Royal Netherlands
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ozone sonde: statistical analysis of the effect of the background current on the measured profile

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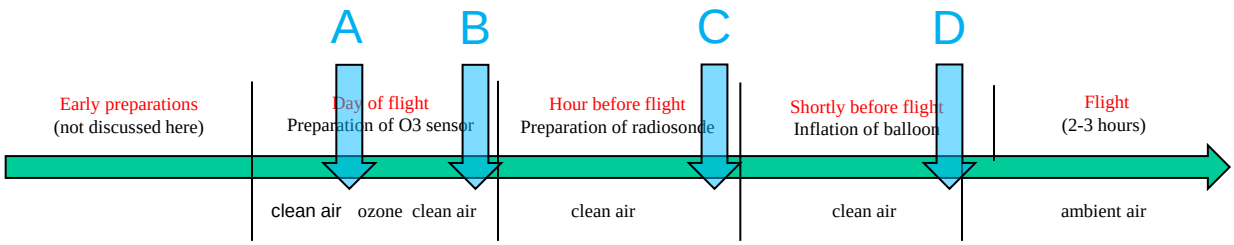
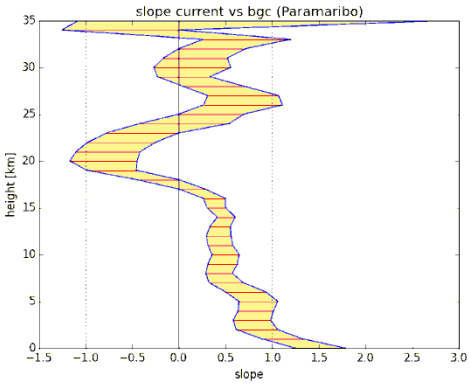


what is the problem?

The ECC cell in an ozonesonde measures at atmospheric ozone content with a reaction between ozone and potassium iodide (KI). The cell gives an electrical current proportional to the concentration of ozone in the atmosphere. (Typically 1-5 uA) However, the cell also produces a "background current" when the cell is exposed to clean air. This background current is measured before the flight at one or more points during the preparation cycle. The background current varies significantly from flight to flight and it disappears immediately when no air is pumped through the cell.



what causes the background current?

There have been several suggestions on what could cause the background current:

- sensitivity of the cell for oxygen.
- a (slow) reaction between ozone and the buffer in the KI solution
- sensitivity of the cell to hydrogen peroxide (H2O2) ; H2O2 could be generated by the ozone-source used during the preparation of the cell
- it could be caused by ion-bridge in the cell
- the background current could be a artefact of poor laboratory procedures, and does not affect the measured ozone concentration during the flight

statistical analysis

we have analysed all (449) successful flights of the tropical station "Paramaribo" to see if the measured background current has affected the ozone profile during the flight. We found a substantial influence of the pre-flight background current on the measured currents, both in the troposphere and in the stratosphere above the ozone maximum. In the lower stratosphere the effect appears to be negative. Note that in Paramaribo, the background current is measured at point "C" in the timeline. Measured background currents range between 0 and 0.2 uA, with an average of 0.13 uA

conclusions

Our analysis suggests that the measured background current is real, and does affect most of the observed ozone profile. The altitude dependence of the observed effect is rather surprising, and is inconsistent with any of the suggested causes. Not correcting the ozone profile, or correcting it with some kind of "climatological" value, will result in poor measurements at most -but not all- altitudes.

We would like to thank our colleagues at the Meteorological Service of Surinam for their efforts in making quality ozone obervations.