



# Validation of TCCON Observations of $\text{CO}_2$ , $\text{CH}_4$ , and $\text{CO}$ at Sodankyla Using AirCore

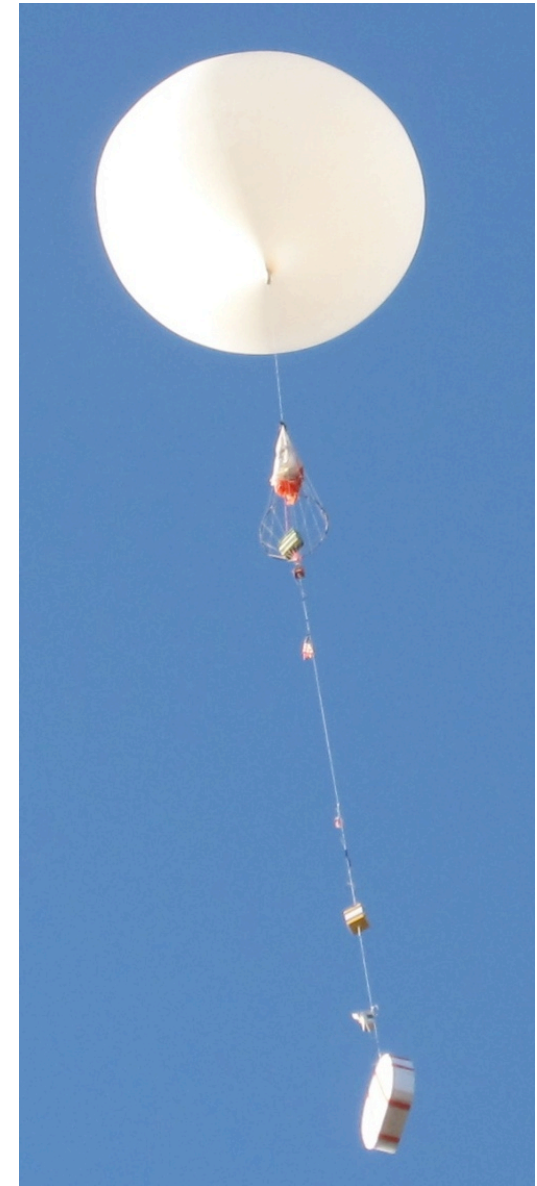
**Huilin Chen**<sup>1,2</sup>, Bert Kers<sup>1</sup>, Rigel Kivi<sup>3</sup>, Pauli Heikkinen<sup>3</sup>,  
Juha Hatakka<sup>4</sup>, Tuomas Laurila<sup>4</sup>, Colm Sweeney<sup>2,5</sup>  
and Pieter Tans<sup>5</sup>

1. CIO, University of Groningen, The Netherlands
2. CIRES, University of Colorado, Boulder, USA
3. FMI, Arctic Research Centre, Sodankyla , Finland
4. FMI, Helsinki, Finland
5. NOAA ESRL, Boulder, Colorado, USA

# AirCore measurements



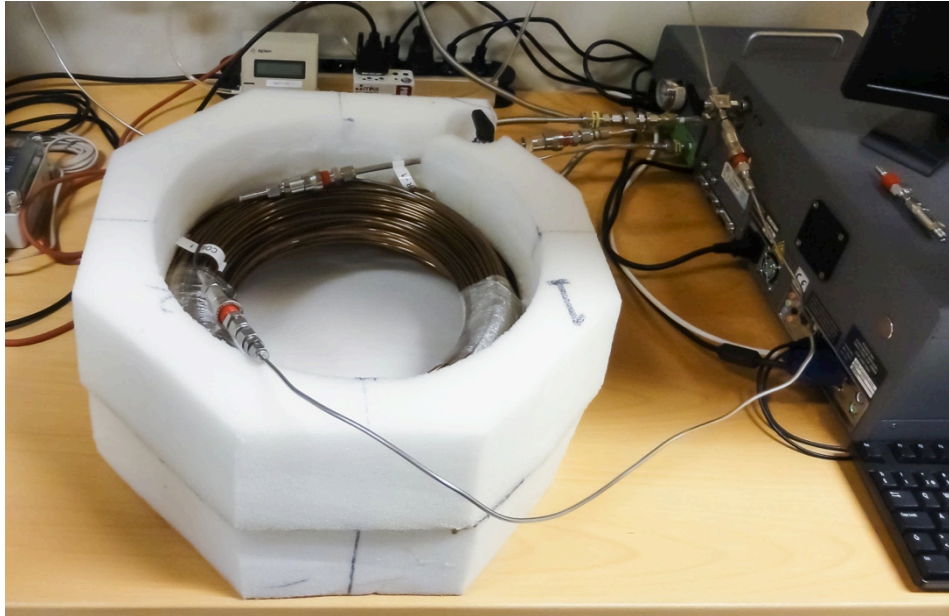
The AirCore with magnesium perchlorate driers and shut-off valves attached on each end, 152 m long, 7 kg [Karion *et al.* 2010]



