The National Climate Center of Thailand

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ABSTRACT

In February 2007, the Meteorological Department of Thailand (TMD) had integrated climate group and climate academic group forming to the National Climate Center of Thailand (NCCT) which is the unique center of the country to provide climate information, climate research and application, climate change and strength cooperation to international climate service and research. The NCCT had provided climate information and prediction to local and international public for use to monitoring and early warning the climate system which impact to human health, ecosystem, agriculture, water resources and market sectors. The climate information had been provided in routine work, more 100 observation station climate data, global and regional climate model, and four kinds of long range forecasts; monthly weather forecast which updates every month, seasonal weather forecast that updates every three months and weather outlook forecast of four-week weather forecast which updates every week and three-month forecast which updates every month. Some climate information will be arranged and adjust to the need of end users especially in the agriculture and water resource sectors. At present, the medium and long-range weather forecast has been conducted by means of statistical, analogue, and/or climatology data analysis which based on the monthly and long-range forecast products that obtained from several other climate prediction centers including ECMWF, IRI, JMA(TCC), KMA, NCEP, CMA(BCC). The global G-RSM model had been used for monthly and seasonal prediction in stead of the global MM5 which lacks of surface information. The NCCT had the strength collaboration with the TCC to developed the statistical climate model which will be improved the climate information, climate change impact, and climate service. KMA, APCC and CMA had also frequently provided assistance and capacity building to our service. In the near future, the NCCT will be contributed to the GEO in various climate tasks.

1. INTRODUCTION

The National Climate Center of Thailand (NCCT) is the unique center of the country to provide climate information, climate research and application, climate change and strength cooperation to international climate service and research. The NCCT had provided climate information and prediction to local and international public for use to monitoring and early warning the climate system which impact to human health, ecosystem, agriculture, water resources and market sectors. The NCCT has been focusing its efforts to monitoring of climate, climate modeling and forecasting, climate data and information services and international collaboration with National Meteorological and Hydrological services (NMHSs). NCCT employs the regional climate model developed by the Providing REgional Climates for Impact

Studies (PRECIS) to carry out numerical prediction of future climate change due to the increase of the global greenhouse gases concentration. The NCCT intensively contributing to international collaboration to asses the future climate and climate change, particularly through the activities of the various climate research center (APCC, TCC, BCC, etc.), the Intergovernmental Panel on Climate Change (IPCC) and the intergovernmental Group on Earth Observations (GEO).

2. CLIMATE PREDICTION AT NCCT

Thailand is a tropical country; her national economics depend heavily on the agricultural production, which in turn, largely depends on the weather and climate conditions. Geographically, Thailand is situated at the southwestern part of Indo-Chinese Peninsula. She has complicated topography of mountain, plateau and plain area and long coastline along the Gulf of Siam and Andaman Sea (Fig. 1). Shielded by the mountains in the North and the Khorat plateau of the North-East. Thailand is free from the invasion of cold surge originated on Mongolia or Siberia. Favored by the oceanic monsoon, plenty of rainfall is precipitate all over the tropical country of Thailand during the rainy season. This is the normal case. But in some abnormal years, the stronger cold surge or weaker oceanic monsoon may be happened to cause the frosty or droughty disaster. The climate of Thailand is influence of northeast and southwest monsoon. Her climate is divided into three seasons: the rainy season, the winter, and the summer season. The southwest monsoon, which starts in May, brings warm moist air from the Indian Ocean towards Thailand, causing abundant rain over the country, especially on the windward side of mountains. Rainfall during this period is not only caused by the southwest monsoon but also by the Inter Tropical Convergence Zone (ITCZ) and tropical cyclones which produce a large amount of rainfall. On the month of May is the period of first arrival of ITCZ to the Southern part, and then moves northward rapidly and lies across southern China around June to early July that is the period of dry spell over upper part of Thailand. The ITCZ then moves southerly direction to lie over the Northern and Northeastern parts of Thailand in August and later over the central and southern part in September and October, respectively. The northeast monsoon, which starts in October, brings cold and dry air by the anticyclone in China. In the Southern region, this monsoon causes mild weather and abundant rain along the eastern coast. The onset of monsoons varies to some extent. Southwest monsoon usually starts in mid-May and ends in mid-October, while northeast monsoon normally starts in mid-October and ends in mid-February. The prediction of coming rainfall is an essential factor for all agricultural activities. Having known the beginning of rainy season or southwest monsoon season becomes very helpful not only for agricultural planning but also for other related activities in Thailand such as irrigation and water resource management.

