Airborne measurements of GHG fluxes in subarctic regions

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Sky Arrow ERA

- small, light and high-winged research aircraft (max take-off weight 650 kg) with pushing Bombardier Rotax motor, 2-blade propeller
- used measure airborne fluxes of energy and greenhouse gases
- recently (early 2013) upgraded scientific equipment to meet state-of-the-art standards in current research topics

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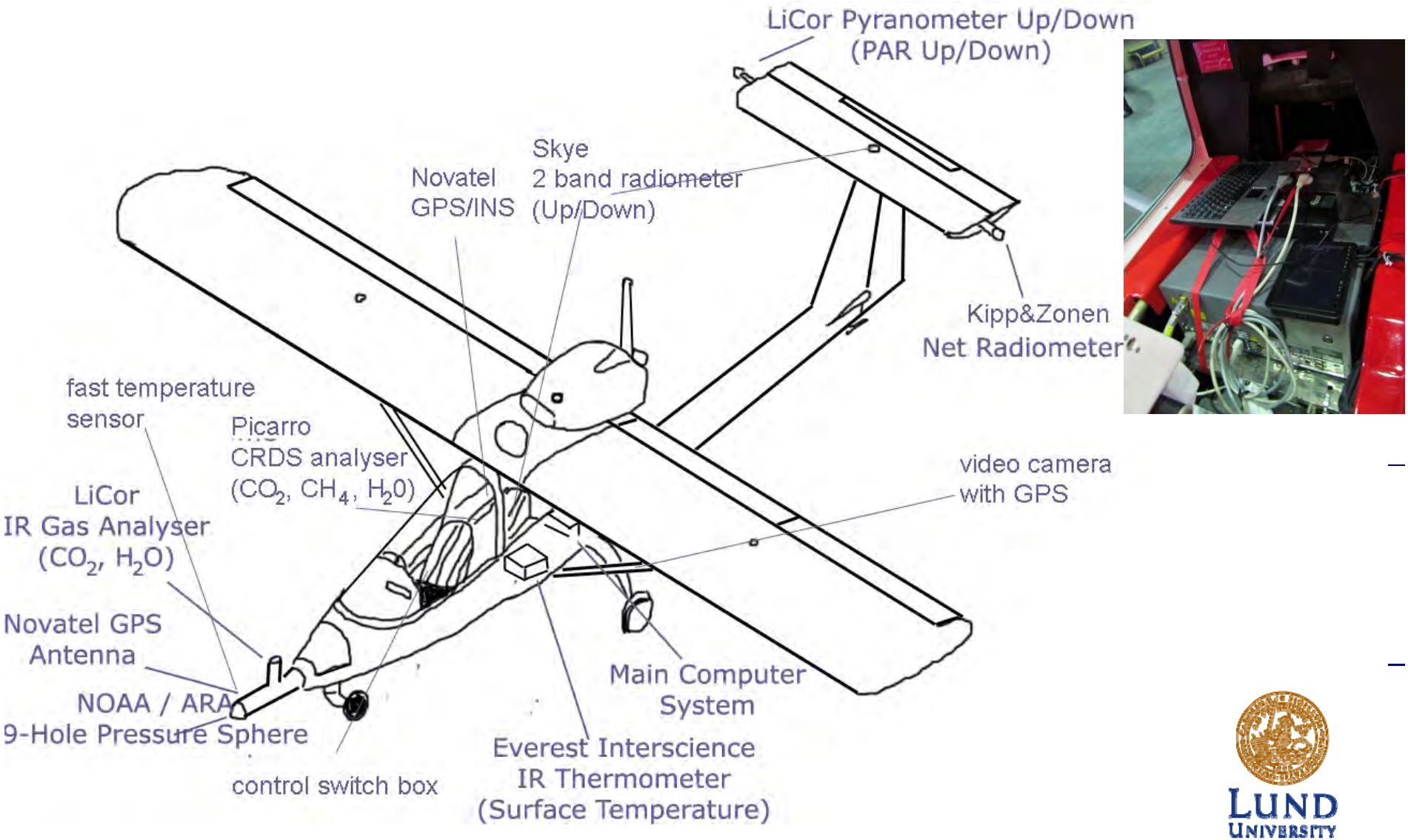
Sky Arrow ERA - instrumentation



