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RESEARCH ARTICLE

Utilization of Google Earth Engine for Assessment of Daily and Seasonal Variations of TRMM3B43-v7, GPM-v6 and PERSIANN-CDR Data Over the Coastline of Pahang State, Malaysia

Abolghasem Akbari[1] · Majid Rajabi Jaghargh[2] · Azizan Abu Samah[3] · Jonathan Cox[4]

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Abstract

Precipitation is one of the main components of the hydrological cycle, and its accurate measurement has been a long-term objective of scientists, water resources industries, and earth observation technology. The Tropical Rainfall Measurement Mission (TRMM) launched in 1997 opened a new era for precipitation estimation from space. Since then, several other satellite-based precipitation products (SPPs) have been released. Examining the suitability and validity of these SPPs has become a proactive line of research in recent years. This study uses the Google Earth Engine platform to daily and seasonal variations of TRMM3B43-v7, GPM-v6 and PERSIANN-CDR data over the coastline of Pahang State in Malaysia using seven rain gauges located in the vicinity of the South China Sea. An initial comparison of three SPPs was performed with the ground truth monthly data for the period of 10 years (2002–2011) in four recognizable time periods through the year known as; northeast monsoon (NEM) (Nov–Feb), southwest monsoon (SEM) (May–Aug), intermonsoon 1 (IM1) (Mar–Apr) and intermonsoon 2 (IM2) (Sep–Oct). This study found that TRMM3B43-v7 data satisfactorily explained the rainfall characteristics in the NEM period followed by GPM based on the applied statistical metrics CC (0.76, 0.72), NSE (0.73, 0.70) and KGE (0.72, 0.67). However, a relatively weak and unstable correlation was observed for PERSIANN-CDR in all four investigated time periods. It was also revealed that SPPs could only explain the monthly precipitation well on the NEM and relatively well for the IM2 period. The poorest results were obtained for the SWM period with CC (0.35,0.26,0.17), KGE (0.24,0.16,0.06) and NSE (0.29, 0.24, 0.00) for TRMM3B43-v7, GPM-v6 and PERSIANN-CDR, respectively. In addition, this study enhances the weakness of SPPs in daily timescales specifically when it comes to hydrological applications such as real-time flood forecasting.

Keywords TRMM3B43-v7 · GPM · PERSIANN-CDR · Kuantan · Malaysia · Google Earth Engine

Introduction

The hydrological cycle describes the continuous movement of water on, above and below the surface of the Earth. Precipitation is widely recognized as the main driving component for the global hydrological cycle and has an essential role in regulating the climate system (Miao, 2019; Trenberth et al., 2003; Wang et al., 2012). Changes in precipitation measurements impact on ecosystem, hydrological, climate modeling and process studies (Lynch, 2010). In tropical climates, most precipitation falls as rain with occasional hail episodes. Rain gauges measure the depth of precipitation at a given location per unit area. These unit point values are often interpolated to represent the rainfall field spatiotemporally; however, invariably, this

✉ Abolghasem Akbari
akbariinbox@yahoo.com

[1] Department of Civil Engineering, Binaloud Institute of Higher Education, Mashhad, Iran

[2] Department of Water Science and Engineering, Ferdowsi University of Mashhad, Mashhad, Iran

[3] Institute of Ocean and Earth Sciences (IOES), University of Malaya, Kuala Lumpur, Malaysia

[4] Caribbean Institute for Meteorology and Hydrology, P.O. Box 130, Bridgetown, Barbados

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