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

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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

<table>
<thead>
<tr>
<th>Sampling platform</th>
<th>Sampling range</th>
<th>Cost ($)</th>
<th>Error in XCO₂</th>
<th>Error in XCH₄</th>
<th>Regular launch?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-aircraft</td>
<td>0 – 4 km</td>
<td>1.5K</td>
<td>1.0 ppm</td>
<td>10 ppb</td>
<td>Yes</td>
</tr>
<tr>
<td>High-aircraft</td>
<td>0 – 12 km</td>
<td>10K</td>
<td>0.50 ppm</td>
<td>6 ppb</td>
<td>NA</td>
</tr>
<tr>
<td>AirCore</td>
<td>0 – 30 km</td>
<td>4.2K</td>
<td>0.10 ppm</td>
<td>2 ppb</td>
<td>Yes</td>
</tr>
</tbody>
</table>
AirCore measurements over Sodankyla

AirCore: 40 m 1/4” + 60 m 1/8”
Coils: 2.8 kg
Total package: 3.6 kg
Analysis: Picarro
CO₂/CH₄/CO/H₂O

TCCON station
Location 67° North
AirCore campaign September 2013

Landing sites
AirCore profiles October 2013

Landing sites
AirCore Analysis on Picarro

- ±0.1 CO₂ ppm
  - Cal gas analysis: 20 min average range: 0.036 (ppm)

- ±2 CH₄ ppb
  - Cal gas analysis: 20 min average range: 0.6 (ppb)

- ±8 CO ppb
  - Cal gas analysis: 20 min average range: 7.5 (ppb)

Time (min)
Sodankyla AirCore profiles
TCCON validations – CO$_2$ (preliminary)

~ 0.1% normal
~ 0.5 % polar vortex
TCCON validations - CH$_4$ and CO (preliminary)

~ 1% normal  
~ 4% polar vortex

~ 5% normal  
~ 20 polar vortex
TCCON validations – CO₂ (preliminary)
TCCON validations - CH$_4$ 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$_2$, ~4% for CH$_4$, ~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!