6.174 Influence of meteorological and trace gas factors on surface ozone concentrations in the interior of South Africa.

Early Career Scientist

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Abstract:

South Africa's own monitoring and modelling of surface ozone (O_3) can be traced back to the early 1980s, however there are still significant gaps in knowledge about ozone in South Africa and of the conditions that contribute towards its formation. Accurate modelling of surface ozone within a local and regional context remains a challenge. This study was conducted to investigate the behaviour of O_3 concentration in surface air with several known meteorological and trace gas variables, using statistical methods to quantify the impact of these variables. This analysis focused specifically on the interior of South Africa where datasets from four inland monitoring locations were used. Multiple linear regression was applied to approximate the linear relationships between several predictor variables and the dependent variable O_3. The coefficient of determination, R^2, for the prediction of the concentration of O_3 was found to be the highest when including the following variables: temperature, solar radiation, relative humidity, wind speed, wind direction, carbon monoxide and nitrogen oxides gas concentrations. Multicollinearity was evaluated in the model and determined to be low. In many O_3 prediction models, air temperature has been found to be the strongest single predictor of O_3 concentration. However, at three of the four monitoring sites studied, relative humidity appears to be the most important atmospheric factor influencing the variation in O_3 levels. Temperature and O_3 precursors (nitrogen oxides and carbon monoxide) were found to be the next significant variables. Relative humidity is important because it affects the amount of liquid water that condenses on the aerosol particles and the rate of reactive nitrogen loss to the particle phase. Several possibilities are being investigated to explain

the predominant influence of relative humidity on O_3 which could have implications for modelling tropospheric O_3 formation and destruction processes in this region of the world.