Mitigation Strategic of Drought in Central Java Indonesia during Covid-19 Pandemic

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Abstract. In 2019, most of the areas in Central Java Indonesia experienced drought disaster. There are 3 districts that conduct emergency response due to drought disasters. If there is another drought in this year during Covid-19 pandemic, it will be very fatal due to the need for more water than usual. Besides being used for daily needs, water is also needed for washing hands and bathing during the Covid-19 pandemic. This study aims to determine the level of drought in Central Java province and provide solutions on how to reduce the drought strategy so as not to aggravate the spread of Covid-19. The method used to determine rainfall prediction is the Canonical Correlation Analysis (CCA) method with input data of average monthly rainfall for approximately 30 years in Central Java. Then to determine the drought map using the Standardized Precipitation Index (SPI) method with input data of rainfall prediction for the last 3 months from the CCA method. The results of data processing show that in August to October 2020 there was a drought with normal levels in almost all regions in central Java, except in the Muria peninsula which is still very wet (August-September) and wet (October). In November and December 2020 there was a drought in all regions in Central Java with normal levels. The level of dryness in this period is normal, meaning it is neither too high nor too dry. Meanwhile, based on several references that at the end of the year there will be a La Nina phenomenon, so that at the end of the year there will be no drought but there will be lots of rain. Several recommendations to overcome this situation will be presented in the final section of this paper.

1. Introduction
Central Java Province is one of the high densities of population in Indonesia. Central Java located stretches along the equator between 5°40’ to 8°30’ South Latitude and 108°30’ to 111°30’ East Longitude (including Karimunjawa Island). In terms of geographic position, Jawa Tengah has boundaries as follows: North – Java Sea; South – D.I. Yogyakarta Province and Indian Ocean; West – West Java Province; East – East Java Province. Central Java has 35 Regency/Municipality, these include 29 Regency and 6 Municipality. [1]

In mid of 2019, there were 3 districts that conduct emergency response due to drought disasters, i.e. Purworejo, Blora and Brebes. During Covid-19 pandemic in 2020, hopefully there are no drought disaster in Central Java. It would be worst if during Covid-19 pandemic and people are lack of water for their daily needs. During the Covid-19 pandemic in 2020, we hope that no drought will hit the Central Java province. If there is a drought, there will be a further disaster, namely the spread of the Covid-19 virus, because people lack water to wash their hands or clean their bodies. This study aims to predict the level of drought in Central Java and provide recommendations for overcoming this drought so that it can curb the transmission rate of the corona virus during this pandemic.
2. Methods

2.1. Rainfall Forecast in Central Java
As the first step in determining drought in Central Java, we perform rainfall prediction calculations. In this rainfall prediction we use the Canonical Correlation Analysis (CCA) method. CCA is a multiple variable statistical technique or the multivariate analysis used for determines the relationship between two set of variables. One set is a set of predictor variables (predictors) while the other set is a set response variable (predictant) [2-4]. We use average rainfall in Central Java during the last 30 years as an input of CCA calculations. Figure 1 shows the rainfall prediction in June 2020 to December 2020.

![Rainfall prediction in Central Java from June to December 2020](image)

Figure 1. Rainfall prediction in Central Java from June – December 2020

2.2. Drought Forecast in Central Java
The second step we predicted the drought in Central Java by using SCOPIC (Seasonal Climate Outlook in Pacific Island Countries) tool. This software uses a statistical method to determine forecast probabilities, based on historic data [5]. As input for drought forecast, we use rainfall data in the last
three months of CCA. For instance, the drought forecast of June 2020, the input data are rainfall forecast (CCA) of March, April and May 2020. Figure 2 shows the result of Standardized Precipitation Index of drought for June to December 2020.

![Maps of Standardized Precipitation Index for June to December 2020]

**Figure 2.** Standardized Precipitation Index of drought for June to December 2020.
3. Result and Discussion
Based on rainfall forecast data, in June to September the rainfall is still quite low. Especially in August on the eastern side of Central Java province. Then in October to December there has been rain with moderate to high levels. Meanwhile, based on drought forecast data in Central Java, it appears that from June to December the level of drought is at a normal or moderate level. The map does not show a high level of drought.

We compare this result with data from Bureau of Meteorology of Australia [6]. In August 2020 the La Nina index shows in level ‘Watch’. It means that in the end of this year, the season tends to La Nina or a lot of rain. Another possibility that may occur, if there is La Nina at the end of the year, is a hydrometeorological disaster, for example floods, flash floods and landslides.

Based on the above analysis, we provide several recommendations to the provincial government or competent agencies. That there is no drought from June to December 2020 so that there is no need to worry about an increase in the spread of Covid-19 during the dry season due to lack of water. Second, related to the existence of La Nina at the end of the year, it is necessary to improve the mitigation of floods, flash floods and landslides, in areas in Central Java Province that have the potential for such disasters.

Flood disaster mitigation can be done by mapping areas that have a high risk of flooding, cleaning up trash that has stagnated in rivers or bridges. Another thing is to make people aware not to throw garbage in the river. Meanwhile, landslide disaster mitigation is to alert people living in mountainous areas to always be alert if there is rain with a high enough intensity and for a long time (2 or 3 days). If there is a crack in the ground, please close it immediately so that water does not enter and always be alert to be ready to evacuate. Checking disaster early warning system tools so that they can work in the event of a disaster.

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