Research brief
Estimating lightning NO_x production over South Africa

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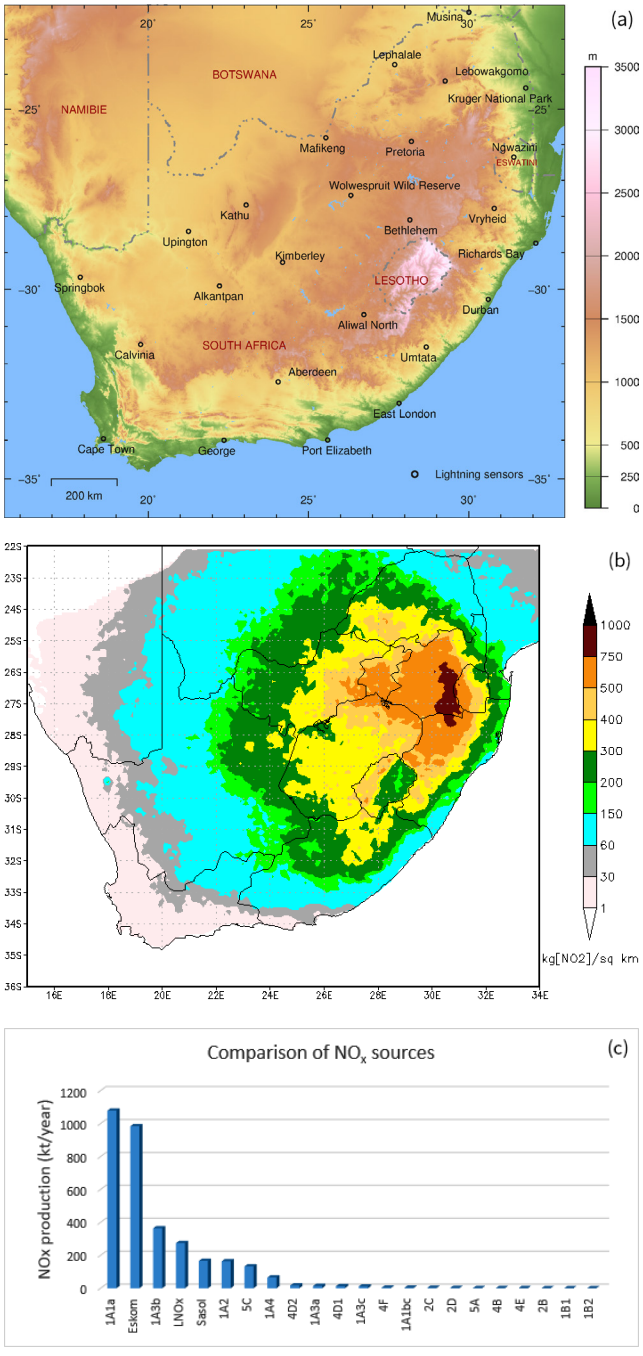
Poor air quality is a key environmental concern in South Africa, as it poses a serious threat to the well-being of the people of South Africa. Nitrogen oxides (NO_x = nitric oxide (NO) + nitrogen dioxide (NO_2)) are toxic air pollutants and play a significant role in tropospheric chemistry. Global NO_x hotspots are the industrialised regions of the USA, Europe, Middle East, East Asia and eastern parts of South Africa. Lightning is one of the many natural and anthropogenic sources of NO_x to the troposphere. The discourse on NO_x over the southern African continent has mainly focused on anthropogenic sources. However, lightning is known to be a significant source of tropospheric NO_x globally. It is therefore important to understand its contribution to the national and global NO_x budget.

A recent paper by Maseko et al., (2021), published in the South African Journal of Science, used data from the South African Lightning Detection Network to approximate the contribution of lightning on the NO_x load over South Africa (Figure 1a), and to develop a gridded data set of lightning-produced NO_x (LNO_x) emissions for the period 2008–2015 (Figure 1b). The Network monitors cloud-to-ground lightning strikes; and theoretically has a detection efficiency of 90% and a location accuracy of 0.5 km. An emission factor of 11.5 kg NO_2/flash was employed to calculate a national LNO_x budget of ~270 kt NO_2/year. The calculated LNO_x was 14% of the total NO_x emission estimates published in the EDGAR v4.2 data set for the year 2008 (Figure 1c). The LNO_x emission inventory will improve model performance and prediction and enhance the understanding of the contribution of lightning to ambient NO_2.



References

Maseko, B., Feig, G., Burger, R., 2021. Estimating lightning NO_x production over South Africa. South Afr. J. Sci. 117. https://doi.org/10.17159/sajs.2021/8035

Schumann, U., Huntrieser, H., 2007. The global lightning-induced nitrogen oxides source. Atmos Chem Phys 85.

Figure 1: *(a) Position of the 25 Vaisala lightning detection sensors over South Africa; (b) Average number of total LNO_x in (kg NO_2/km^2/year), using the emission factor of Schumann and Huntrieser, (2007); (c) NO_2 emission from EDGAR v4.2 and lightning for the year 2008 over South Africa, in kt NO_2/year.*