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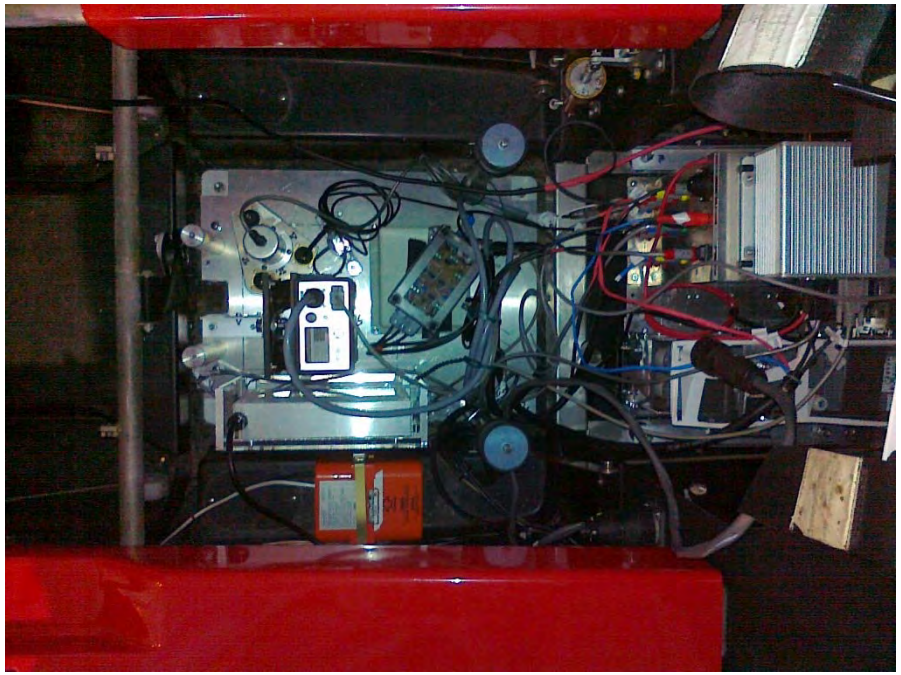

