Fire Impactology: Modeling and Estimating the Impact of Wildfire Emissions on Public Health

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There are over 350,0 wildfires on Earth yearly with the impact of big territories and clear tendency to rise as the climate changes take place. Predictive estimates indicate tripling of the wildfires globally and importance to study their impact on air quality, public health and the economy. Experts are concerned about wildfires emissions (in particular PM10 and PM2.5), leading to 340,000 additional deaths annually. Project's goal is to create the software for forecasting air pollution from wildfire emissions to preserve public health. Methods used during the research: physical and chemical (gas analyzers HORIBA); cartographic (geospatial analysis of wildfires areas by MODIS and VIIRS satellites via API from NASA); statistical; mathematical modeling (Gauss model). PM10 and PM2.5 concentrations measurements (~35,000 values total) collected from monitoring stations. A component of the Gaussian plume model was used in simulation to forecast air pollution in space and time including weather factors and specific biomass burning parameters. PM10 and PM2.5 concentrations showed their highest peaks during wildfires. The calculated risk levels determining the air quality standards exceedance by 2.8 and 4.2 times, respectively. This could cause 4 additional deaths per 100 people (cardiovascular and pulmonary diseases). The suggested modeling of concentrations dispersion made it possible to improve the math model of the Gaussian plume ensuring the fulfillment of the equation requirements. In conclusion, climate change and wars make Fire Impactology especially relevant for many countries to forecast the impact of wildfires on air pollution and population alert regardless of the monitoring observations presence.

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