Variation of CO_2 mole fraction in the lower free troposphere, in the boundary layer and at the surface

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3D CO_2 distribution is needed by

- transport models (operation, development, validation)
- calibration/validation remote sensing instruments (satellites, FTIR etc.)

Tall towers: up to 100-500 m

estimation of boundary layer mean may be possible during intensive vertical mixing

Exchange between the PBL and the lower free troposphere

↓

Information is also needed from above the PBL

↓

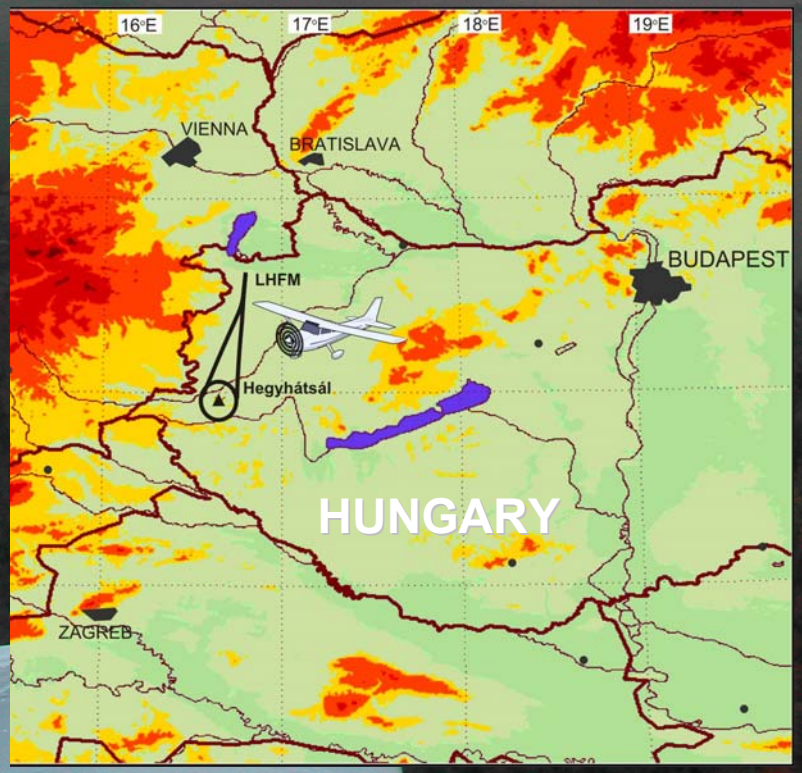
Aircraft, baloon, kite etc. sampling/in situ measurements

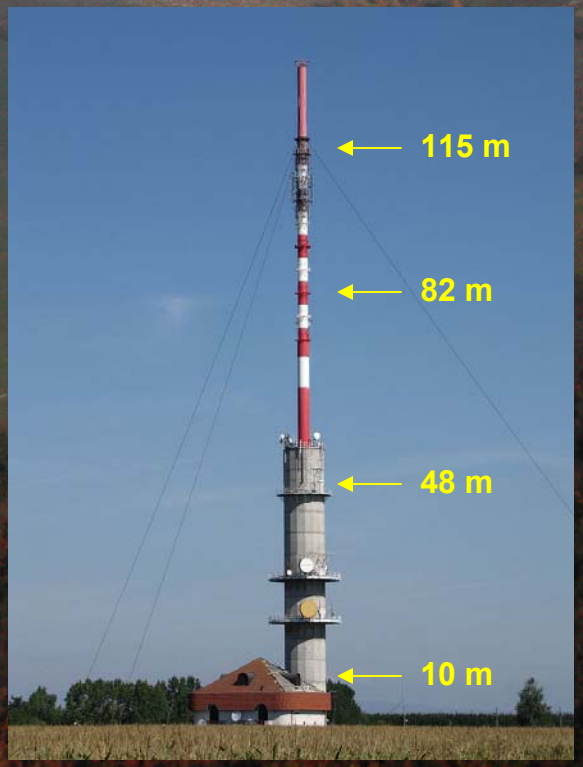
Hegyhátsál TV/radio transmitter tower (135 m) located in a flat region, in rural environment in western Hungary

(see Haszpra et al., Atm. Envir. 42 [2008], 8707-8716.)