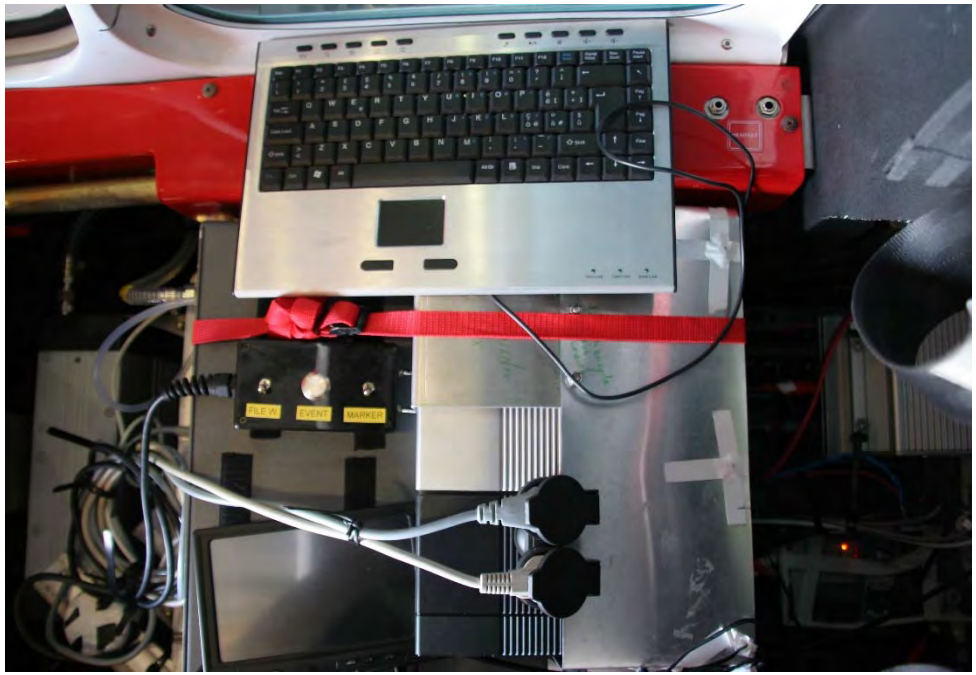

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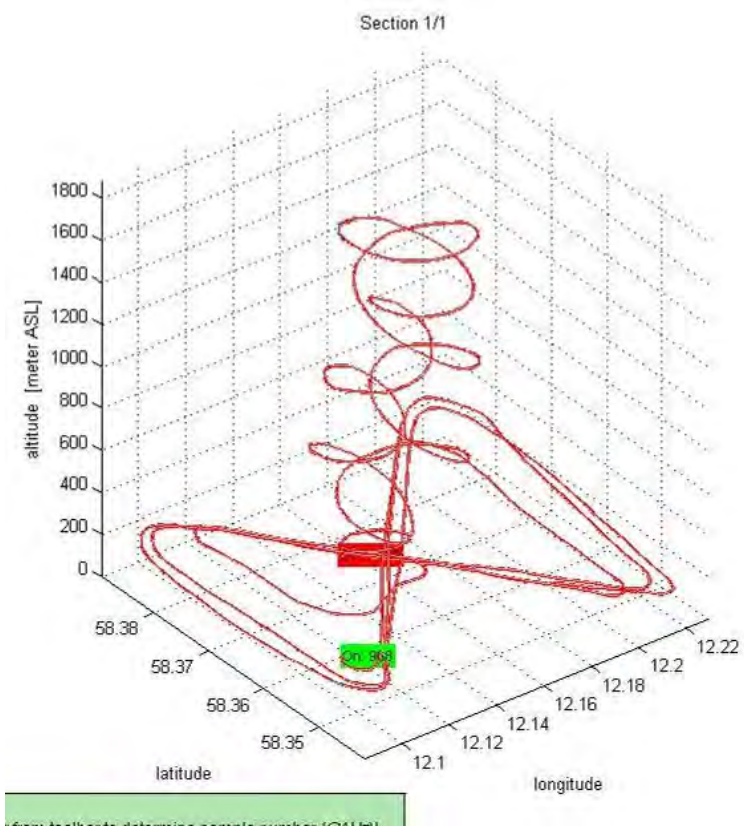
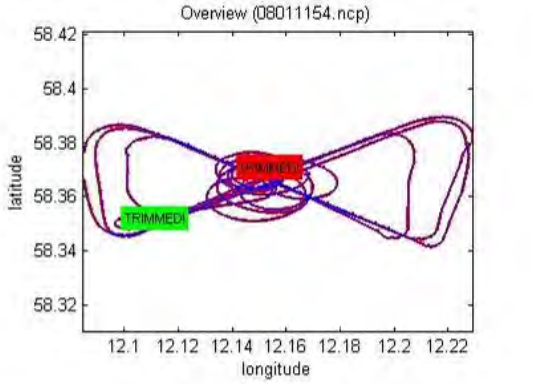
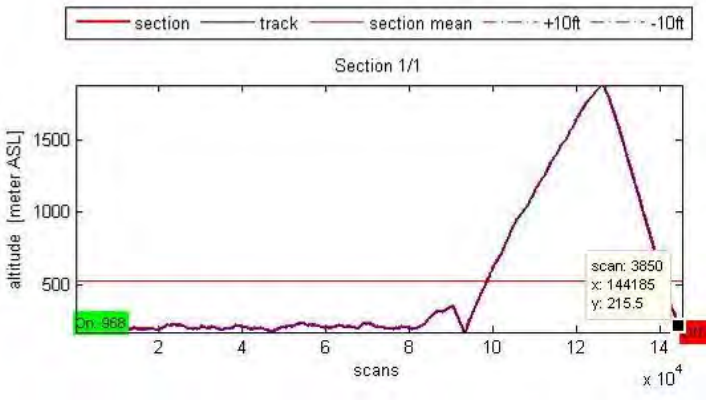
Sky Arrow ERA – flight characteristics

- cruise speed: approx. 85 knts (approx. 150 km/h)
- max research flight duration: approx. 1.5 h
- operating altitudes range: 50 m to 2000 m above ground
- only visual flight







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INGOS TNA3 campaigns

campaign	Date	PI	Target area	Number of research flights
1	08/2013	Allen et al, UK	Subarctic wetlands/SE	7
2	09/2013	Allen et al, UK	Subarctic wetlands/SE	0
3	06/2015	Laurila&Kivi, FI	Subarctic wetlands/FI	3
4	07/2015	Friborg, DK	Subarctic wetlands/SE	6

