Assessing the Impacts of Long-Range Forest Fire Emission Transport on Air Quality in Toronto, Ontario, Using MODIS Fire Data and HYSPLIT Trajectories

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Abstract : Pollutants emitted from forest fires such as $PM_{2.5}$ and carbon monoxide (CO) have been found to impact the air quality of distant regions through long-range transport. $PM_{2.5}$ is of particular concern due to its transport capacity and implications for human respiratory and cardiovascular health. As such, significant increases in $PM_{2.5}$ concentrations have been exhibited in urban areas downwind of fire sources. This study seeks to expand on this literature by evaluating the impacts of long-range forest fire emission transport on air quality in Toronto, Ontario, as a means of evaluating the vulnerability of this major urban center to distant fire events. In order to draw correlations between the fire event and air pollution episode in Toronto, MODIS fire count data and HYPLSIT trajectories are used to assess the date, location, and severity of the fire and track the trajectory of emissions (respectively). Forward and back-trajectories are run, terminating at the West Toronto air monitoring station. $PM_{2.5}$ and CO concentrations in Toronto during September 2017 are found to be significantly elevated, which is likely attributable to the fire activity. Other sites in Ontario including Toronto (East, North, Downtown), Mississauga, Brampton, and Hamilton (Downtown) exhibit similar peaks in $PM_{2.5}$ concentrations. This work sheds light on the non-local, natural factors influencing air quality in urban areas. This is especially important in the context of climate change which is expected to exacerbate intense forest fire events in the future.