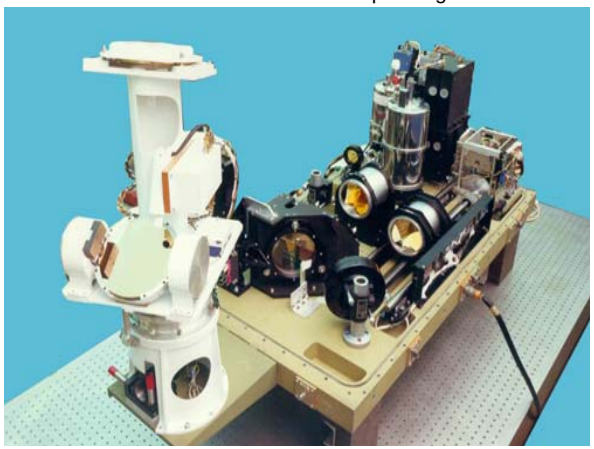
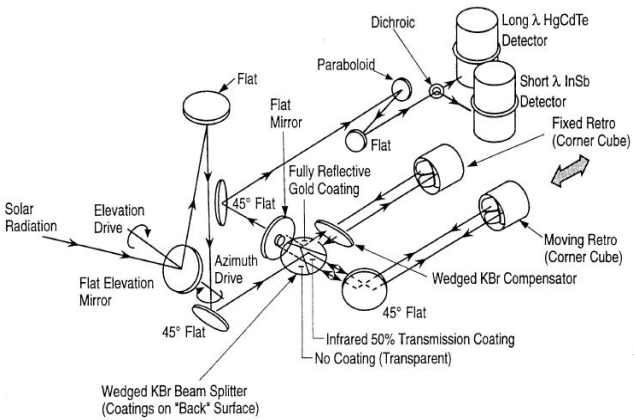
The JPL MkIV Balloon Interferometer

MkIV was designed and built at JPL in 1984 to perform remote observations of the composition of the Earth's atmosphere by solar occultation spectrometry.

Instrument

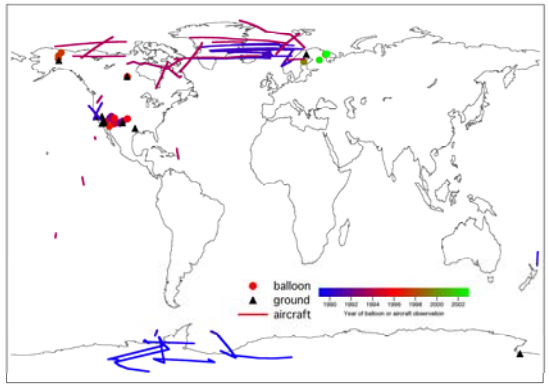
- Double-passed Michelson interferometer.
- Mass = 250 kg; Size = 1.2 x 0.5 x 0.6 m; Power = 150W.
- KBr beamsplitter and compensator provide wide spectral coverage (650-5650 cm^{-1}) and low reflection losses.
- Dual HgCdTe and InSb detectors fed by dichroic.
- Parallel 12-bit ADCs provide 19 bits of dynamic range.
- Cube-corner retro-reflectors provide tilt compensation.
- Leadscrew provides <0.5% velocity error and 200 cm OPD.
- Two-axis suntracker maintains solar pointing.



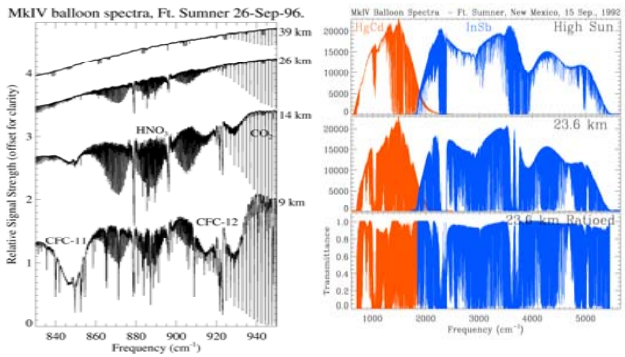


Observations

MkIV has has performed 15 high-altitude balloon flights, 3 aircraft campaigns (35 flights) on board the NASA DC-8 aircraft, and over 900 days of ground-based observation from various sites. These measurements, made over a wide range of latitudes, are used for model validation, process studies, trend detection, and satellite validation.

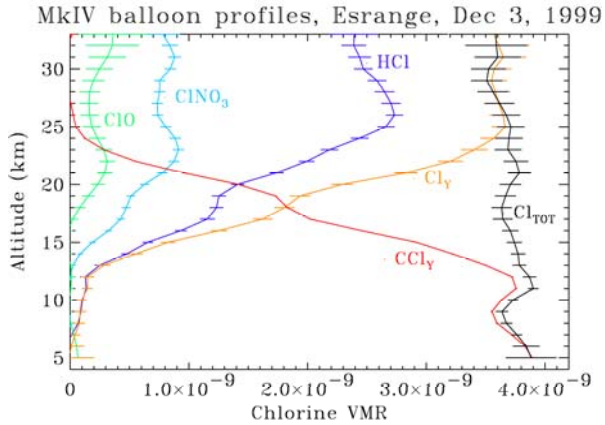


Solar spectra measured at sunrise and sunset provides information about the atmospheric composition at different altitudes. Ratioing the limb spectra by exo-atmospheric spectrum removes solar and instrumental features.



Results

The high sensitivity of the MkIV instrument to atmospheric trace species, together with the large number of gases that can be measured simultaneously, makes the MkIV profiles very useful in constraining atmospheric models.



The high signal-to-noise ratio of the MkIV spectra, together with their high spectral resolution, makes it possible to detect weak absorbers, even when overlapped by much stronger bands. Figure below shows the detection of atmospheric phosgene ($COCl_2$) from Toon et al. [2001]