SO2 Plumes Observation with LMOL: Theory, Modeling, and Validation

G. Gronoff[1,2], T. Berkoff[1], W. Carrion[1,2], L. Lei[1,2],D. Phoenix[1,2]

[1] NASA Langley Research Center, *Hampton, Va, USA, E-mail: Guillaume.P.Gronoff@nasa.gov*

[2] *Science Systems and Applications Inc, Hampton, Va, USA*

LMOL, the NASA Langley Mobile Ozone Lidar, is located near NASA's LaRC steam plant when not deployed in campaigns. The steam plant is an incinerator and its plume occasionally produces SO2.

LMOL previously observed affected O3 values in the 100m-200m, it was theorized that SO2 from the plant plume was the source of these noisy/full of artefacts data.

In this work, we show how we modified the Lidar to detect the plant SO2 plumes and compute the density of SO2 when the O3 background is stable - densities that are compatible what is expected from the typical SO2 plume exhaust -. We explain how we selected laser lines so that an O3 variation would not get confused with a SO2 detection. We present a model capable of simulating the Lidar signal with (notably) O3 and SO2 absorption for the validation of the retrieval resolution and uncertainty. We finally show the comparison between the modeled and observed performances of the system: the maximum altitude, resolution, and error in the modeled signal and the observed signals are the same within reasonable margins.

This work shows that LMOL is fully capable of working with SO2. The next step being the addition of an additional laser channel, which is simplified by the tunable aspect of the LMOL laser, to address O3 and SO2 simultaneously, allowing the assessment of SO2 when O3 has variations.