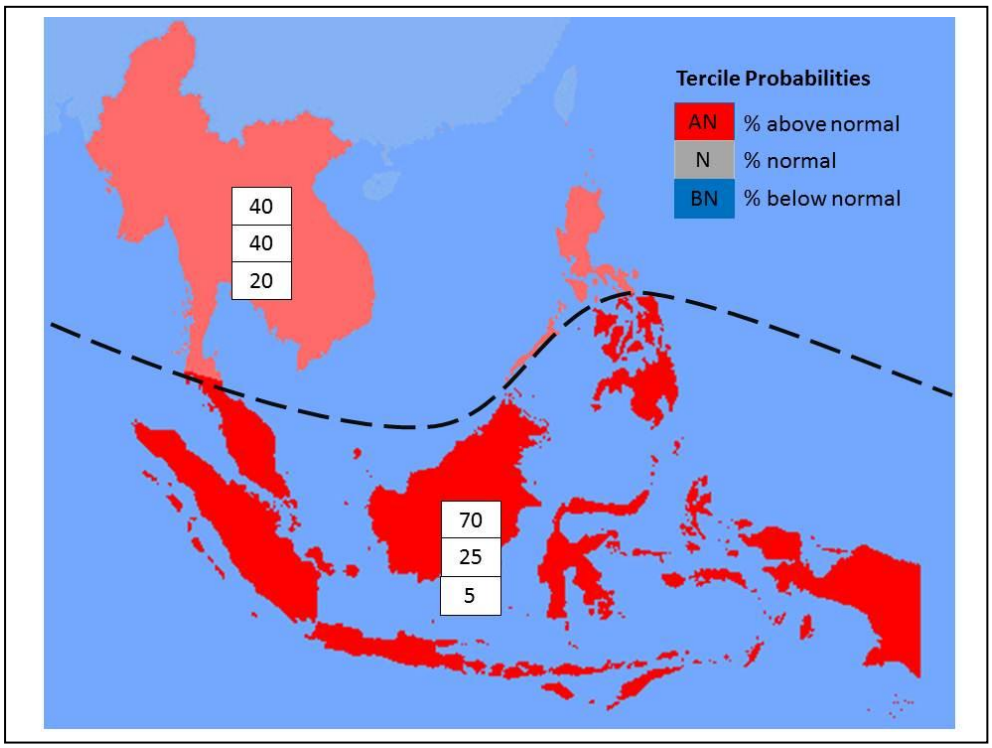

Figure 1: Consensus surface temperature outlook for December 2013 to February 2014 over Southeast Asia.

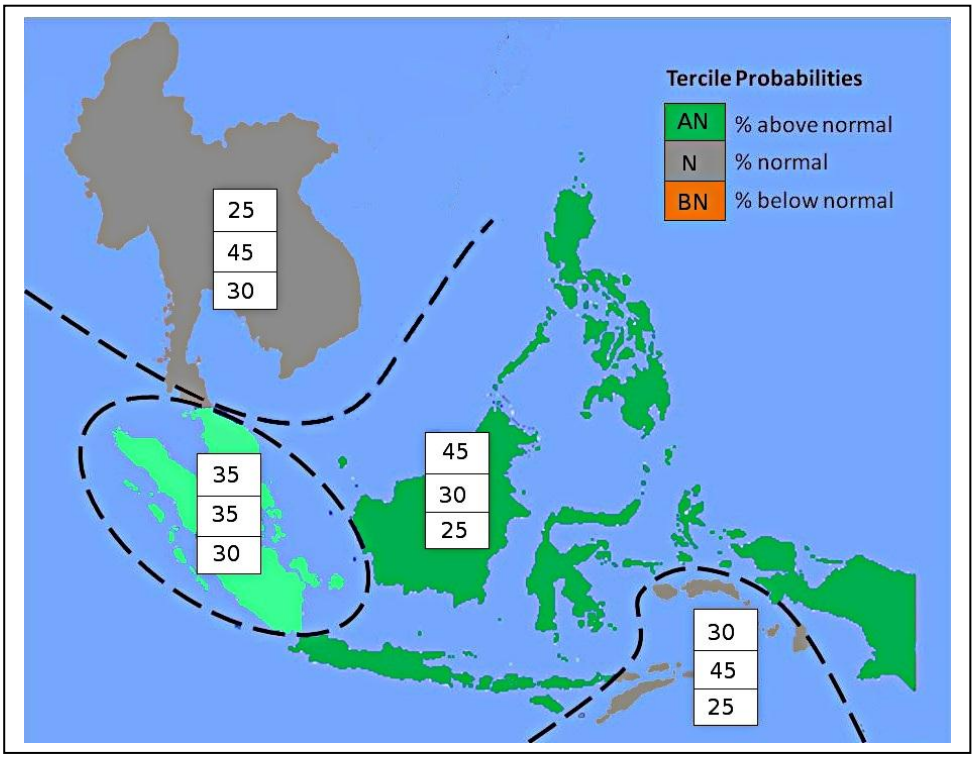

Figure 2: Consensus rainfall outlook for December 2013 to February 2014 over Southeast Asia.