# Validation of TCCON AirCore vs. Aircraft

Sampling platform	Sampling range	Cost (\$)	Error in $\text{XCO}_2$	Error in $\text{XCH}_4$	Regular launch?
Low-aircraft	0 – 4 km	1.5K	1.0 ppm	10 ppb	Yes
High-aircraft	0 – 12 km	10K	0.50 ppm	6 ppb	NA
AirCore	0 – 30 km	4.2K	0.10 ppm	2 ppb	Yes

# AirCore measurements over Sodankyla



AirCore: 40 m 1/4" + 60 m 1/8"

Coils: 2.8 kg

Total package: 3.6 kg

Analysis: Picarro

CO<sub>2</sub>/CH<sub>4</sub>/CO/H<sub>2</sub>O

TCCON station



Location 67° North



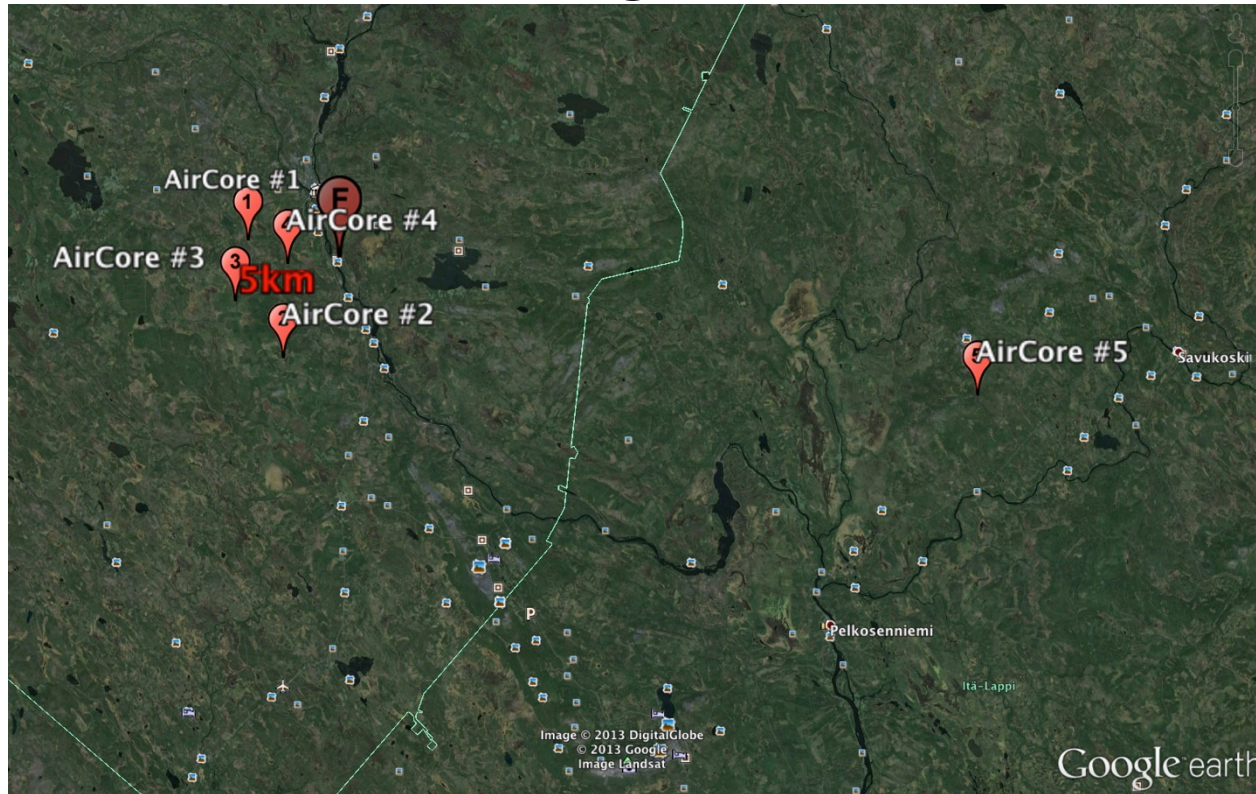
