The SERVIR Southeast Asia air quality monitoring and forecasting platform: new features and enhancements put forward in version 2

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Southeast Asia is a densely populated geographical area with significant anthropogenic air pollution generation, which is remarkably elevated during seasonal agricultural burning. The incidental health hazard arising from air pollution is nowadays effectively realized and the consequences recognized. According to the World Health Organization, outdoor and household air pollution in 2016 caused cumulatively approximately 7 million deaths globally, with Southeast Asia possessing one of the highest attributable mortality rates. Despite the efforts of authorities to keep an outlook on the issue, primarily by installing surface-observation sensors and establishing monitoring systems, remote sensing technology is still incompletely leveraged. Nevertheless, recent advancements in the domain such as recently launched satellite systems, numerical modeling, low-cost sensors and machine-learning algorithmic development provide a promising outlook for the near future.

In an effort to support regional air pollution monitoring, SERVIR-Mekong launched in 2020 the Mekong Air Quality Explorer, a geospatial platform distributing near-real time air quality information over the lower Mekong, consisting of surface measurements and a machine learning-based forecasting model. This information has enabled the realization of a comprehensive monitoring and forecasting system of air quality over the region, and therefore, assist related authorities to devise evidence-based policies to tackle the underlying causes such as forest fires, agricultural burning and air pollution generation. Moving forward with the second phase of the programme between 2023 and 2028, SERVIR Southeast Asia will focus on expanding the coverage area to Southeast Asia, augment the availability of data and products, enhance the machine learning and methodological aspects of pollutants estimation and reach out to a larger audience of authorities and practitioners.

In the current paper, we present an overview of the ongoing scientific activities that are anticipated to transition to operationalization at the next distribution of the SERVIR Southeast Asia air quality

monitoring platform. In regard to data availability, the system is anticipated to incorporate data from the GEMS and Sentinel-5P satellites and consequently introduce satellite remote sensing-based now-casting monitoring capabilities at sub-daily intervals. The use of satellite as a proxy to surface-level air pollution is planned to be substantiated by quantitatively judging against ground measurements in related validation experiments. In parallel, the forecasting capacity will be enhanced threefold; first, down-scaling efforts will refine the spatial resolution of the GEOS-5 model from 25km to 5km, and secondly, the addition of WRF-Chem as an alternative forecasting output. Last, a high spatiotemporal resolution machine learning-based model fusing a plethora of proximate and remote measurements is expected to provide a finer input for developing application-ready products for human and crop health. Last but not least, information provision on the main source of air pollution in the greater region, which is vegetation fires, will be enriched with the inclusion of a satellite-based fire emission inventory. The advancements described above, and planned during the SERVIR Southeast Asia programme, advocate a means of fostering science- and evidence-based results to support enhancement of policies in tackling the long lasting air pollution burden in Southeast Asia.

Keywords: evidence-based policy, abatement, vegetation burning, air pollution, PM2.5