Probability of Dry and Wet Spells in Northern Part of Thailand during El Niño, La Niña and Normal Events

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Introduction

The water management for agriculture is a very important problem in Thailand due to annual erratic distribution of rainfall. This erratic depends on several of factor variability. El Niño-Southern Oscillation (ENSO) is a factor that contributes climate anomalies especially those relate to rainfall, which effects on crop production in Thailand. Therefore, it is necessary to know the sequence of dry and wet periods during ENSO events (El Niño, La Niña and Normal) for properly water management planning in agricultural crop growing season.

In this study, the Markov chain technique has been use to compute probability of wet and dry spell at decadal time unit (ten days). A dry day is considered any day with rainfall equal or less than 3 mm and a wet day is any day with rainfall more than 3 mm. The rainfall threshold of 3 mm per day is the minimum threshold value for crops to satisfy their crop water requirement (Reddy, 1990).

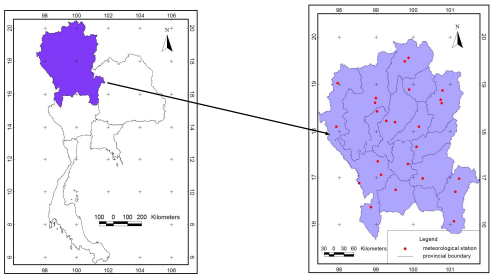
Objective

To study probability of dry and wet spells in the Northern part of Thailand during El Niño, La Niña and Normal Events.

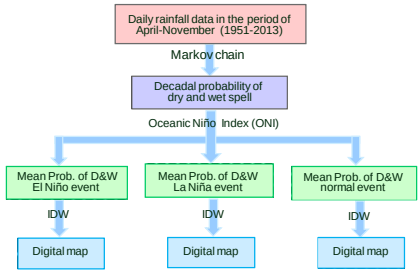
Study area

The study area is the Northern part of Thailand with the climate is divided into three seasons such as rainy season (mid-May to mid-October), winter season (mid-October to mid-February) and summer season (mid-February to mid-May). In this area is located of the 25 meteorological stations shown on Figure 1.

Figure1 the study area and location of the meteorological stations



Methodology



According to the Markov chain method, described by Robertson (1976), the probability of dry and wet spell for N days period are given through the following analytical expression:

$$P(D) = F(D)/N$$
$$P(DD) = F(DD)/F(D)$$
$$P(W) = F(W)/N$$
$$P(WW) = F(WW)/F(W)$$

where P(D) is probability of the dry days, P(W) is probability of the wet days, F(D) is number of dry days, F(W) is number of wet days, P(DD) is probability of a dry day preceded by a dry day, P(WW) is probability of a wet day preceded by a wet day, F(DD) is number of dry days preceded by another dry day, F(WW) is number of wet days preceded by another wet day.

Result

Some examples probability of dry and wet spell at Chiangmai meteorological station during normal event was shown in Table 1. The result of these probability of dry and wet spell have been used for analysis of climate in the study area and classified the level of dry and wet spell of P(D) as shown in table 2

Table 1 Probability of dry and wet spell at Chiangmai meteorological station during normal event

decade	PD	PDD	PW	PWW
10	0.94	0.93	0.06	0.02
11	0.88	0.89	0.12	0.13
12	0.81	0.83	0.19	0.15
13	0.73	0.75	0.27	0.24
14	0.7	0.77	0.3	0.35
15	0.66	0.68	0.34	0.34
⋮	⋮	⋮	⋮	⋮

Table 2 level of dry and wet of P(D)

P(D)	level
> 0.8	Dry
0.7 - 0.8	Moderately dry
0.6 - 0.7	Normal
0.5 - 0.6	Moderately wet
< 0.5	Wet

For the spatial analysis of P(D) at decadal time unit with Inverse Distance Weight (IDW) interpolation and classified with the level of dry and wet of P(D) have performed in each of El Niño, La Niña and Normal events. The results were shown in form of maps on figure 2-4.

Figure 2 The level of dry and wet of P(D) during Normal events

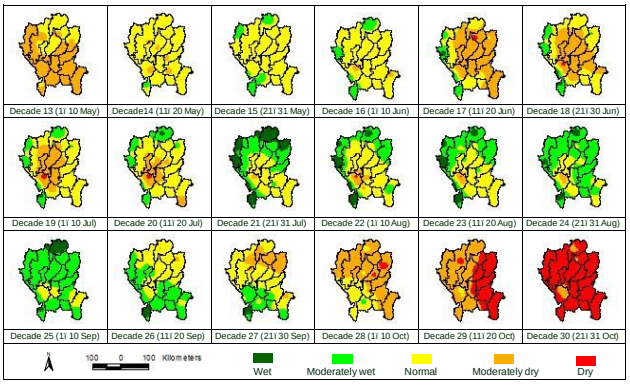


Figure 3 The level of dry and wet of P(D) during El Niño events

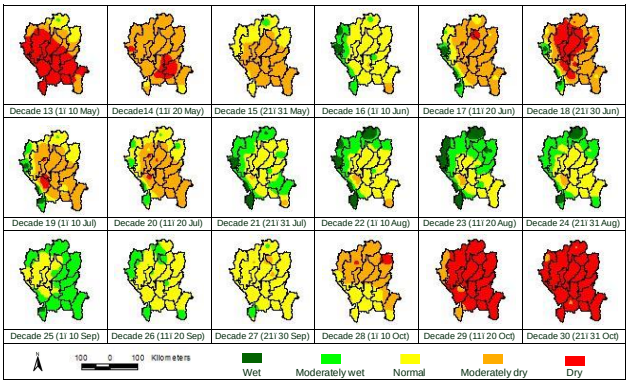
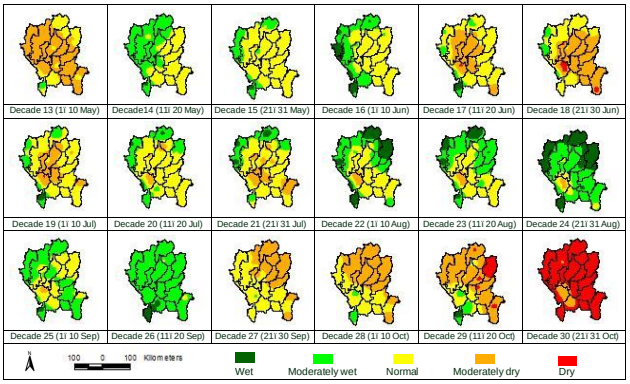


Figure 4 The level of dry and wet of P(D) during La Niña events



Conclusions

For the result of analysis can be concluded that during El Niño event, the beginning of wet spell in rainy season is relatively late and also there are more the area and intensity of dry spell, when comparing with Normal event. Consequently, during La Niña events there are more wet areas when comparing with Normal event. These results can be used by agriculturist or water usage committee for planning and managing all water resources with a view to preserve excess water from the wet period by storing it in reservoirs for using in the dry period.

Reference

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Robertson, G.W. (1976). Dry and wet spells. Project field report A-6., part of project MAL/71/529. UNDP/FAO and FELDA. Malaysia. 14