

## Rainfall Seasonality Index for South Sulawesi Province, Indonesia, 1982-2012

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Indonesia is one country in the world which is traversed by the low latitudes that is one area that has a tropical climate. Therefore, this region has two seasons namely wet and dry seasons that turns naturally (Sellers and Robinson, 1988). In addition, local geographic conditions also influence in determining the type of climate, especially rainfall regime of the region. Due to limited rainfall regime was influenced by various actors such as: (1) the position of the sun relative to the path (location latitude); (2) the existence of the ocean or surface water; (3) the pattern of wind direction; (4) in such a land surface; and (5) the density and type of vegetation (Lakitan, 2002) suggests that the seasonal rainfall to give effect to the characteristics of the soil and vegetation can even give effect to the distribution of vegetation and soil density or the entry into force of the erosion process. In addition, the amount of rainfall is very important to maintain the capacity of the soil and water storage in the soil (Sto) which will be used by plants. (Thornthwaite, 1957; Gomez, 2004 and Adejuwon, 2012)

According to Guhathakurta and Serve (2012) that the knowledge of the spatial variability of rainfall and the smaller scale is important for planners in various sectors including water and agricultural planners. Especially in the area of Jharkhand, India which has rainfed areas more than 70% means dependence on rainfall is very large (Nandargi and Mulye, 2014).

The studies that have been ongoing or more than 100 years data in Maharashtra in India (Guhathakurta and Saji, 2012) and for the monthly precipitation series of the 24 districts in Jharkhand for the period 1901-2000 shows the variability of rain during the rainy season and the annual rain for the country Jharkhand (Nandargi and Noble, 2014). Guhathakurta and Serve (2012) also tried to look at the impact of climate change on the spatial and temporal patterns through the analysis of the trend of declining monthly rainfall. The results showed a decrease trend of the rainy season in the first five months of the year led to increased heating, as well as an impact on the lack of soil moisture, groundwater and surface water decreased. Whereas, Nandargi and honorable (2014) tried to see trend index of seasonal rainfall or the year 1901-2000 in Jharkhand, India. Results from both studies show that there has been an increase in the index of seasonal rainfall over time and affect the condition of water and agriculture in two areas, namely, Maharashtra and Jharkhand, India. This study used climate data for 64 rain stations for 29 years (1983-2012) in South Sulawesi, Indonesia. The data obtained from the Department of Meteorology and Climatology and the Department of Irrigation and Water Resources in Makassar City. Furthermore, the seasonal index (SI) is calculated using the formula developed by Walsh and Lawer (1981); Kanellopoulou (2002); Schoof and Pryor (2008) as shown in formula 1. The identification included in the classification regime seasonality index consisting of seven levels of seasonality index as set forth. The index value less than or close to zero indicates the presence of rain throughout the year. On the contrary the index showed a larger highly significant seasonal rainfall was only 1-2 months. While the index 0.60 - 0.79 show where seasonal rainfall in the rainy season and the dry season is balanced (Walsh and Lawer, 1981; Kanellopoulou 2002; Pryor and Schoof, 2008). However, one disadvantage of this index is indescribable

when applicable, wet and dry conditions. SI values obtained in spatial analysis using ArcView software. The resulting map is a map of the distribution of the SI in the study area. The results showed that rainfall patterns respectively north and south of Santa Cruz. One of the significant findings is the seasonal rainfall regime (from 0.60 to 0.79 mainly in the central region of South Sulawesi. Moreover, quite seasonal rainfall regime with a short dry season (0.40 to 0.59) occurred in the northern region to spread in various districts in the central part of South Sulawesi such as in the southern part of the Regency, the central part of the regency, the central part Kabuapten Bone, the eastern and southern part of the regency Wajo. While in the western part of South Sulawesi is dominated by seasonal and long dry season (0.80 to 0.99). A fraction of the amount of rain has less than three months

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(1.0-1.19) and extreme seasonal (> 1.2) which are each located in the south western part of the regency and Takalar. Meanwhile, rainfall amounts of less than three months, the central part Takalar and the western part of Jeneponto for extreme seasonal. In detail, rainfall data is divided into the three-year period 1983-1992 (first), 1993-2002 (second), and 2003-2012 (the third). The first period, SI dominance is seasonal with a short dry season (0:40 to 0:59) spread from East Luwu regency, which is located in the northern part of South Sulawesi until at Soppeng, which is located in the central part of South Sulawesi. Furthermore, seasonal (0.60-0.79) occurred in Bone regency south central part so as to continue to the east of Gowa district the western part of the district of Sinjai, Jeneponto and Bantaeng. The rest is the number of months with rainfall of less than three months and seasonal extremes. Furthermore, as shown in Figure 2.

The second period, SI domination is seasonal (0:40 to 0:59) covers the East Luwu regency, directly to the Central, South Sulawesi, as Pinrang, Sidrap, Soppeng, and Bone. In addition, there are also dibahagain south as in Maros, Sinjai and the piece. Furthermore, seasonal and short dry season (0:40 to 0:59) are in the north up to the middle of South Sulawesi include Luwu Utara, Luwu, Tanah Toraja, Palopo, part Pinrang, Soppeng, Bone and Bulukumba. Whereas, with seasonal drought (0.80-0.99) occurs in Enrekang.

the west coast of South Sulawesi include Pinrang, Sidrap, Pare-pare, Pangkep, Maros, Makassar, directly to the south include Gowa, Jeneponto, Bulukumba and Selayar. The rest is the amount of rain in less than three months (1.0-1.19) and extreme seasonal ( $> 1.2$ ) were both found only on the southern coast of South Sulawesi as Takalar, Jeneponto and Bantaeng as set forth in Figure 3.

The third period, showing dominant SI is seasonal with a short dry season (0:40 to 0:59), spread starting from the northern part of South Sulawesi, North Luwu in South Sulawesi until the middle of the cover and Bone regency. Furthermore, SI seasonal (0.60-0.79) is available in a variety of central as in the district of Pinrang, Wajo, Soppeng, Bone up to southern part includes Pangkep, Sinjai, Bulukumba, and Bantaeng. What is interesting is that there SI with rain all spread throughout the year, but the rainy season is limited (0:20 to 0:39), namely in the border area between North and East Luwu. Meanwhile, extreme seasonality is dominant in the southern part of the

Based on the results of the study reveal that in the northern part of South Sulawesi has a rainfall higher than the central and southern parts of South Sulawesi, even more to the south is getting less rainfall are characterized by a long drought with rainfall amounts of less than three months.

This is according to a study conducted by Maru and Jaya (2009) using methods Thornthwaite to see the drought index in South Sulawesi. The results of the study show that in the northern part of South Sulawesi is dominated by the drought index in leading little or no water scarcity (0 - 16.7%). Furthermore, in the central part is dominated by water scarcity is leading (16,7-33.3%). While in the southern part is dominated by water shortages leading to severe ( $> 33.3\%$ ).

Comparison of the three periods of 1983-1992, 1993-2002, and 2003-2012 Based on the results of the study found that, in general, SI dominant in South Sulawesi is seasonal (0:40 to 0:49), especially in the central part of South

Sulawesi. Furthermore, the northern part of South Sulawesi has a rain regime that is longer than the central and southern areas of South Sulawesi. In contrast, the southern region is seasonal, with long dry season (0.80-0.99) implying that these regions may experience less water supply or domestic and agricultural sectors. Rain regimes vary in each part of the region had an impact on the pattern of plants that should be developed in line with the regime of rain in the area.

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