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ChemSonde: CO_2 profiles using Radiosondes

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Atmospheric composition measurements in the tropical tropopause layer (TTL) and upper troposphere/lower stratosphere (UTLS), are fairly sparse. They require specialised equipment, such as instrumented aircraft or large balloons, and these platforms can be expensive to run and operate intermittently, and therefore cannot provide continuous or long-term measurements. Although satellites can provide this level of coverage, they have a finite operational lifetime, are expensive to develop and launch, and encounter limits to their information retrieval; especially in the UTLS due in part to the radiative properties of clouds and the spatial gradients of the gas species encountered there, leading to errors and lower resolution vertical measurements compared to in-situ observations.

The UTLS generally ia an important region of the atmosphere, being sensitive to changes in climate (through anthropogenic activity for example) which can influence the radiative, transport and chemical processing occurring there. As the interface between the stratosphere and troposphere, changes in the UTLS structure and chemical composition can effect the composition of the stratosphere (e.g. O_3 and H_2O) in turn changing the radiative environment, with potential feedbacks on tropospheric climate.

At present, the only routine profile measurements are provided by the global ozonesonde network with a small number of ground-based lidar measurements. Again, these methods are limited by their spatial coverage and the range of species measured. Extending these existing networks by making it feasible to conduct wide-ranging composition profile measurements, would have the potential to revolutionise atmospheric measurement programmes.

ChemSonde is package developed to incorporate a novel miniature optical cavity CO_2 instrument launched on standard meteorological balloons (and electrochemical (EC) sensors for CO, O_3, NO_x).The package is suitable for use in global sonde networks, e.g. Global Climate Observing System (GCOS), and for stand-alone use, with applicability to short-term monitoring (pollutant transport, chemical processing) and long-term monitoring; trend detection, source attribution, and climate change.

We will introduce the technologies behind the project, and present results from recent field-campaigns in the UK as part of GAUGE.