In situ CO_2 measurements at 4 elevations since Sept. 1994

NOAA air sampling since March 1993 (site code: HUN)





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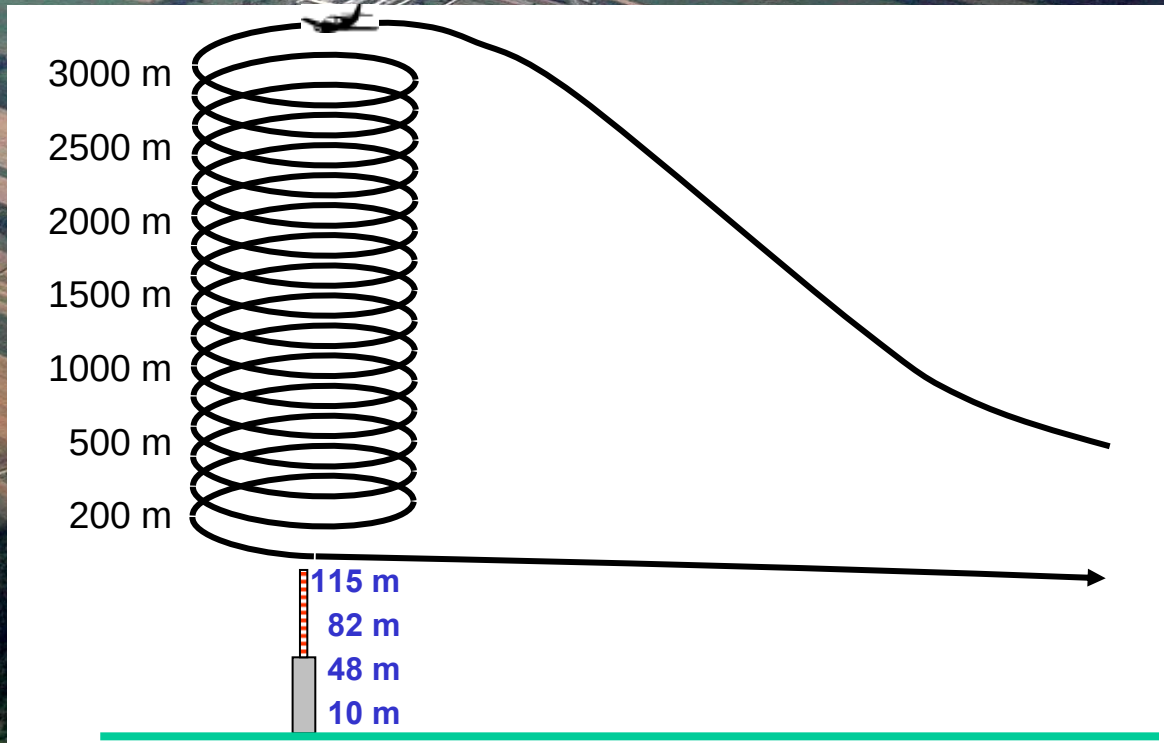
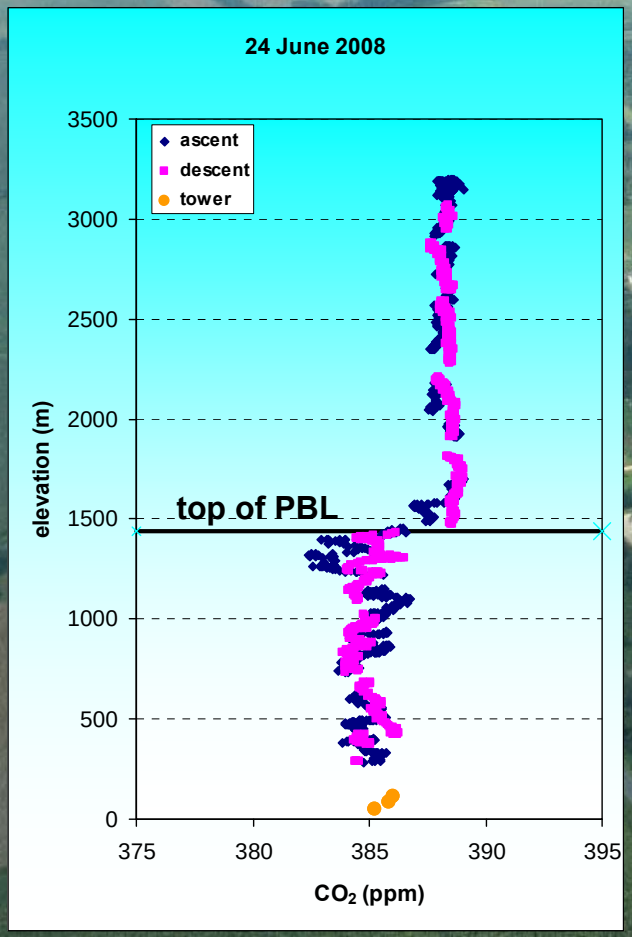
Flask air sampling at 7 elevations between 2001 and 2008 (1 flight/month)

