PM_{10} Simulation using WRF-Chem with T1-Mozart Chemical Mechanism during the 2019 South Kalimantan, Indonesia Forest Fire Episode

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Abstract

In this study, we investigated the impact of forest and land fires on PM_{10} emissions in South Kalimantan, Indonesia, a region where such fires significantly affect air quality and public health. We used the Weather Research and Forecasting model coupled with Chemistry (WRF-Chem), equipped with the T1-MOZCART chemical mechanism, to simulate the distribution of PM_{10}, particulate matter smaller than 10 micrometers. The study, conducted from November 8^{th} to 15^{th}, 2019, integrated high-resolution meteorological data, emissions data from the Fire Inventory from NCAR (FINN) version 2.2, and ground-based observations. Three simulation scenarios were performed, with a special focus on Simulation 3, which incorporated the Kain-Fritsch scheme for cumulus parameterization and FINN v2.2 for fire emissions. This particular simulation closely matched observed PM_{10} levels, especially in capturing the nocturnal peaks, although it underestimated peak values by approximately 20 µg/m3. Despite this, Simulation 3 proved to be the most precise, as indicated by its lowest Root Mean Square Error (RMSE) value. Nonetheless, the relatively high RMSE values across all simulations point to the need for further improvement in the model's accuracy. This research underscores the importance of detailed emissions data and precise model parameterizations in effectively assessing the environmental impacts of forest and land fires.

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