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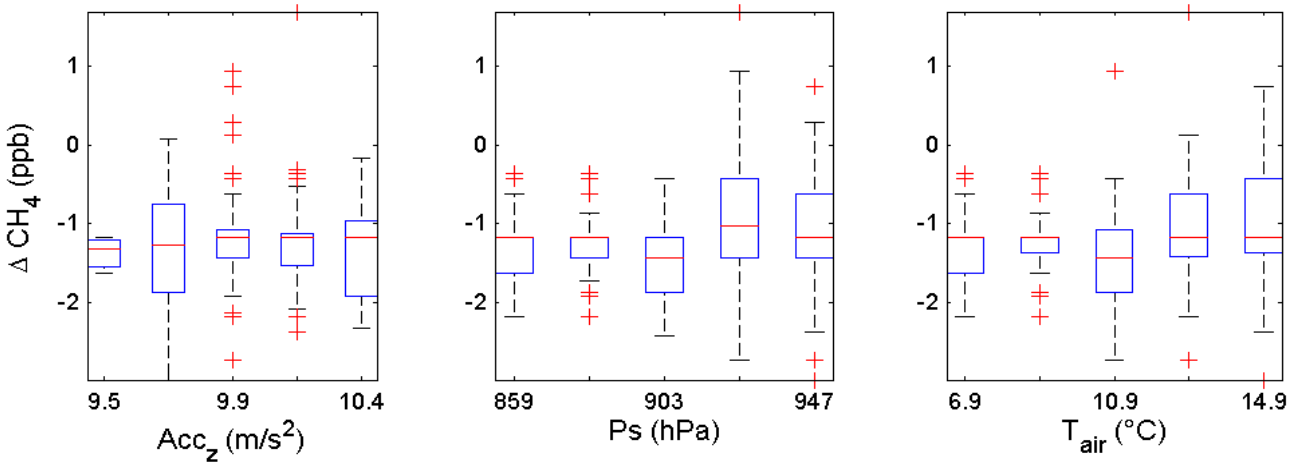
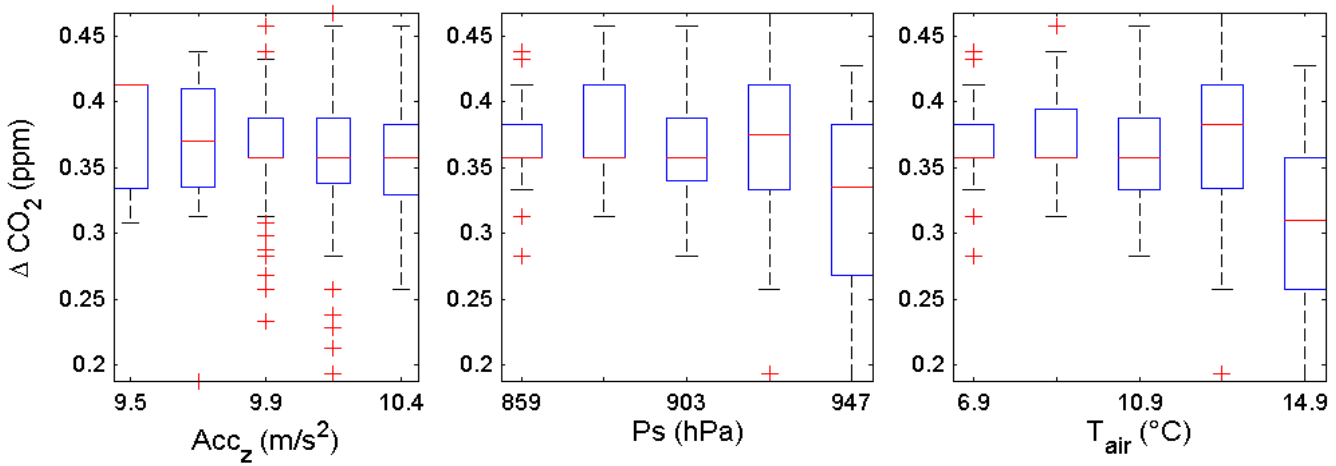
Results: system validation

Kiruna 2013: in-flight target measurements (instrument test)





