

Status labelling of Birkenes Observatory

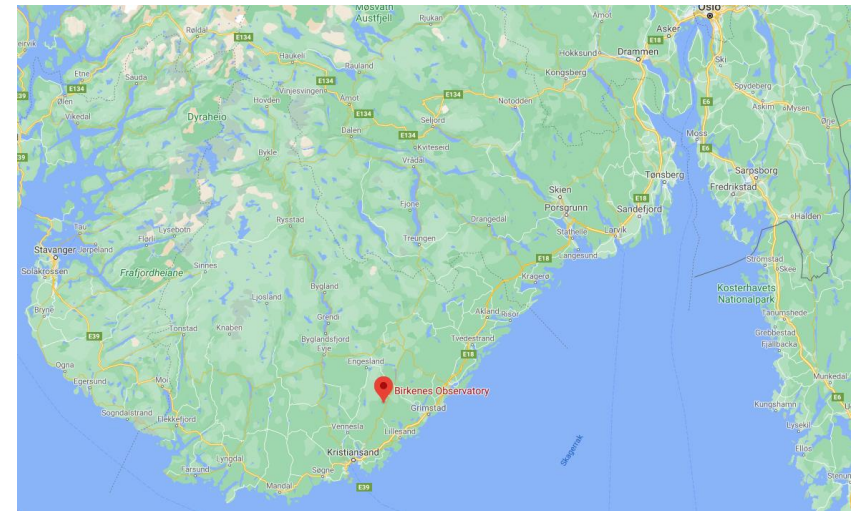
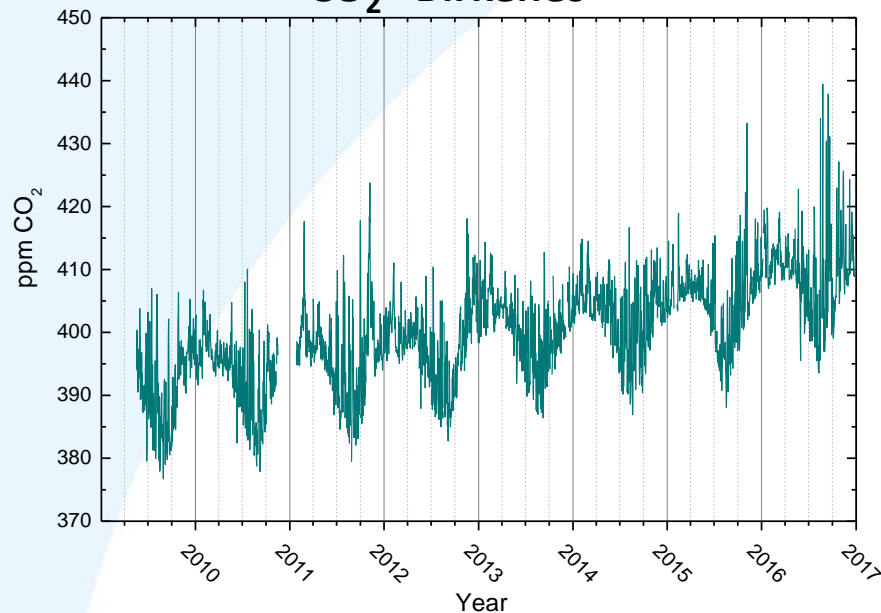
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Comprehensive measurement programme ongoing

- **CO₂ and CH₄** from 2009 (continuous measurements)
- Aerosol mass (PM₁₀ and PM_{2.5}) and all essential optical and physical properties of aerosols since 2010
- POPs (Environmental toxics) since 1992
- Tropospheric O₃ since 1984
- SO₂, NO₂, HNO₃, NH₃, in both air and precipitation since mid-1970's



CO₂ - Birkenes



Extension and development of Birkenes and Zeppelin to comply with ICOS requirements

ICOS Norway – Atmosphere will

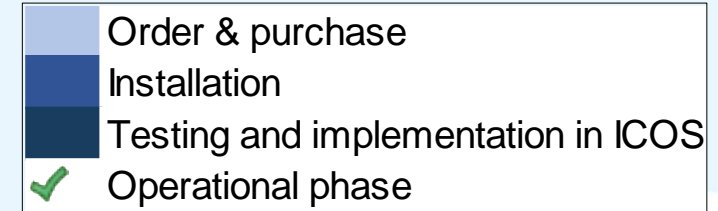
- 1) Upgrade Zeppelin to ICOS Class 1 and Birkenes to ICOS class 2 sites, comply with the ICOS quality assurance and quality control
- 2) Set up of data flow to the Atmospheric Thematic Centre (ATC) and Carbon Portal