5. Responses to the Pre-Meeting Questionnaire

A questionnaire titled: 'Priority needs for dynamical-model climate prediction: questionnaire for suppliers of climate forecast services in the ASEAN region' was sent to all ASEAN NMHSs ahead of the ASEANCOF-1 meeting. The questionnaire was based upon one recently used in Africa by Dr Richard Graham from UK Met Office and was modified for the Southeast Asian region. We are grateful to Richard Graham and the UK's Department for International Development (DFID) for permission to use this. Questions were asked about the techniques used for monthly and seasonal forecasting, who were the main users of the forecasts and what was the level of contact, what dynamical products are currently used from the global centres, and what new products (assuming they could be produced with appropriate skill levels) would be most useful.

Nine ASEAN countries responded to the questionnaire. The respondents indicated that in providing monthly and seasonal forecasts for their country or region, both statistical and dynamical methods are used, with greater emphasis on statistical methods. Analog methods are also being used in two countries. In general, all respondents indicated boreal winter and summer monsoons as seasons of interest but with variations in season length definitions among countries. Typically, the boreal winter monsoon season spans or partially spans the months October through March, while the boreal summer monsoon spans or partially spans the months April through September. Of the groups of users that the countries provide climate services to, those that the countries come into contact with more regularly are government bodies/ministries, water resource managers, organisations in disaster risk management, and users from the agriculture and food security sectors. NGOs and users from the health and energy sectors are also some of the others that countries work with.

Most respondents indicated that they regularly use basic dynamical products (e.g. probabilistic forecasts of three-month average/accumulated rainfall) for producing their national seasonal forecasts. Around half of the respondents indicated that these products form the main basis of their forecasts. Respondents indicated that beyond the basic dynamical products already in use, further research and development into additional products is required involving, for example, greater spatial detail, better tailoring of three-month means (e.g. probability of exceedances beyond specified amounts), temporal distributions through the season, one-month means and frequency of extremes. These products would be considered very useful for precipitation forecasts and to a lesser degree for temperature.

For applications concerning onset and cessation timing of monsoons, duration of rainy seasons and likely frequency of dry spells, the following priority order emerged for enhanced products (a) onset timing of the rainy season, (b) duration of the rainy season (without specific onset/cessation timing), (c) cessation timing of the rainy season and (d) risk of dry seasons within the rainy season. There was a mix of responses in indicating if having forecasts with lead times of around two to three months (seasonal forecast) would be more

useful than having forecasts with lead times of two to three weeks (monthly forecasts) or vice versa. Responses vary markedly because requirements are application-dependent and different countries have unique requirements. Respondents indicated in general that if their onsets (cessation) were late (early) by about 15 days, it would be considered significant, about 25 days would be considered exceptional, and anything longer than about 45 days would be considered extreme. Similarly for monsoon durations, approximately 15 days longer (shorter) than the normal duration would be considered significant, 30 days longer (shorter) would be considered exceptional and more than 50 days would be considered extreme. For duration of dry spells, respondents indicated that approximately 10 days of continuous dry days would be considered significant, around 30 days would be considered exceptional, and around more than 60 days would be considered extreme. Most countries have a way of defining damaging rainfall rates, but thresholds and methods (mm/day or mm/hour) vary for different applications in different countries. While most respondents indicated that they use objective methods to define the onset and cessation of rainy season, identification methods vary across countries with different countries using different thresholds of rainfall and large-scale circulation patterns.

Most respondents indicated that they would find it very useful to have individual month predictions (note WMO LRFMME website already provides these), more so for rainfall than for temperature. Respondents had also indicated that it could be useful to have predictions for rainfall totals in the first half and second half of the season, as well as probability of temperature anomalies being higher in the first or second half of the season.