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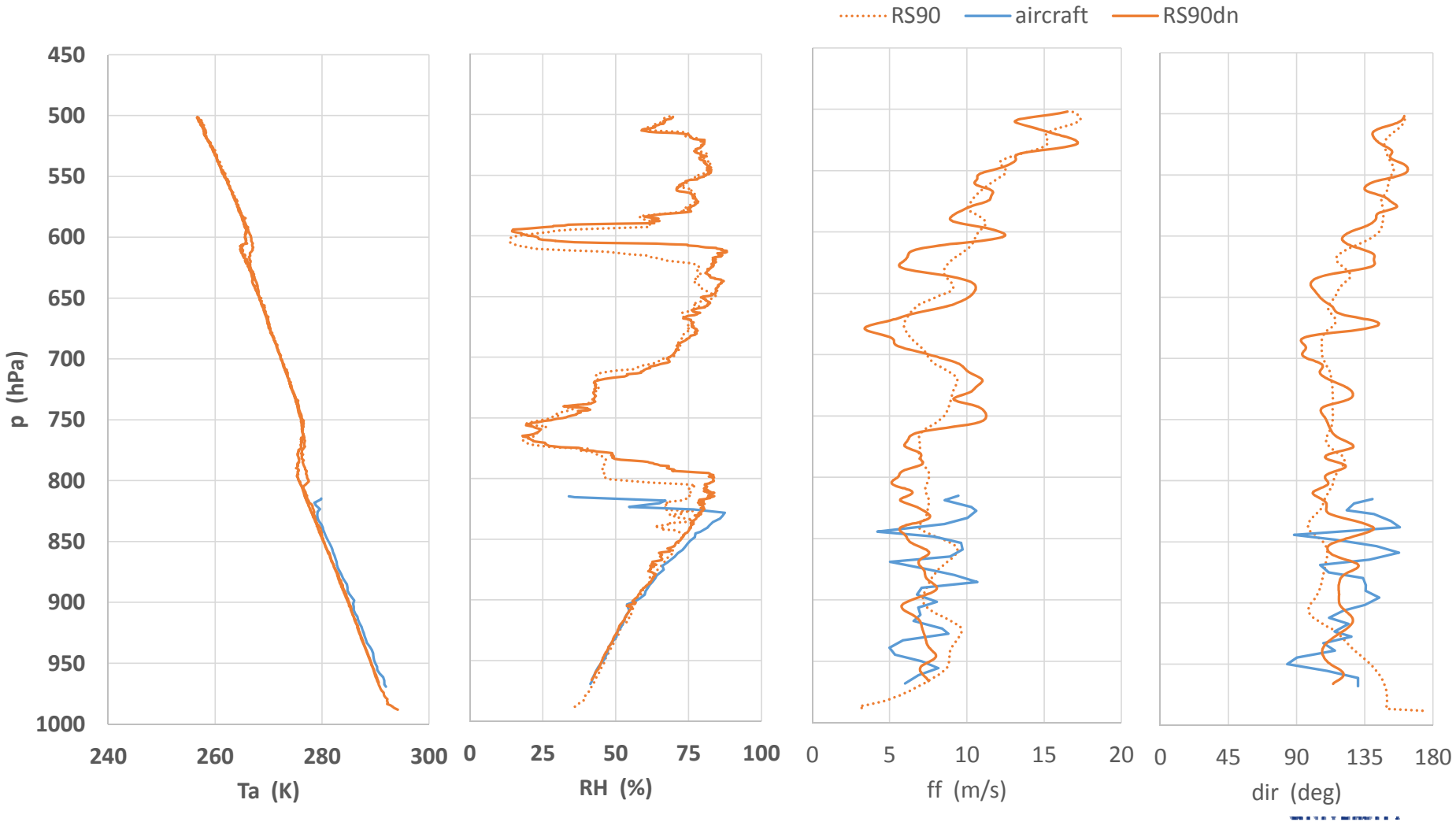
Results: system validation

Sodankylä 2015: comparison radisonde data – aircraft data



Results: Sodankylä campaign

Aim:

(i) Intercomparison of concentration profiles measured with aircraft and AirCore data (session 9 on Thursday: Chen: AirCore, aircraft, and FTS measurement campaign at Sodankylä) – TNA2

(ii) Ecosystem GHG fluxes over subarctic wetlands – TNA3

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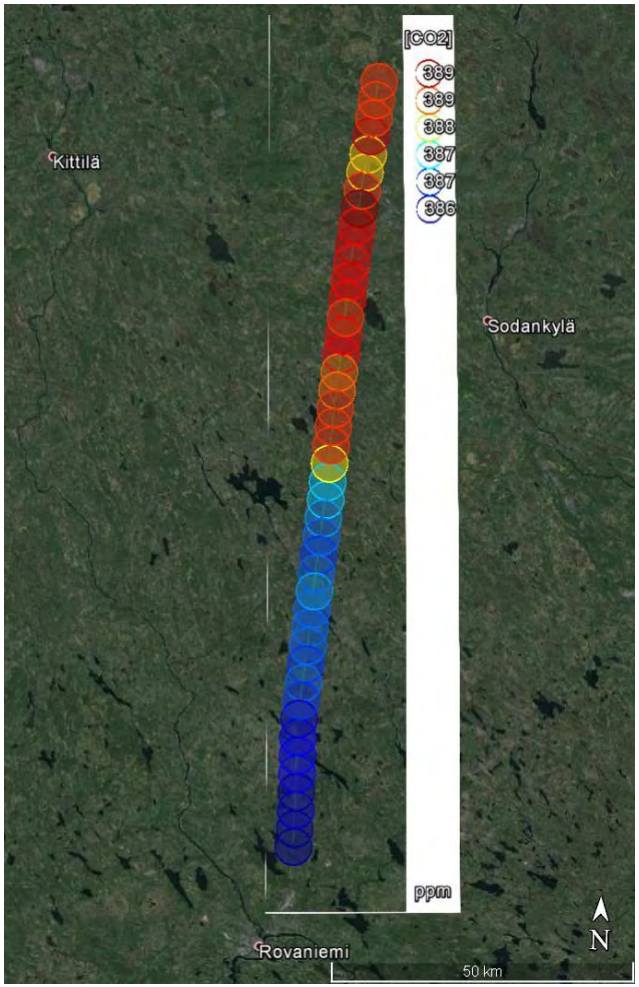
Results: CO_2 concentration and fluxes over Finnish subarctic wetlands

CO_2 concentrations measured during flight No. 2015/2 north of Rovaniemi airport on 23/06/2015.



