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Simulating the dispersion of pollutants from the fires on the X-Press Pearl ship

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The X-Press Pearl container ship caught fire on May 20, 2021, which lasted until an explosion led to the ship sinking on June 2, 2021. The ship was carrying dangerous cargo as classified by the International Maritime Organization. Plumes of pollutants arising from the burning ship was transport across the ocean and lands surrounding through advection and dispersion processes and plume dynamics in the lower atmosphere. Some pollutants even in trace quantities can lead to consequences in the atmosphere such as an alteration to the cloud microphysics leading to drop in rainfall in Sri Lanka and causing acid rain. We sought to identify the potential impacts on the atmosphere on the ground and above it in the air column. Materials as listed in the ship's cargo manifest were ranked by tonnage and their combustion product toxicity. To track the direction of the pollutant dispersion, the HYSPLIT model was used. To identify the impacted region at ground levels from toxicants released into the ambient air, the ALOHA model was attempted but not reported here. Trajectories from HYSPLIT showing mean air parcel movement at 100 m, 500 m, and 1000 m vertical height were computed every 12 hour from May 21 to June 2. These trajectories propagate towards parts of the Western Sabaragamuwa, Central, North-Western, North-Central, Eastern, and Uva provinces. The plume trajectories show dispersion from the ground level to the atmosphere up to 1500 m and extend beyond Sri Lanka. Air quality in the close vicinity was simulated to be affected by nitric acid, carbon monoxide, and methanol. The nitric acid, carbon monoxide, and methanol transport from the ship fires were detected in simulations at distances 10 km away. While our simulations were for these three gases, other hazardous pollutants such as persistent organic pollutants, heavy metals, and particulate materials could also be consequential. We shall update these simulations beyond the 10km range with more precise data as they become available.

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