Geophysical Research Abstracts
Vol. 17, EGU2015-11183-2, 2015
EGU General Assembly 2015

Modified ECC ozone sonde for long-duration flights aboard isopicnic drifting balloons

Francois Gheusi (1), Pierre Durand (1), Nicolas Verdier (2), François Dulac (3), Jean-Luc Attié (1,4), Philippe Commun (5), Brice Barret (1), Claude Basdevant (6), Antoine Clénet (2), Alain Fontaine (7), Corinne Jambert (1), Yves Meyerfeld (1), Laurent Roblou (1), and Flore Tocquer (1)

(1) Laboratoire d'Aérologie, University of Toulouse / CNRS, France (francois.gheusi@aero.obs-mip.fr), (2) Centre National d'Etudes Spatiales (CNES), Toulouse, France, (3) Laboratoire des Sciences du Climat et de l'Environnement, IPSL-LSCE, CEA/CNRS/UVSQ, Gif-sur-Yvette, France, (4) Centre National de Recherche Météorologiques / Groupe d'études de l'Atmosphère Météorologique, Météo-France / CNRS, France, (5) ALTEN, Toulouse, France, (6) Laboratoire de Météorologie Dynamique, University Pierre et Marie / Ecole Poytechnique / Ecole Normale Supérieure de Paris / CNRS, Paris, France, (7) Observatoire Midi-Pyrénées, Toulouse, France

Since few years, the French space agency CNES has developed boundary-layer pressurized balloons (BLPB) with the capability to transport scientific payloads at isopicnic level over very long distances and durations (up to several weeks in absence of navigation limits). However, the autonomy of conventional electrochemical concentration cell (ECC) ozone sondes, that are widely used for tropospheric and stratospheric soundings, is limited to few hours due to power consumption and electrolyte evaporation (owing to air bubbling in the cathode solution).

In collaboration with the French research community, CNES has developed a new ozone payload suited for long duration flights aboard BLPB. The mechanical elements (Teflon pump and motor) and the electrochemical cell of conventional ECC sondes have been kept but the electronic implementation is entirely new. The main feature is the possibility of programming periodic measurement sequences – with possible remote control during the flight.

To increase the ozone sonde autonomy, a strategy has been adopted of short measurement sequences (typically 2-3 min) regularly spaced in time (e.g. every 15 min, which is usually sufficient for air quality studies). The rest of the time, the sonde is at rest (pump motor off). The response time of an ECC sonde to an ozone concentration step is below one minute. Consequently, the measurement sequence is typically composed of a one-minute spin-up period after the pump has been turned on, followed by a one- to two-minute acquisition period. All time intervals can be adjusted before and during the flight.

Results of a preliminary ground-based test in spring 2012 are first presented. The sonde provided correct ozone concentrations against a reference UV analyzer every 15 minutes during 4 days.

Then we illustrate results from 16 BLBP flights launched in the low troposphere over the Mediterranean during summer field campaings in 2012 and 2013 (TRAQA and ChArMEx programmes). BLPB drifting altitudes were in the range 0.25-3.2 km. The longest flight lasted more than 32 hours and covered more than 1000 km between Minorca and the limit of the authorized flight area south of Malta.

During some flights, satisfying comparisons were obtained relatively to independent measurements close in time and space. The obtained quasi-Lagrangian measurements allow an evaluation of the ozone production/destruction rate as a function of the solar radiation (also measured onboard, as well as standard weather variables) that will be helpful to test chemistry-transport models.