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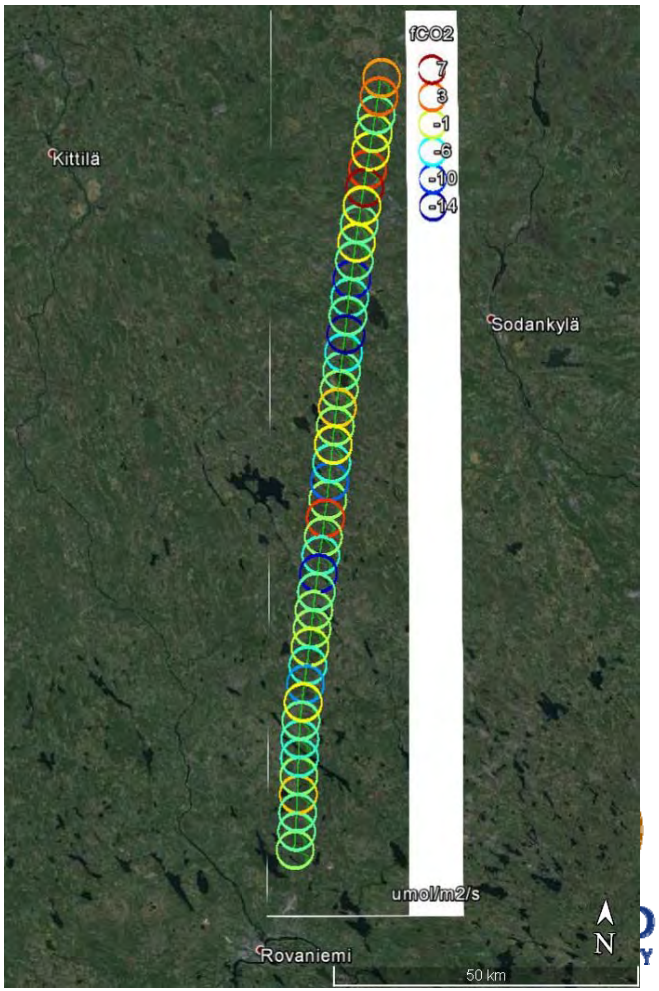

Results: Kiruna campaign 2015

Aim:

(i) GHG fluxes over subarctic wetlands – TNA3

(ii) GHG fluxes over a subarctic lake (lake Torneträsk) – TNA3

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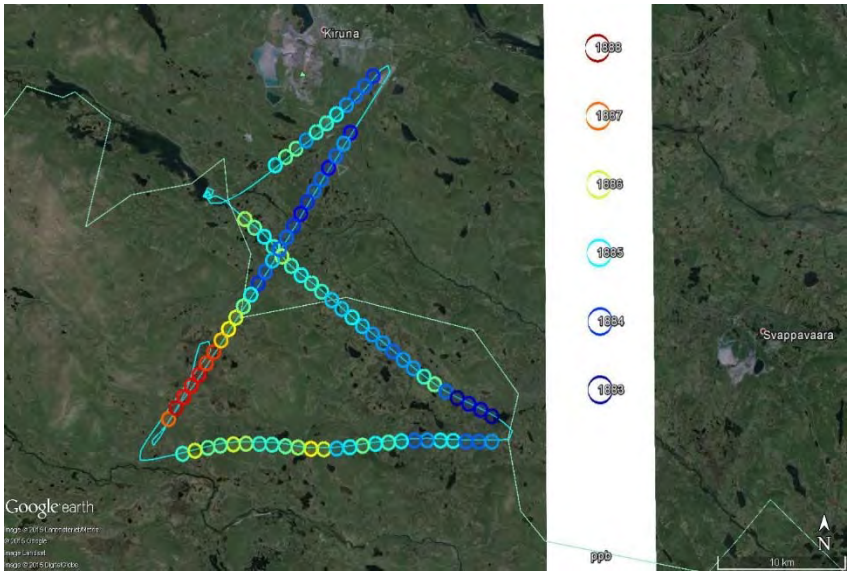
Results: CH_4 concentrations and fluxes over Swedish subarctic wetlands



CH_4 concentrations measured during flight No. 2015/9 south of Kiruna airport on 13/07/2015.