Analyses by LSCE, France

In situ measurements (AOS Inc., Boulder, CO, USA) 200-3000 m in 2006 and 2008 (1 flight/week)





Estimation of the mean PBL CO_2 mole fraction using

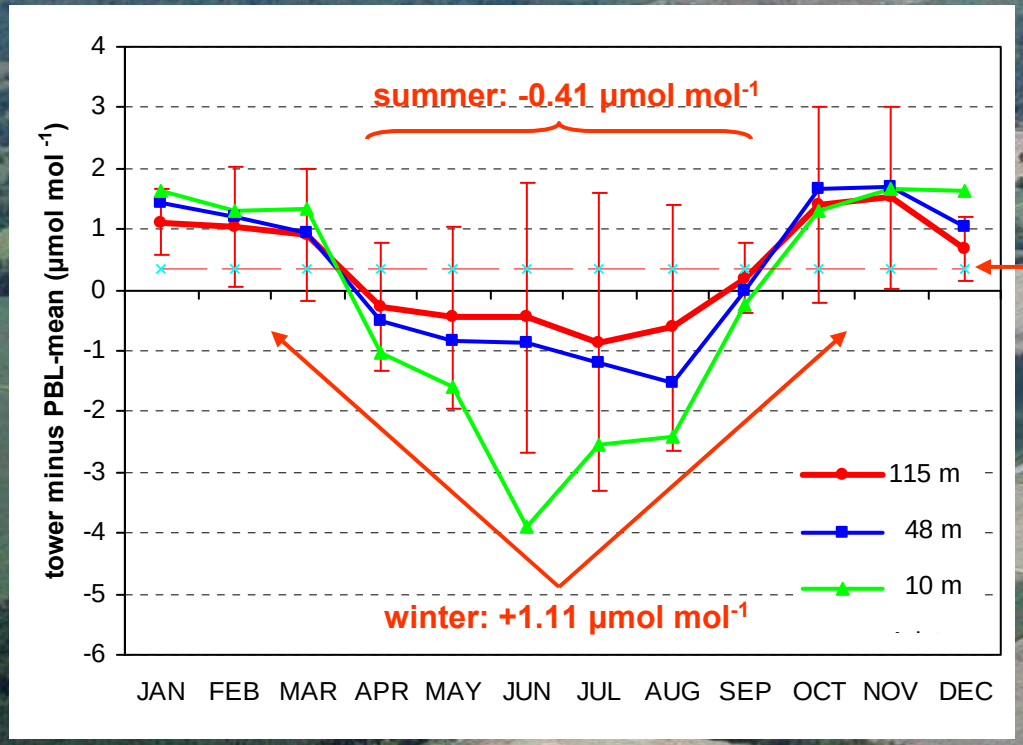
- in situ aircraft measurements

  +

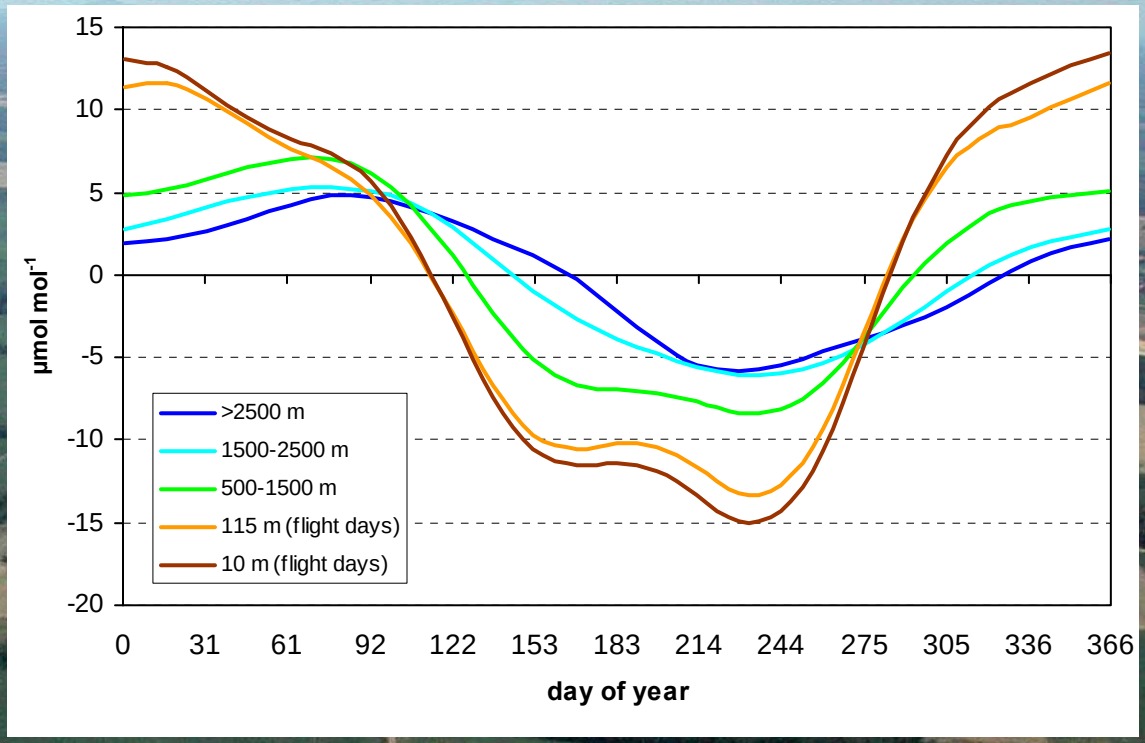
- tower measurements