There are three type of weather forecast used by the Thai Meteorological Department (TMD): the short-range weather forecast for beyond 12 hours and up to 3 days, the medium-range weather forecast for valid beyond 3 days and up to 7 days, and the long-range weather forecast for longer than about 7 days ahead as monthly or season. TMD issues two-types of long-ranged weather forecast as monthly weather outlook and Seasonal weather outlook for temperature, rainfall relative humidity, and wind. The first issues is usually issued every month and contains the weather forecast for one month period before the actual weather will be take place and the second issue is a seasonal published fanzine which is publish every four month throughout the year for: the rainy season weather outlook is in April for the period of mid-May until mid-October; the winter weather outlook is in September for the period of mid-October until mid-February, and the summer weather outlook is in January for the period of mid-February until mid-May. Long-ranged weather forecast are carefully provided in order to ensure that end users nationwide will obtained needed appropriate information for their specific activities in a certain area, including agriculture, irrigation as well as water resource management , and natural disaster mitigation and preparedness. A schematic for the development issues of long-rang weather forecast is show in Fig. 1.

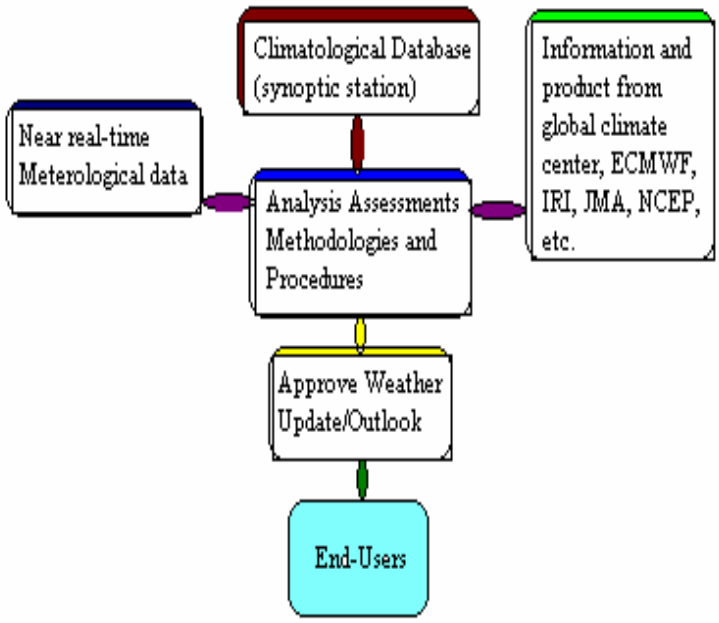


Fig. 1 A schematic for issues long-range weather forecast

Table 1 Outline of the operational long-range weather forecast of Thailand

Kind of Forecast	Methodologies	Contents	Issues	Distribution
Monthly				
	Statistical and analogy ECMWF, IRI	Characteristic of rainfall, temperature, relative humidity and wind	Once a month before first day of month	Fax, e-mail, and http://www.tmd.go.th
Seasonal				
Summer (mid Feb to Mid May)	Statistical and analogy ECMWF, IRI	Characteristic of means maximum temperature and extreme maximum temperature in some areas of portion	Before the beginning of summer season (end of January)	Fax, e-mail, and http://www.tmd.go.th
Rainy (mid May to mid Oct.)	Statistical and analogy ECMWF, IRI	Characteristic of rainfall, prediction by below normal, normal and above normal	Before the beginning of rainy season (end of April)	Fax, e-mail, and http://www.tmd.go.th
Winter (mid Oct. to mid Feb.)	Statistical and analogy ECMWF, IRI	Characteristic of means minimum temperature and extreme minimum temperature in some areas of portion, rainfall in southern parts	Before the beginning of winter season (end of September)	Fax, e-mail, and http://www.tmd.go.th