Category	Gases, continuous	Gases, periodical	Meteorology, continuous	Eddy Fluxes
Class 1 Mandatory parameters	<ul style="list-style-type: none"> • CO₂, CH₄, CO : at each sampling height 	<ul style="list-style-type: none"> • CO₂, CH₄, N₂O, SF₆, CO, H₂, ¹³C and ¹⁸O in CO₂: weekly sampled at highest sampling height • ¹⁴C (radiocarbon integrated samples): at highest sampling height 	<ul style="list-style-type: none"> • Air temperature, relative humidity, wind direction, wind speed: at highest and lowest sampling height* • Atmospheric Pressure • Planetary Boundary Layer Height** 	
Class 2 Mandatory parameters	<ul style="list-style-type: none"> • CO₂, CH₄ : at each sampling height 		<ul style="list-style-type: none"> • Air temperature, relative humidity, wind direction, wind speed: at highest and lowest sampling height* • Atmospheric Pressure 	
Recommended parameters***	<ul style="list-style-type: none"> • ²²²Rn, N₂O, O₂/N₂ ratio • CO for Class 2 stations 	<ul style="list-style-type: none"> • CH₄ stable isotopes, O₂/N₂ ratio for Class 1 stations: weekly sampled at highest sampling height 		<ul style="list-style-type: none"> • CO₂ : at one sampling height

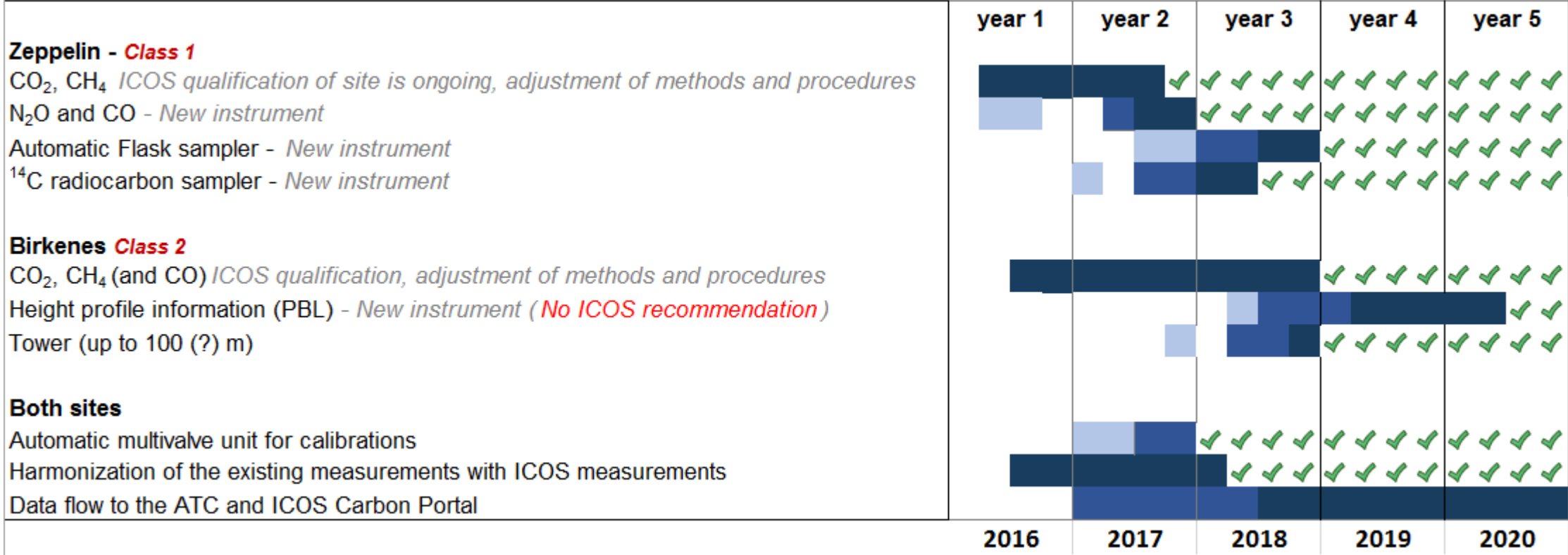
* Atmospheric temperature and relative humidity recommended at all sampling heights
 ** Only required for continental stations.
 *** Recommended for its scientific value but support from ATC in terms of protocols, data base, spare analyzer will not be ensured as long as the parameters are not mandatory.