Comparison of the PBL-mean with the measurements on the tower

115 m (tower) *minus* PBL-mean = 0.35±0.85 µmol mol^{-1} (annual average)



	annual	summer	winter
115 m	0.35	-0.41	1.11
48 m	0.25	-0.83	1.33
10 m	-0.24	-1.96	1.48



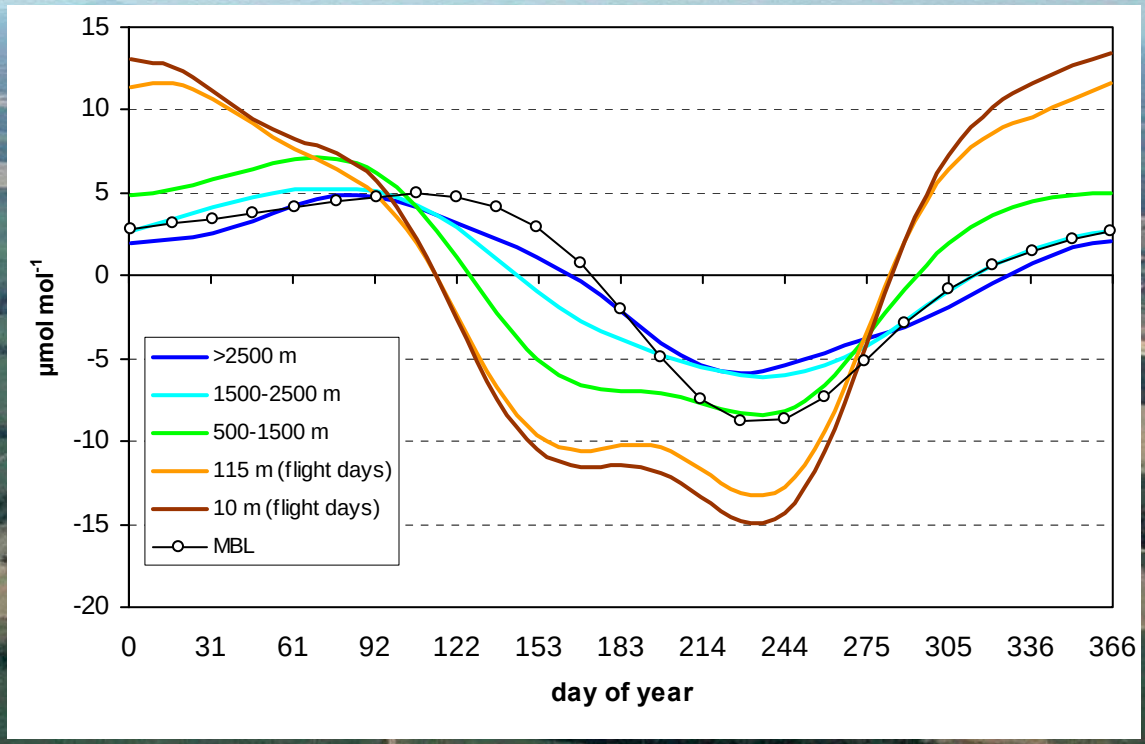
CCGCRV data processing software by Kirk Thoning, NOAA