Owing to non climate models specially developed for Thailand until nowadays, long-ranged weather forecast, performed by the TMD are based on the analogue as well as the

statistical/mathematical methods such as, probability, time series, space and time interpolation, harmonic analysis, etc. The conventional climatic observation of 76 stations and 30-year records has used. In addition, the long-ranged weather forecast products, provided by the climate forecasting center such as, European Center for Medium-Range Weather Forecast (ECMWF), International Research Institute for Climate Prediction (IRI), Japan Meteorology Agency (JMA), and National Center for Environmental Prediction (NCEP) for instance, completely depict the details over Thailand. Once all available techniques have been implemented, the document draft of long-ranged weather forecast of Thailand will carefully be proposed fro the final decision before it will be published for public awareness. The analytical techniques implemented comprise of analogue, probability, and harmonic analysis. Analogue analysis is a method to estimate the future situation by assuming that the present weather condition is likely to change in the similar fashion as the past. The probability technique is used to estimate the probability of the rainfall from historical record. The probability used to describe the expected rainfall is divided into 5 levels of above normal (+20 %), slightly above normal (+10 %), normal (+/- 5 %), slightly below normal (-10 %), and below normal (-20 %). Harmonic analysis is used to represent the periodicity of rainfall which will be used as the guidance for the forecast together with other available technical methods that mention above. Outlines of the operational long-range weather forecast are shown in Table 1.

The climatic information are used to serve the needed of various end-users such as, government agencies (Ministry of Interior, Department of Local Administration, Royal Irrigation Department, Electricity Generating Authority of Thailand, Sports Authority of Thailand, Tourism Authority of Thailand, etc.), private and publics sectors, and also supplied on request.

3. CLIMATE MODELING AT NCCT

The mesoscale model MM5 has been applied to demonstrate of the southwest monsoon onset pattern over Thailand.

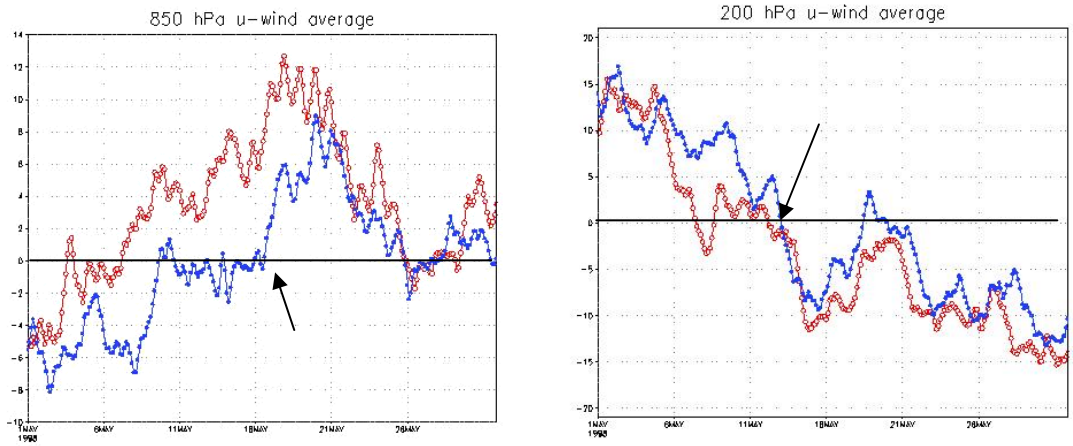
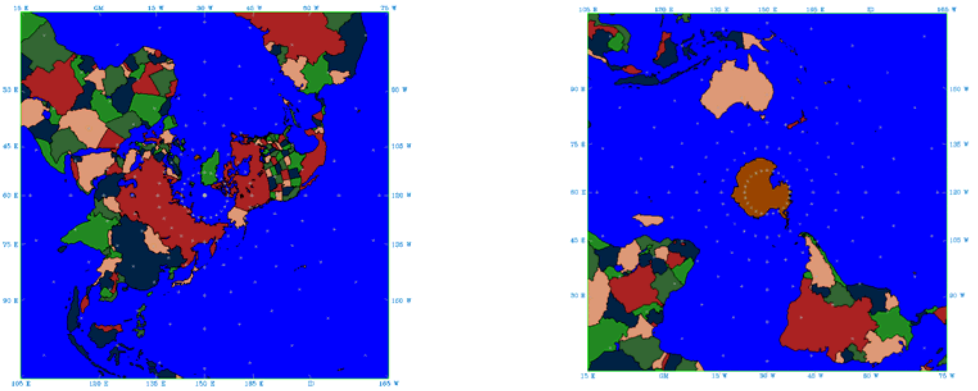