The main atmospheric work is related to

- ✓ Replacement of instrumentations (e.g. upgrade analyser at Birkenes to measure CO₂, CH₄, CO)
- ✓ Add new instruments (e.g. automatic flask sampler at Zeppelin)
- ✓ Calibration equipment and new procedures
- ✓ Build a tower for air inlet at various heights at Birkenes to have measurements above the boundary layer
- ✓ Set up data flow to ATC
- ✓ Implement ICOS data quality control procedures



Upgrade of the Birkenes and Zeppelin Observatories to ICOS sites



Category	Gases, continuous	Gases, periodical	Meteorology, continuous	Eddy Fluxes
Class 1 Mandatory parameters	<ul style="list-style-type: none"> CO₂, CH₄, CO : at each sampling height 	<ul style="list-style-type: none"> CO₂, CH₄, N₂O, SF₆, CO, H₂, ¹³C and ¹⁸O in CO₂: weekly sampled at highest sampling height ¹⁴C (radiocarbon integrated samples): at highest sampling height 	<ul style="list-style-type: none"> Air temperature, relative humidity, wind direction, wind speed: at highest and lowest sampling height* Atmospheric Pressure Planetary Boundary Layer Height** 	
Class 2 Mandatory parameters	<ul style="list-style-type: none"> CO₂, CH₄ : at each sampling height 		<ul style="list-style-type: none"> Air temperature, relative humidity, wind direction, wind speed: at highest and lowest sampling height* Atmospheric Pressure 	
Recommended parameters***	<ul style="list-style-type: none"> ²²²Rn, N₂O, O₂/N₂ ratio CO for Class 2 stations 	<ul style="list-style-type: none"> CH₄ stable isotopes, O₂/N₂ ratio for Class 1 stations: weekly sampled at highest sampling height 		<ul style="list-style-type: none"> CO₂ : at one sampling height

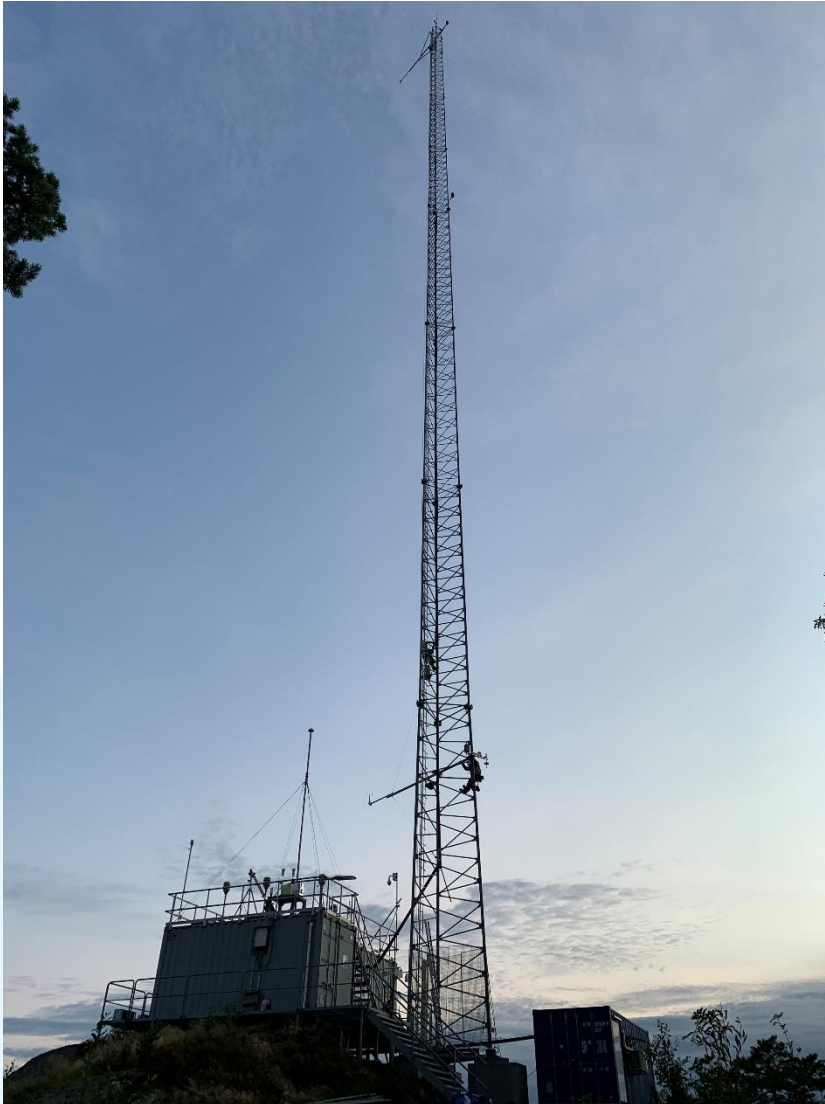
* Atmospheric temperature and relative humidity recommended at all sampling heights
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Zeppelin (ICOS Class 1): Labelled May 2018

- ✓ CO₂, CH₄, CO cont. measurements
- ✓ CO₂, CH₄, CO analyser checked at ATC
- ✓ ¹⁴C radiocarbon
- ✓ Meteorology (Air temp, rel.hum., wind dir, wind speed, atm. pressure)
- ✓ Weekly flask samples (automatic sampler) **New**