# AirCore campaign September 2013

## Landing sites



# AirCore profiles October 2013

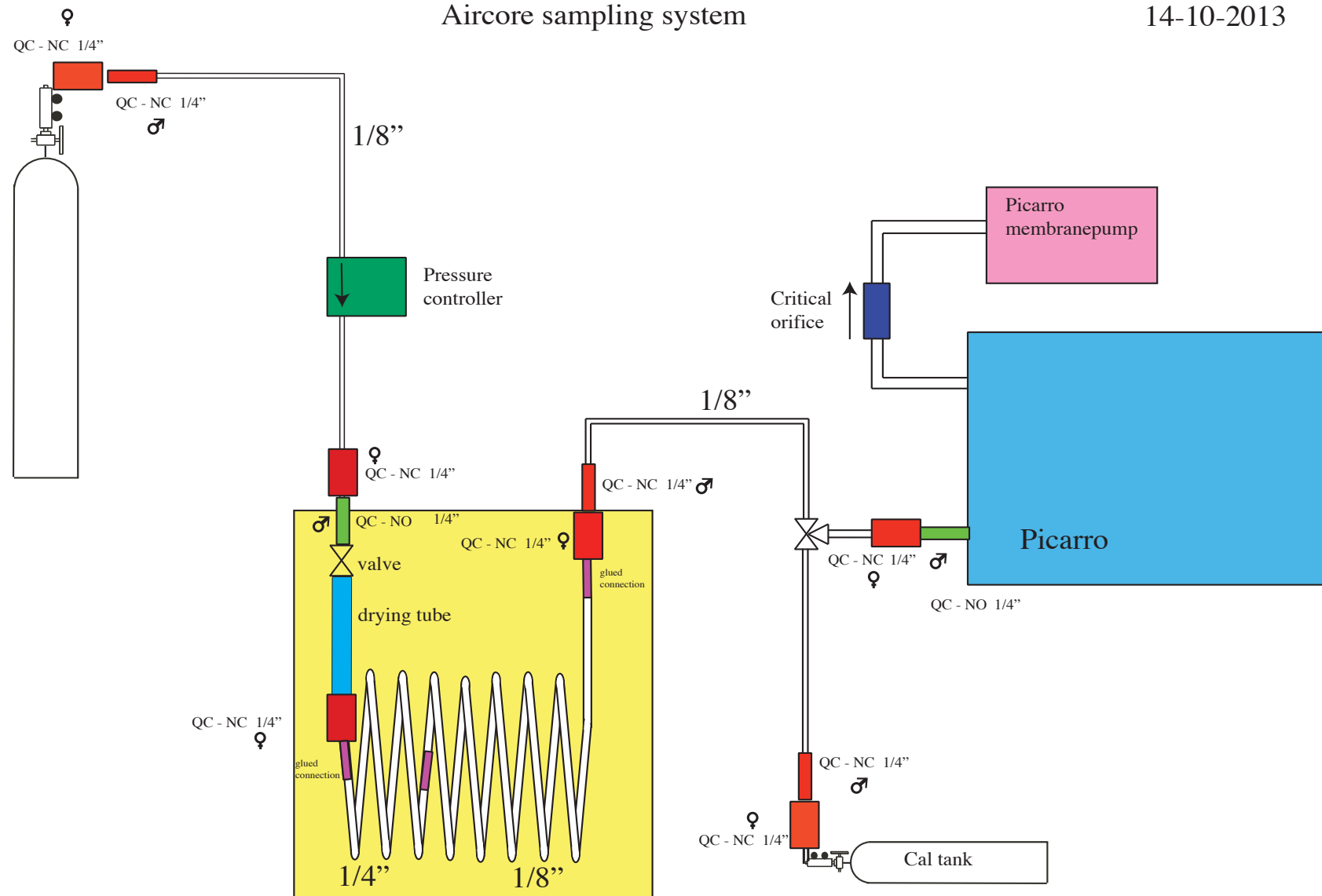
## Landing sites



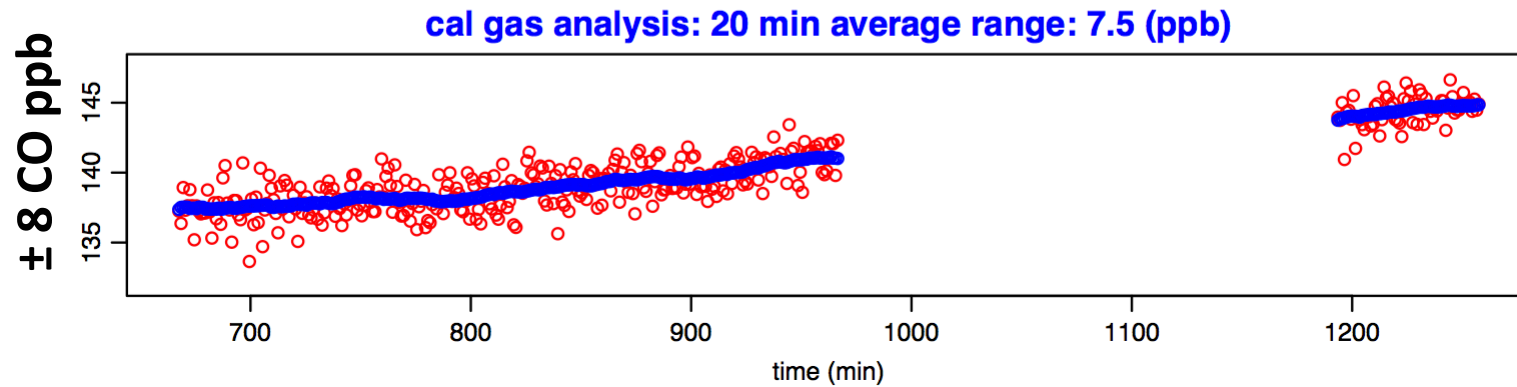
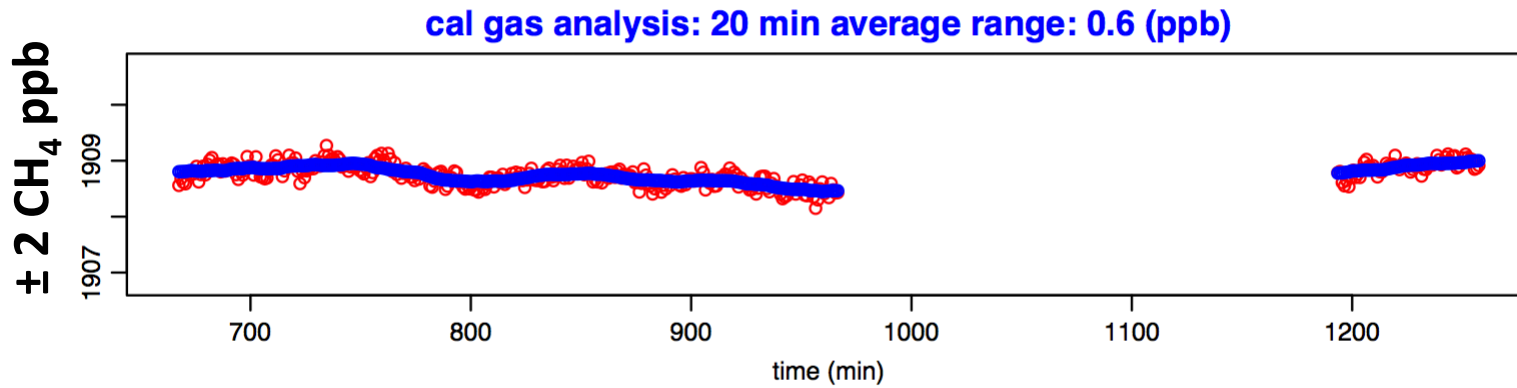
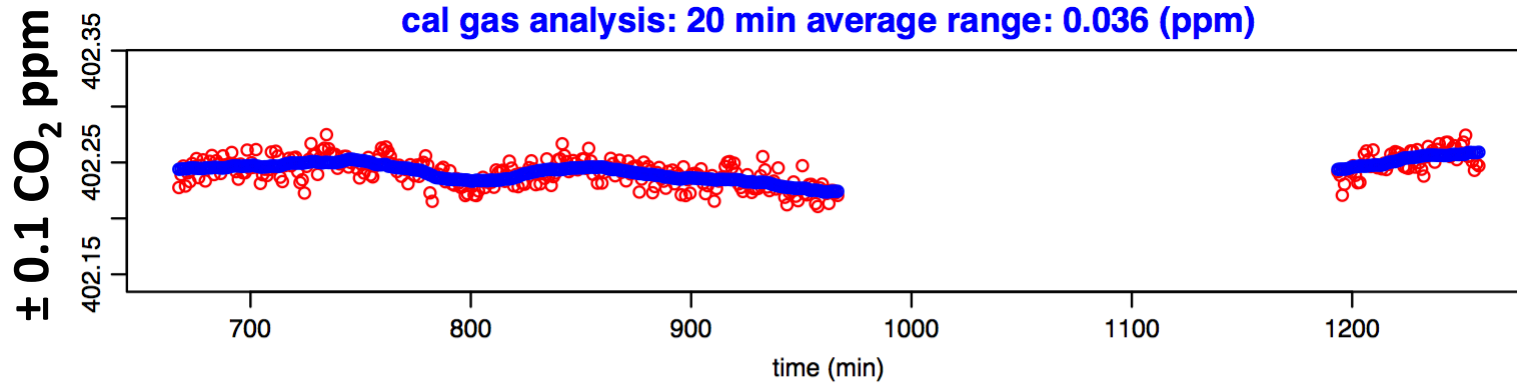
# AirCore Analysis System

