

4.131 Short-term direct radiative effects of near-source biomass burning aerosols in northern peninsular Southeast Asia.

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Abstract:

Biomass burning (BB) is a major source of black carbon (BC) and organic carbon (OC) aerosols and very pronounced during the dry season (late February to April) over northern peninsular Southeast Asia (PSEA). BC aerosols, in the atmosphere, absorb solar radiation and may affect the hydrological cycle through changes in the surface-atmosphere radiation budget. However, OC aerosols have approximately the same lifetime as BC, but scatter sunlight to a much larger extent than BC, and therefore cool the atmosphere-surface system. The radiative effects of these particles have remained poorly quantified due to their diverse optical and cloud-activating properties. Regional variation in radiative forcing may have important regional and global climatic implications, which are not resolved by the concept of global mean radiative forcing. As a part of the Seven South East Asian Studies/Biomass-burning Aerosols & Stratocumulus Environment: Lifecycles & Interactions Experiment (7-SEAS/BASELInE) 2014 campaign, aerosol measurements were carried out at Doi Ang Khang (DAK; 19.93°N, 99.05°E, 1536 m above sea level), a near-source BB location in northern PSEA, where BB activities were densely distributed in the surroundings. The DAK is an excellent site for investigating the radiative impacts of near-source fresh BB aerosols. In this current study, direct aerosol radiative effects of BB-derived aerosols were assessed by synergizing the observed data set for aerosol physical, chemical, and optical properties along with their vertical distributions in a radiative transfer model. BC contributes up to 80% to the atmospheric forcing. Substantial atmospheric heating (as high as $+81 \text{ W m}^{-2}$) accompanying with the surface dimming (as high as -75 W m^{-2}) assessed over DAK can have a significant impact on atmospheric circulation prior to the onset of the Asian summer monsoon over northern PSEA.