Birkenes (ICOS Class 2):

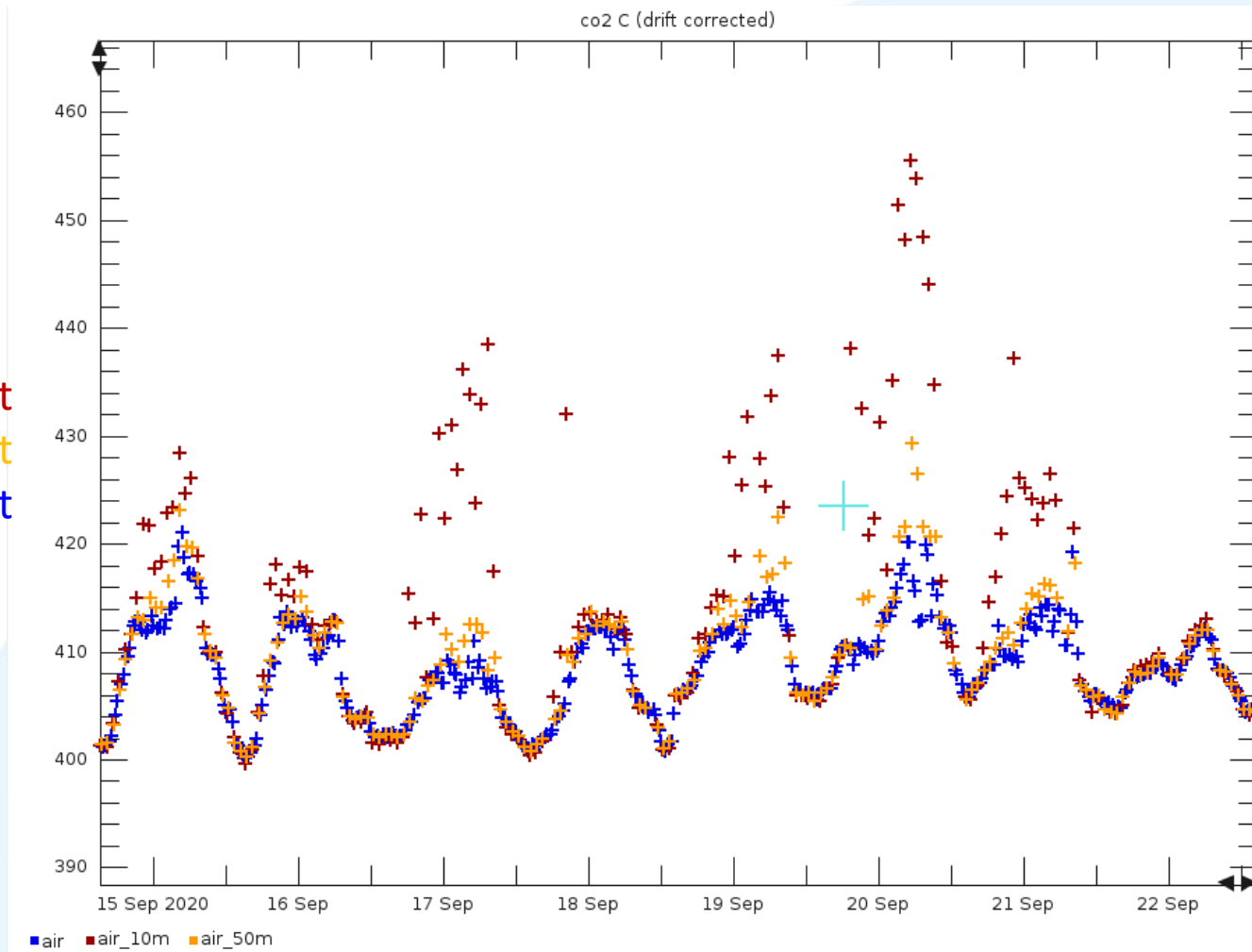
- ✓ CO₂, CH₄ and CO cont. measurements
- ✓ CO₂, CH₄, CO analyser checked at ATC
- ✓ Meteorology (Air temp, rel.hum., wind dir, wind speed, atm. pressure)
- ✓ Sampling mast (75m) **New**



- 75m sampling mast installed end of August
- Sample inlets and met. sensors at 10m, 50m and 75m
- Data flow to ICOS ATC since 14.Sep

The first measurements in the mast at three levels

+ = 10m inlet
+ = 50m inlet
+ = 75m inlet



- Differences in the night-time CO₂ concentrations at 10m, 50m and 75m
- ⇒ Installation of the mast has been successful
- Most probably labelled in the next labelling session in March-April 2021