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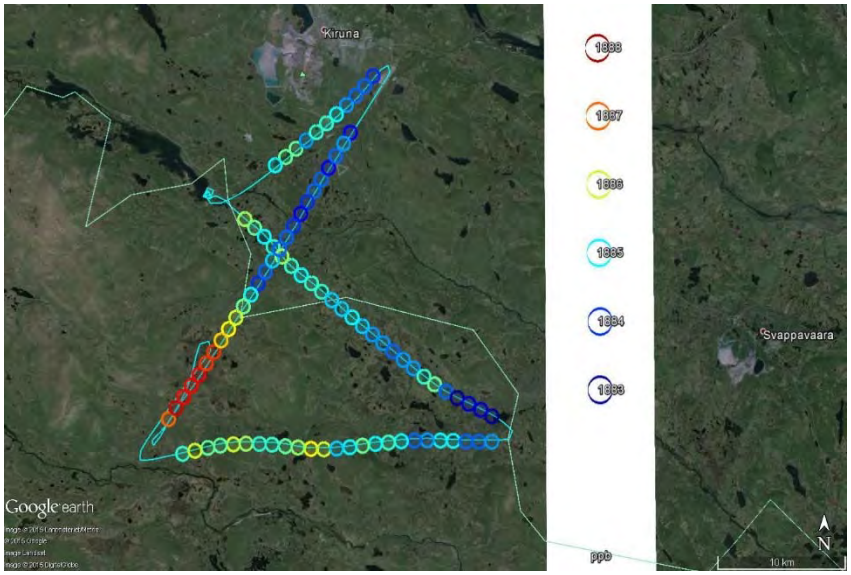
Results: CH_4 concentrations and fluxes over Swedish subarctic wetlands



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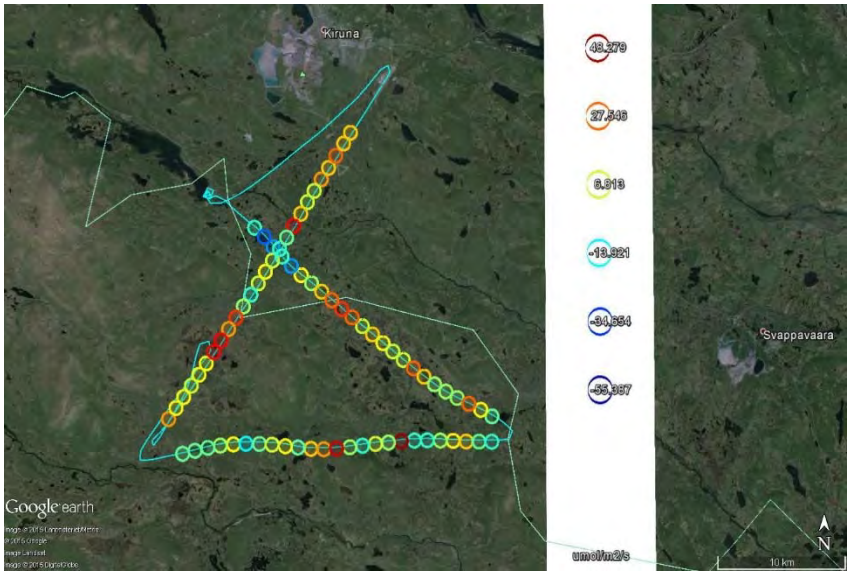

Preliminary results of CH_4 flux calculated from flight No. 2015/9 south of Kiruna airport on 13/07/2015.

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Results: CH_4 fluxes over Swedish subarctic wetlands

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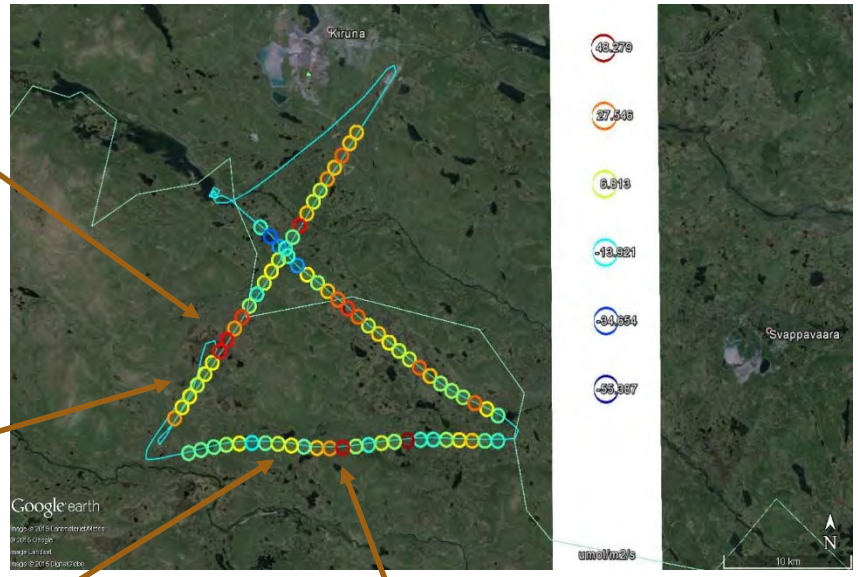

