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Impact of Soil Water Fluctuation to Water Budget in the Atmospheric Boundary Layer at Kototabang, West Sumatra, Indonesia

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Soil wetness and water transport to upper layer is one of important factor to intervene water budget in the atmospheric boundary layer. The objectives of study are: (1) to identify soil physic, land use type and climate variability and (2) to analyze water content fluctuation in the layer of soil and water budget in the ABL for wet and dry season. The observation was conducted from 6 to 14 November 2003 as wet season and from 18 to 24 July 2004 as dry season. Site experiment is around Global Atmospheric Watch (GAW) Station and Equatorial Atmospheric Radar (EAR) at Kototabang, West Sumatra (0.20°S; 100.32°E). Soil characteristic was identified by using 8 soil profiles. Key of Soil Taxonomy of USDA was referred to classify of soil. For measuring of soil infiltration, double ring was utilized. Its capacity was calculated and fitted by Horton equation and non linear regression analysis. Soil water content (SWC) was taken in the 3 level of soil depth. To determine SWC, gravimetry method was used. For a convenient of analysis tendency of SWC change, a standard variable analysis has been done. Data from Meteorological Automatic Weather Station (MAWS) was used for calculate an evapotranspiration by using Penman and Montheit method. For analyze water budget, some assumptions was used, those are (1) initial soil water storage is between field capacity (pF 2.54) and permanent wilting point (pF 4.2), (2) runoff is considered if rainfall is more than FC, (3) water is from irrigation and loss through drainage are zero, and (4) soil and ABL are impressed as one closed system of water column, no intervention water form other system. Three subgroup of soil was found are Pachic Melanudans, Typic Melanudans and Typic Hapludans with permeability, porosity, and field capacity are 1.51-6.26 cm/hour (slowly-moderate), 66.4-80.8 % vol, and 33.1-54.2 % vol respectively. Infiltration capacity is around 0.35-2.49 mm/minute with k value is about 0.136-0.356. The correlation coefficients of SWC between layer 2 and 1, and between layer 3 and 2 are significant. Maximum, mean, and minimum temperature, wind speed, and solar radiation during IOP on July 2004 were higher than November 2003. The total average of evapotranspiration from 18 to 24 July 2004 is higher around 0.743 mm/day than from 6 to 14 November 2003. The amount of rainfall in IOP on July 2004 was lower about 68.2 mm than November 2003. Average SWC fluctuation in each layer during IOP on November 2003 and July 2004 are approximately +0.447and -0.436 mm/minute.

Keyword: Atmospheric boundary layer, water budget, soil water content, Indonesia