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**EVALUATION OF MODIS CAPABILITY FOR CLOUD
SEEDING IN PENINSULAR MALAYSIA.**

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ABSTRACT

Cloud seeding is a known of weather modification technique to enhance rain due to drought, haze, or air pollution. Seeding process is simple process of dispersing salt or seeding agent into cloud to trigger the precipitation at the cloud atmosphere. Recent study has indicated that by using satellite remote sensing MODIS is compatible to study for cloud types classification in order to identify and finding the suitable clouds for seeding. This study has two main objective that is, (i) to produce cloud types classification of MODIS using Brightness Temperature, and (ii) to analysis the distribution of cloud types classification before and during seeding time in peninsular Malaysia.

Study area for this study cover for peninsular Malaysia. MODIS level 1B calibrated radiances from 2019 is used to in this study. MODIS data used in this study has three (3) different selected dates which are 25 February 2019, 16 September 2019 and 28 September 2019. These selected dates choose based on during cloud seeding operation time in 2019. All these data are free download using NASA earthdata website. Brightness Temperature (BT) is retrieved from MODIS data channel 31 (11.03 μm) to classify cloud types into their classes based on BT value range.

Finding from this research have shown cloud types classification can be classed into six (6) from low-cloud level until high cloud level. However, using BT method, it is able to detect and identify the suitable cloud for seeding which are Cumulus (Cu) and Cumulonimbus (Cb) with the BT value range from 278K – 288K. By using the cloud classes, spatial distribution for cloud types classification map is produce to show the apparition of suitable cloud for seeding purposes.

Keywords: Cloud seeding; MODIS; Cloud Types Classification; Brightness temperature.

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CHAPTER 1

INTRODUCTION

1.1 Research Background

Weather modification is an act that altering weather condition. The most popular form of weather modification is cloud seeding, technique for developing rainfall or increasing moisture at the cloud atmosphere. Cloud seeding is a human intervention to produce rain formation by the process of collision and coalescence of the cloud drop that change cloud particles from solid to liquid by using cloud seeding material (Seto et al., 2018)

Cloud seeding is a solution to produce rain, evaporate fog and increasing precipitation, and overcome air pollution by making rain in target seeding area. By spreading chemical agent such like silver iodide, potassium iodide and dry ice, into the cloud, microphysical processes can alter the amount of precipitation that falls from the clouds (Malik, 2018). Due to shortages of water resources, air pollution, community need, and unpredictable weather especially drought season, lots of countries has figure out and planning on how to decrease precipitation for rain enhancement. Now days, variety technologies have been developed for modelling, analytical and cloud observation capabilities for a better understanding on how cloud processes and cloud potential interaction to produce rain (Flossmann et al., 2019). Besides, cloud seeding is a reliable solution to prevent losses due to climate change and nature-disaster especially haze and smoke disaster cause by air pollution (Seto et al., 2018)

However, not all cloud is possible to be seed. There are two commonly cloud type that can be used in seeding process, winter orographic cloud and convective clouds. These two types of cloud are used in different situation where winter orographic cloud is to trigger snowfall while convective cloud used to trigger mixed-phase precipitation (Flossmann et al., 2019). Cloud seeding required cloud analysis before seeded process to evaluate the cloud phases, occurrence frequency, cloud types, and cloud characteristic (Kim et al., 2020)

According to (Malik, 2018), cloud seeding can be divided into two (2) different seeding technique based on needs of the target area which glaciogenic and hygroscopic seeding experiments. Both seeding is used to enhance precipitation. Seeding technique can be done using three (3) different method which is static (i) static cloud seeding that involve with dispersing silver iodide into cloud, (ii) dynamic cloud seeding for the purpose to boost the vertical air current int the atmosphere to encourage more water to pass through the cloud and converting into rain, however this seeding technique is more complex than static method, (iii)