peak-to-peak amplitude:

2500-3000 m: 10.7 µmol mol^{-1}

10 m: 28.5 µmol mol^{-1}

Caution! Potential fair weather bias



Maximum:

10-115 m: late Dec

500-1500 m: ~10 March

1500-2500 m: ~17 March

2500-3000 m: ~24 March

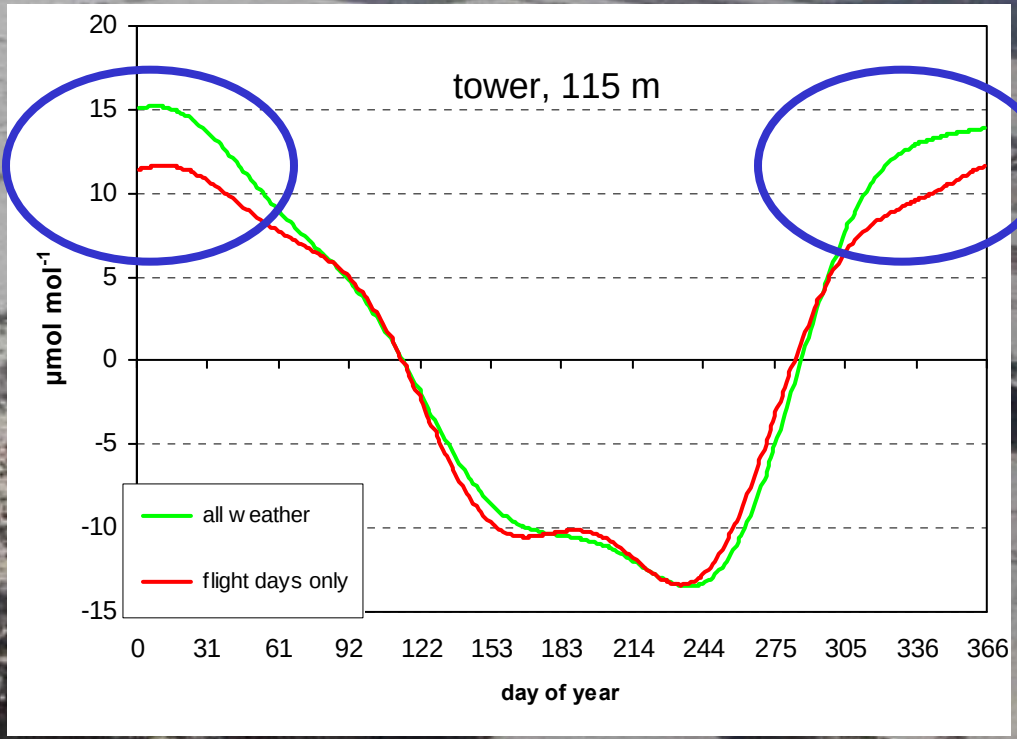
MBL*: ~15 April

Minimum: ~20 August

* GLOBALVIEW, 2010

fair weather bias only

- in winter,
- at low elevation



Haszpra et al., 2012: Variation of CO_2 mole fraction in the lower free troposphere, in the boundary layer and at the surface. *Atmospheric Chemistry & Physics Discussion* 12, 11539-11566. (4 May 2012)

Aerial pictures by
Martin Simon, pilot


Thank you for your attention


HA-SKZ