Fig. 2 Area average of zonal wind over the Bay of Bengal (red) and Thailand (blue)

The global MM5 was run with two hemisphere domains (Fig. 3.) with polar stereographic projections centered on the north and south poles, respectively, center longitude is 150.0 degree east, are run concurrently. The domains are joined together at the equator and provide each other with lateral boundary conditions using a simple 4-point interpolation onto the other's grid at every time step. The model therefore runs with no need for boundary conditions, and, in theory, could run indefinitely given just

an initial analysis. Each domain is a 210x210 grid points and 23 vertical sigma grid levels up to 50 hPa. The nominal horizontal grid distance is 120 km. Actual horizontal grid distance varies from 120 km at the poles to 64 km at the equator. The time step is 210 seconds (limited mostly by equatorial resolution). The physical scheme for current set-up are grell cumulus, simple-ice microphysics, MRF PBL, Cloud radiation (Dudhia), 5-layer soil temperature model, and none variation of sea surface temperature.



(a) Domain 1: Northern Hemisphere (b) Domain 2: Southern Hemisphere

Fig. 3 The global MM5 domains (a) Northern Hemisphere, (b) Southern Hemisphere.

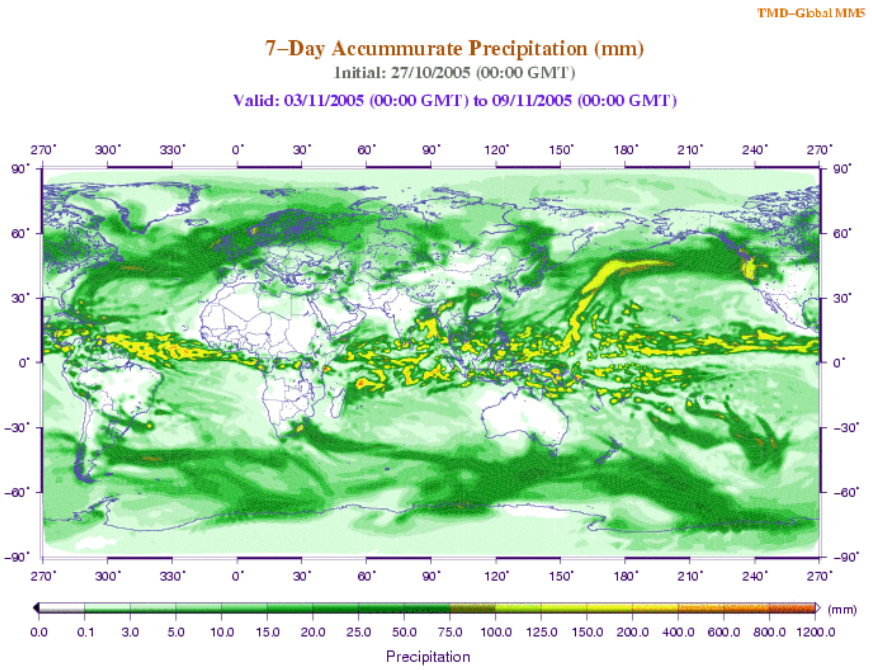


Fig. 4 Some Example of 7-day accumulate precipitation of Global MM5.

