



Importance of Maritime Continent Monsoonal Water Cycle to the Indonesian Throughflow

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The Indonesian throughflow (ITF), going through the maritime continent and providing the only low-latitude connection of the global ocean circulation system, is important to physical and biogeochemistry processes of the ocean as well as to climate variability. Seasonal variation of sea surface salinity (SSS) in the maritime continent is known to affect the vertical structure and transports of the ITF. However, the sources of the freshwaters that influence the regional SSS variation are poorly understood in large part due to the paucity of in-situ salinity measurements in the region both in space and time. Here we conduct a comprehensive analysis of SSS measurements from the SMAP and SMOS satellites and a suite of other ocean-atmosphere-land satellite observations. The results show that the main sources of the freshwater are derived directly from the Java Sea precipitation and the runoff from Kalimantan (Indonesian part of the Borneo island) during boreal winter and spring associated with the maritime continent monsoonal water cycle. These freshwater sources cause low SSS values in the southern part of Makassar Strait (the main channel of the ITF). The low SSS anomalies are associated with higher local sea level, which works against the predominant North-to-South pressure gradient that drives the southward ITF flows. Therefore, the monsoonal water cycle in the maritime continent plays a critical role in regulating the seasonality of the ITF. The results also have implications to ITF variations and the related impacts associated with longer-term changes of Indo-Pacific climate variability and water cycle in the maritime continent region.