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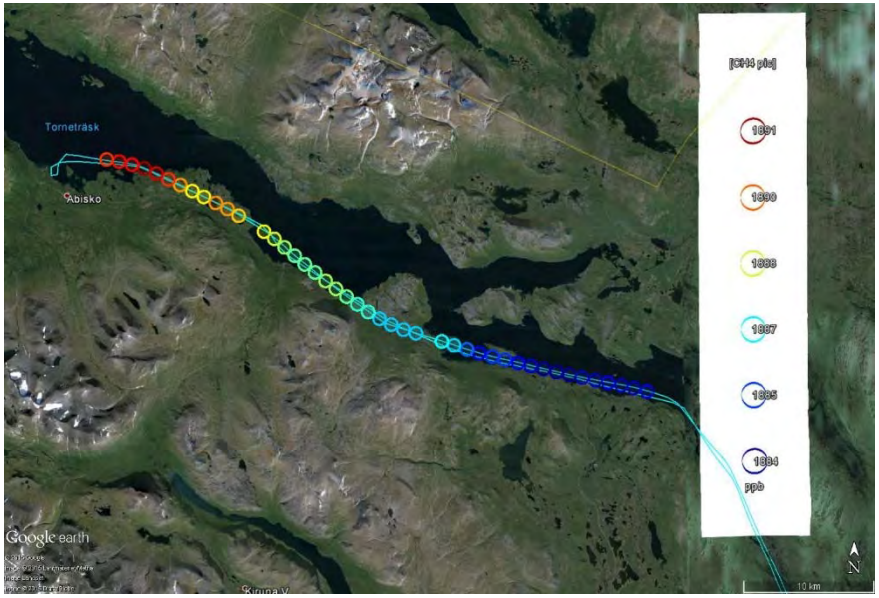
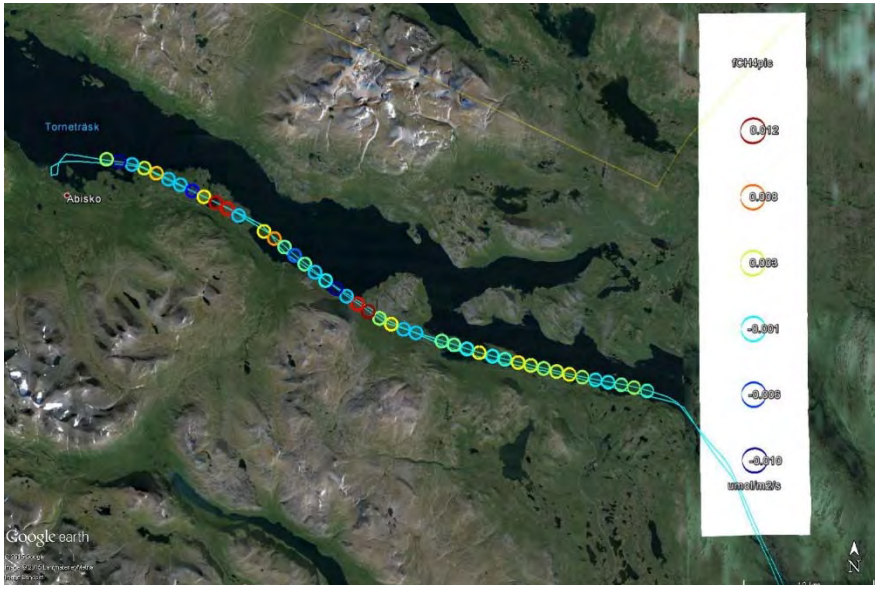
Results: CH_4 concentrations and fluxes over lake Torneträsk



CH_4 concentrations measured during flight No. 2015/7 over lake Torneträsk and the Abisko-Stordalen mire on 13/07/2015.



CH_4 fluxes measured during flight No. 2015/7 over lake Torneträsk and the Abisko-Stordalen mire on 13/07/2015.

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to summarize….

- 16 research flights were performed within INGOS

- System validation

  → high accuracy of Picarro in-flight HF concentration measurements (IF it is working)

  → comparison with radiosonde, esp. wind

- GHG flux analyses started, more work to do in regionalization of the fluxes

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Thank you for your attention!

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