Aircore sampling system

14-10-2013



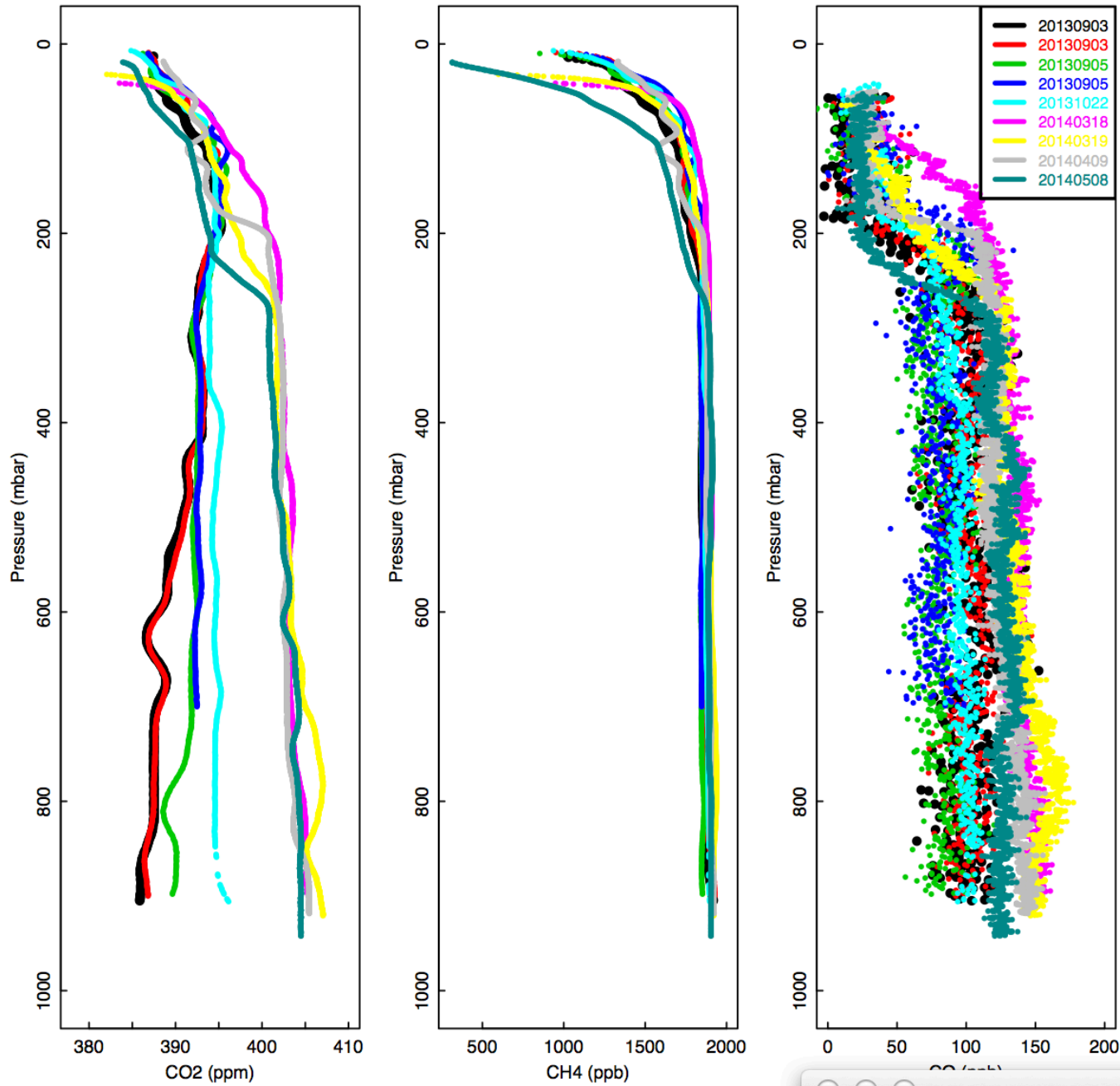
# AirCore Analysis on Picarro



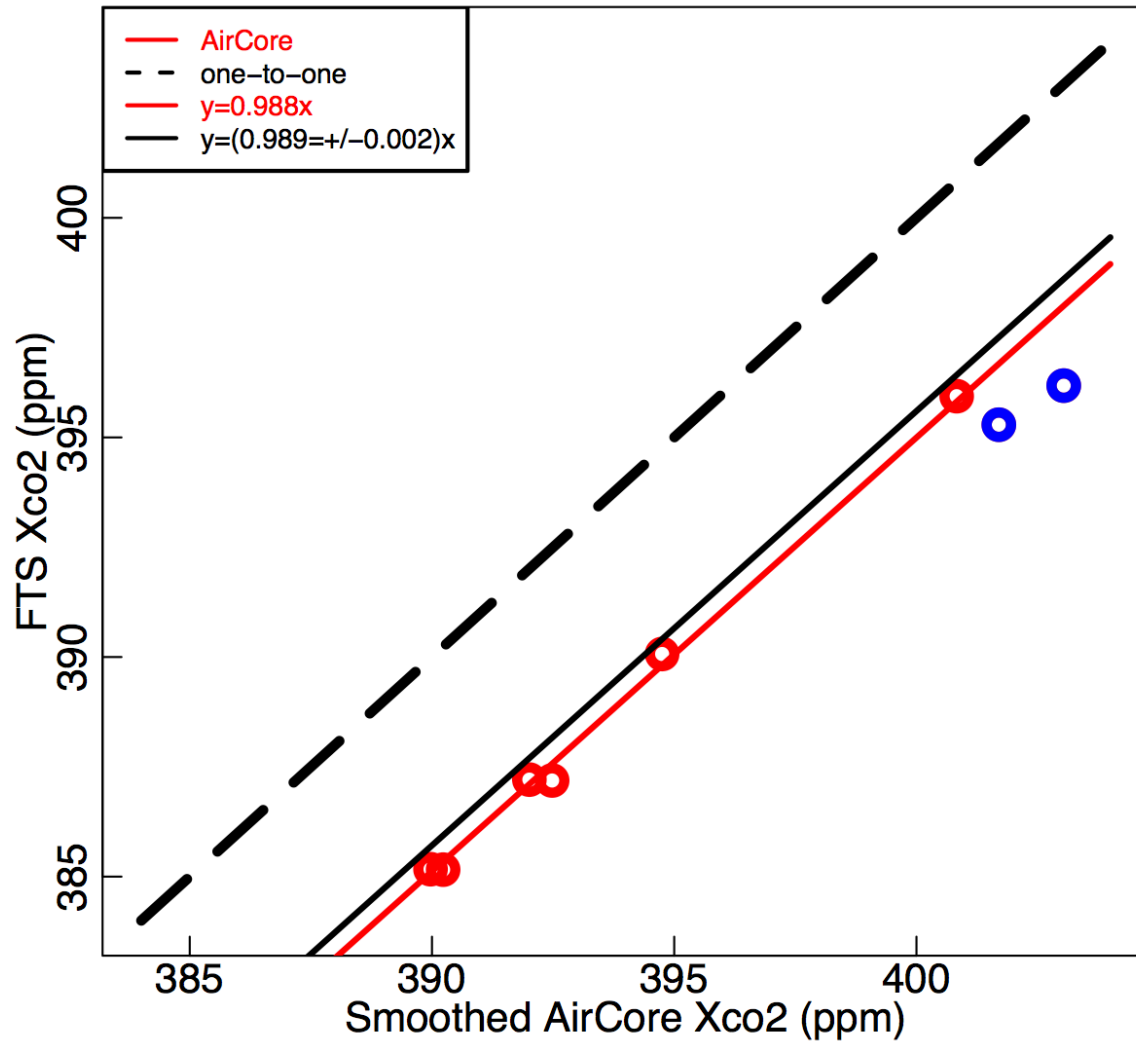