All respondents thought that it would be useful if GPCs could provide wind forecasts for surface and upper levels. For upper level winds, 200 hPa, 300 hPa, 500 hPa, 700 hPa, 850 hPa and 925 hPa levels would be considered useful. Of these, 200 hPa and 850 hPa were the most cited levels. Near-surface wind products have been requested by users such as those from the marine industry, as well as farmers during the flowering periods.

For long-range forecast products of tropical storm (TS) numbers and energy, there are existing efforts to provide such forecasts for countries which are affected by TSs. Some respondents indicated using only statistical tools and forecasting for only TS numbers, but not TS energy. Individual responses indicated that it would be useful to have forecasts for total monthly rainfall contributed by TSs, probable TS tracks and numbers for the season ahead.

For monitoring historical and recent climate variability in their country or for the region, most countries will use their national observational network. They also use monthly gridded global datasets provided by external parties and reanalysis products.

The following recommendations were derived from the responses to the questionnaire. There were basically two areas to consider: (a) making better use of what already exists and (b) the development of new products.

(a) Recommendations on making better use of what already exists

To review methodologies and share experience in the following areas:

- Downscaling and producing greater spatial detail in the forecast
- Better tailoring of monthly means to seasons
- Availability of one-month means and advice on use
- Skill information available on the WMO-LC and APCC sites and guidance on how to use it
- Access to monthly forecast products (e.g. from ECMWF)
- Review products currently available for tropical storm numbers, density and energy and suggest enhancements.

(b) Recommendations on the development of new products

- Investigate the capability of the GPC modelling systems to produce skillful forecasts of monsoon onset, rainy season length, risk of extended dry spells and daily extremes. It is noted that there will be different skill levels across the region. Some of this work has been done in other areas of the world.

- Relate the GCM-based onset (and other) definitions to the variety of in-country definitions, and investigate more precise indication of onset timing two to three weeks ahead of onset on an experimental basis.

- Investigate skill of diagnostics from GPC tropical wind forecasts in the Southeast Asia region.

In addition to the above, it was noted that there is a requirement for improved regional climate monitoring in Southeast Asia. A good start has been made by Indonesia with the Southeast Asian Climate Assessment and Dataset (SACA&D) project led by BMKG and this could be taken as the foundation for an enhanced monitoring activity.

6. Final Meeting Recommendations

The final session focussed on the future of ASEANCOF and the need to establish a Regional Climate Centre (RCC) in the Southeast Asia region.

The following overall recommendations were agreed:

(a) Write an article for the Bulletin of the American Meteorological Society (BAMS), covering the various aspects of seasonal forecasting for Southeast Asia that were discussed in the meeting.

(b) Widely circulate the recommendations arising out of the ASEAN NMHS survey to the relevant stakeholders.

(c) Place the consensus forecast and meeting documents on the ASMC website, which might be developed as a permanent home for ASEANCOF products.

(d) There will be two ASEANCOF meetings a year. The boreal winter monsoon ASEANCOF will be held in mid-October to early November each year. The exact timing will be discussed further with the ASEAN NMHSs and it will be determined to optimise the use of the latest predictions from the global centres and to meet the time schedule for the issuing of the winter monsoon forecast in each country.

(e) A decision on where it will be held next year will be made by 1 April 2014. The boreal summer ASEANCOF, which would ideally happen in May each year, will be held in parallel with the annual ASEAN Sub-Committee on Meteorology and Geophysics (ASCMG).

(f) For the summer ASEANCOF in 2014, consideration will be given to linking the ASCMG meeting with a 'hands-on' workshop focusing on producing the consensus outlook for the boreal summer monsoon.

(g) It was noted that there is an advantage in the first few years in having a common host for the RCOF, to help stabilise the process. The Director General of the Meteorological Service Singapore offered to host ASEANCOF for the next three winter seasons.

(h) There is a need to establish sustainable funding for ASEANCOF.

(i) WMO requests the Director-Generals of the ASEAN NMHSs to identify permanent representative focal points for ASEANCOF and establish mechanisms for sustained interactions and capacity development.

(j) WMO GPCs and other global forecasting centres are requested to actively support the development of ASEANCOF.

(k) For future ASEANCOF meetings, thematic sessions with a specific user focus (e.g. agriculture and water) may be considered.

(l) It is recommended that the establishment of an RCC or RCC-Network in this region, following the applicable WMO designation criteria, be actively pursued. A scoping meeting involving the Director Generals of the ASEAN NMHSs is considered to be the most appropriate next step in this regard. The Director-General of Meteorological Service Singapore has agreed to take a lead in moving this forward with the ASEAN NMHSs and explore the possibility of a meeting in the first half of 2014, in consultation with WMO.

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