Now, the NCCT employs the G-RSM CVS system developed by the Experimental Climate Prediction Center (ECPC) to carry out numerical prediction of future climate for climate research and application in various sectors. The hybrid global model (GFS) analysis data with T38264 resolution were used as the initial condition. Figure 5 illustrates precipitation water from the 240-hour G-RSM CVS simulation.

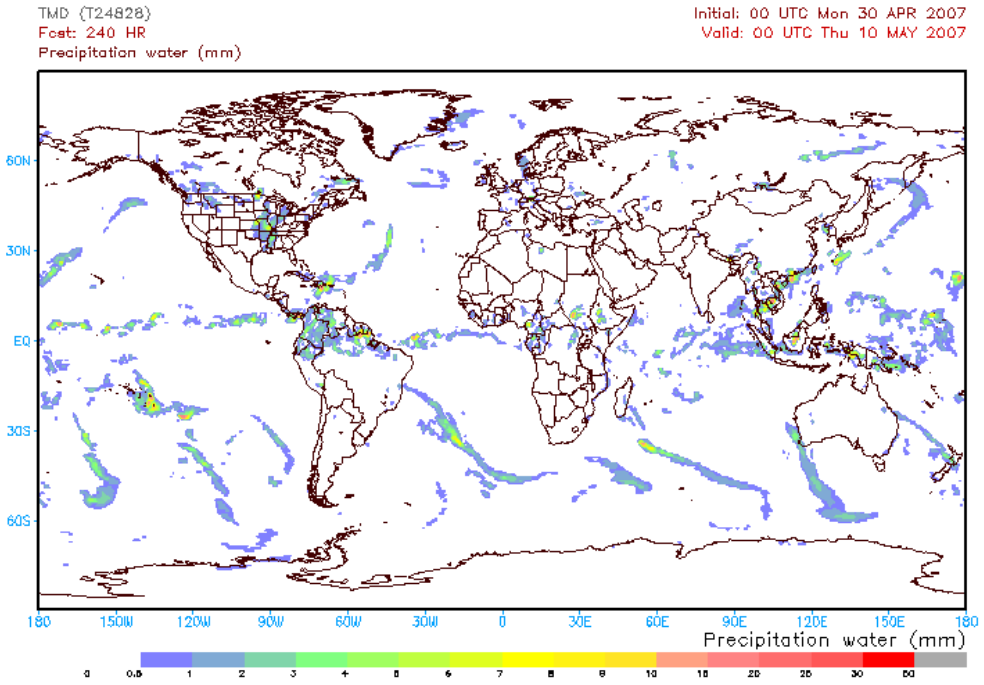


Fig. 5 Precipitation water (mm) from the 240-hour G-RSM CVS simulation

The PRECIS is the high resolution climate model which consider many parameter such as land used, vegetation type, soil type, surface elevation, etc., that strongly influence on physical processes. The NCCT center to provided the climate change scenarios information and data for the government services and any research activity in the country. The climate change scenario impact assessment and requiring of the local end-user for climate change information and data which are relevant to the practical used in the fields of agriculture, water resource, energy and so on.

The numerical weather forecast is reliability, user sectors had not understand technical term. To improve the accuracy of the seasonal forecast in the tropic area is need the advance or new techniques both statistical and dynamical models. Needed the education and training for the climate forecaster to improve their skill in relation with increasing program of the country of the seasonal outlook and also needed improvement of understanding of the users to known and use the climatic information for many sectors.

4. ACKNOWLEDGEMENT

We would like to thank Pennsylvania State University-National Center for Atmospheric Research (PSU/NCAR) for the MM5 modeling system and the Experimental Climate Prediction Center (ECPC) for the G-RSM CVS system.

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