**Time (min)**



# Sodankyla AirCore profiles



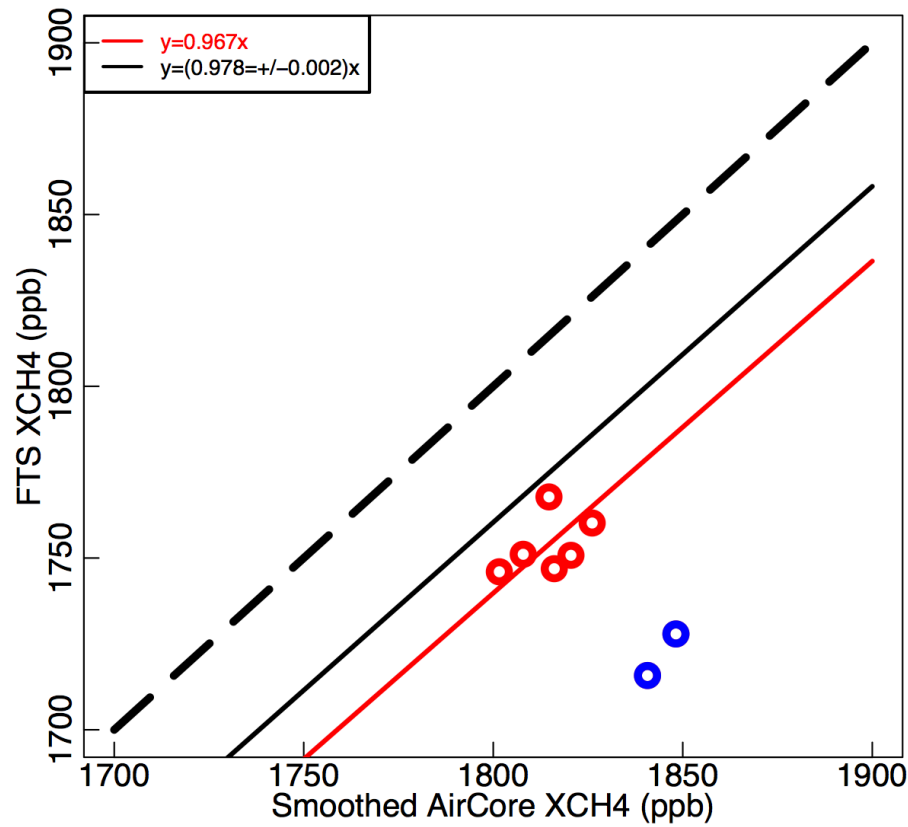
# TCCON validations – CO<sub>2</sub> (preliminary)



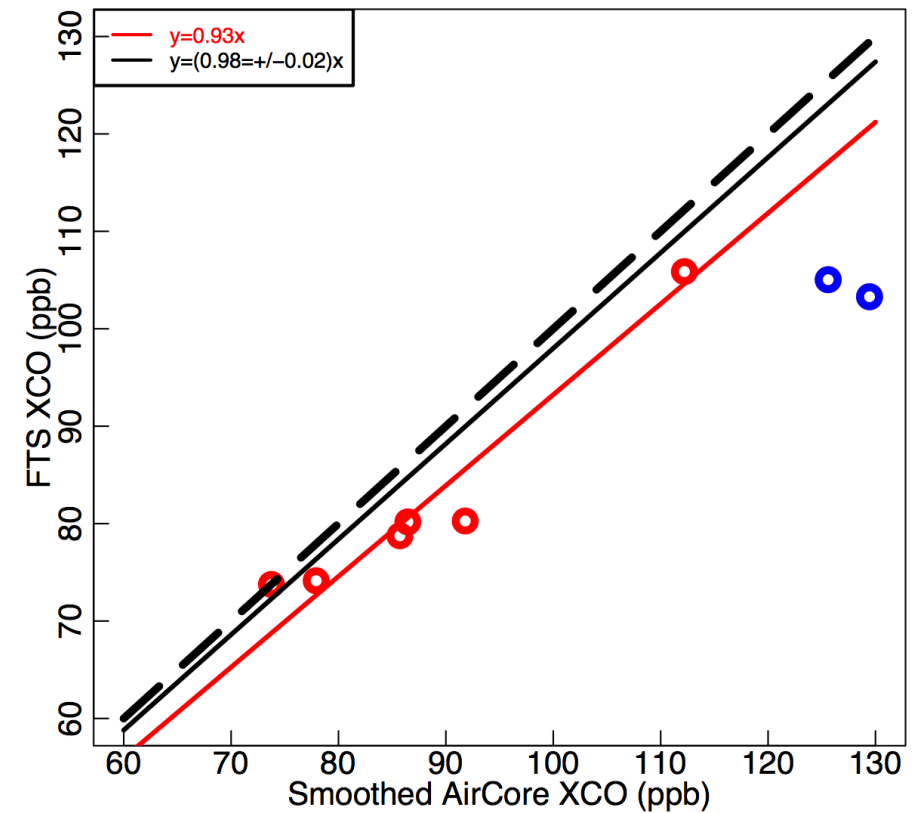
~ 0.1% normal

~ 0.5 % polar vortex

# TCCON validations - CH<sub>4</sub> and CO (preliminary)

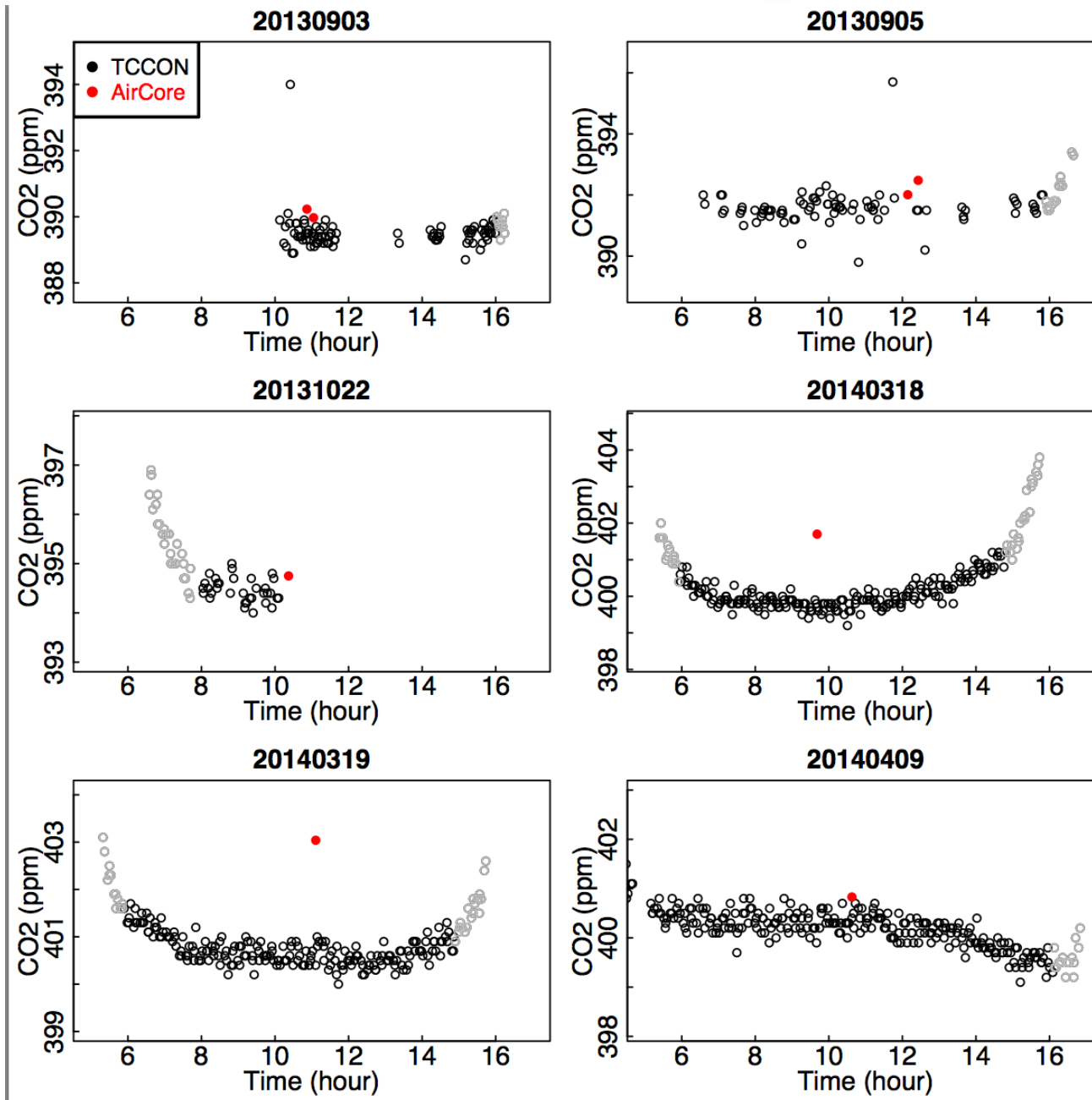


~ 1% normal  
~ 4% polar vortex

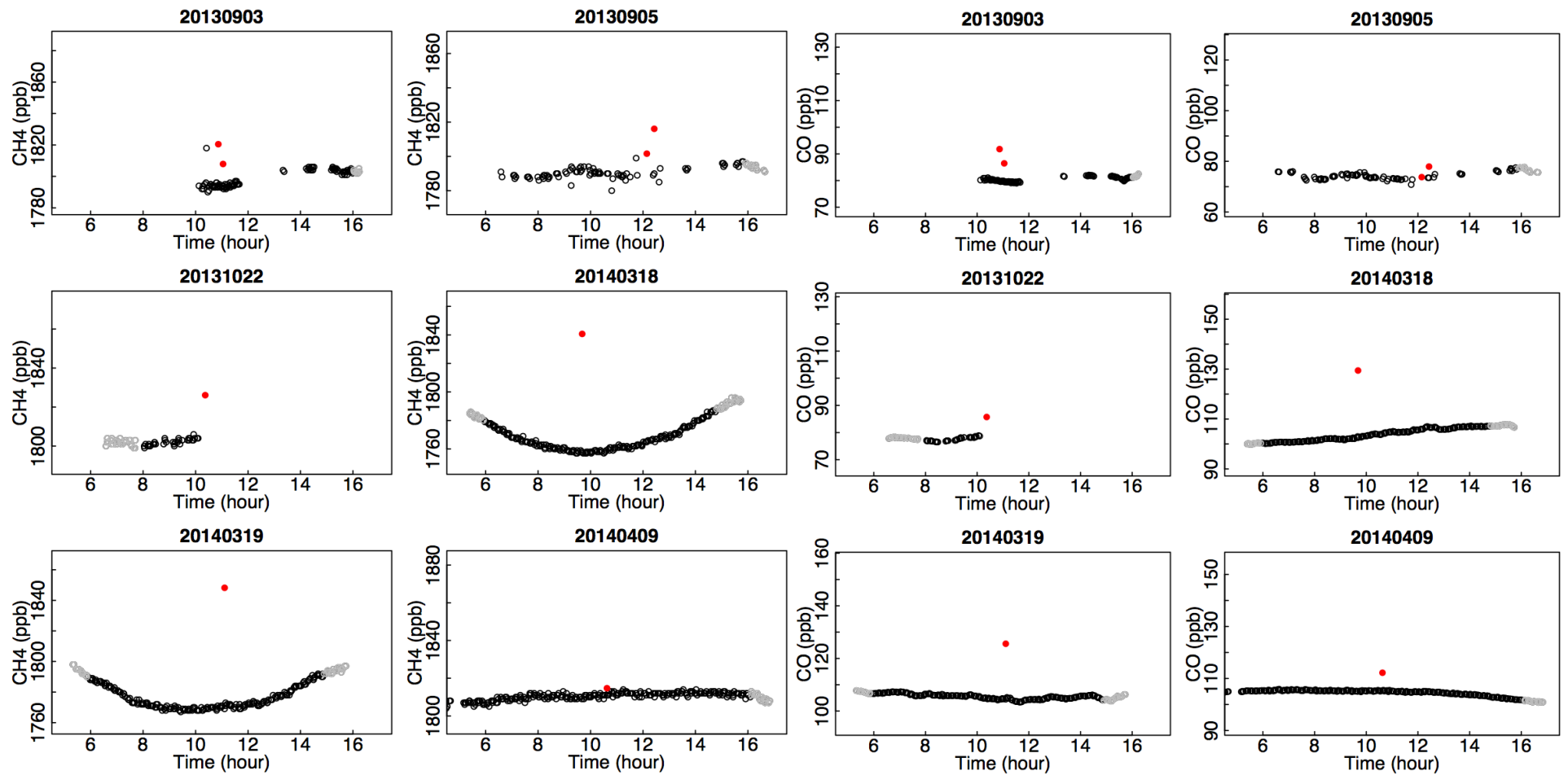


~ 5% normal  
~ 20% polar vortex

# TCCON validations – CO<sub>2</sub> (preliminary)



# TCCON validations - CH<sub>4</sub> and CO (preliminary)



# Conclusions and future work

1. Regular AirCore profiles measurements in Sodankyla, Finland (67° North)
2. Polar vortex measurements: ~0.5% for CO<sub>2</sub>, ~4% for CH<sub>4</sub>, ~20% for CO
3. Technical improvements
  - automatic valve
  - reducing the pressure drop across dryers
  - weight reductions
4. AirCore campaign scheduled in July 2014

Thanks for your attention!