NOx data submission
- What is new in 2024

ACTRIS CiGas workshop, February 8. 2024, Online

Yong Lin, Markus Fiebig and Paul Eckhardt

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Outline

- General information about EBAS data reporting
- New in the NOx data submission in 2024
    - Data levels
    - Templates (flags)
    - Workflow
    - Key metadata

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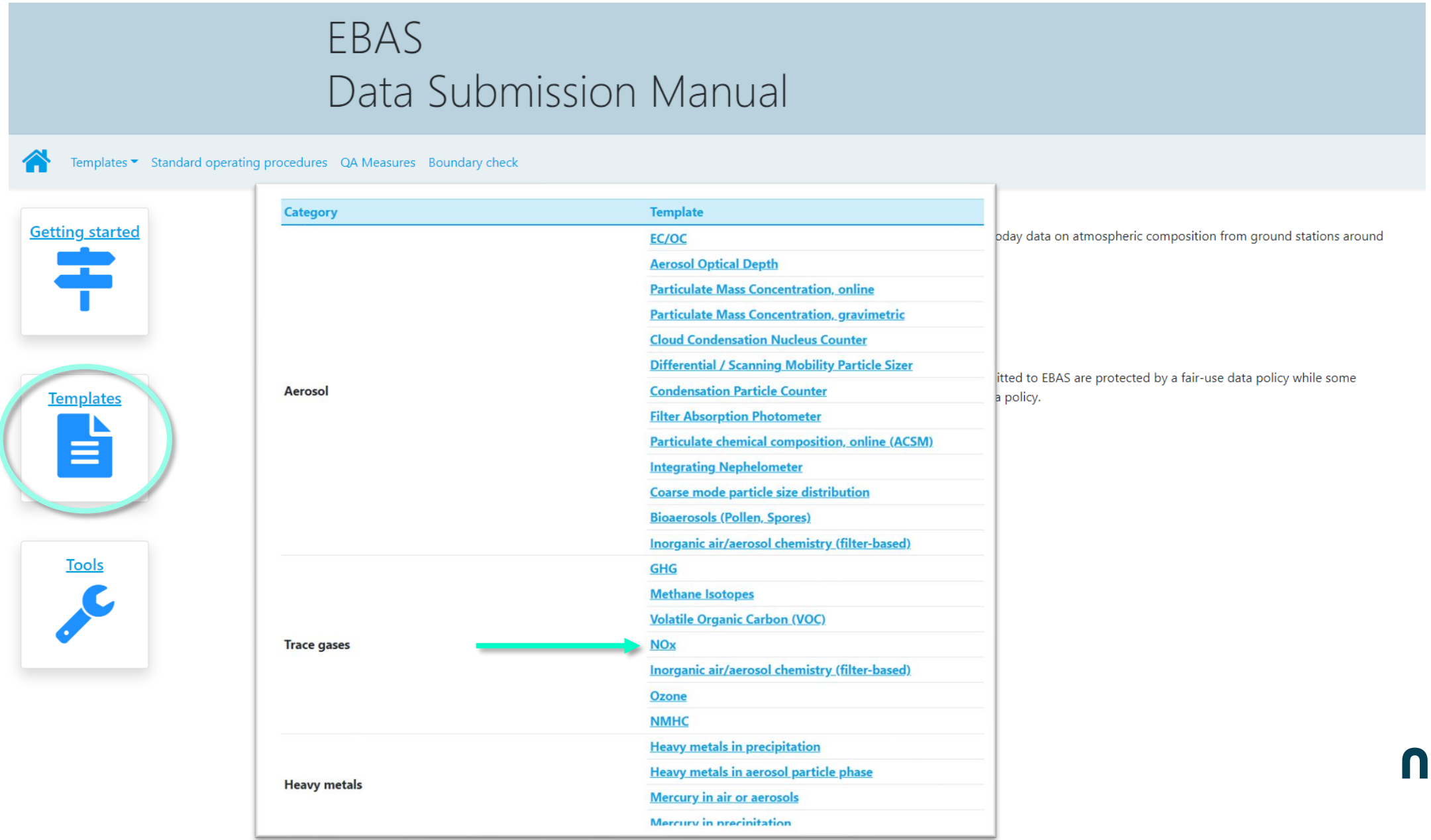
EBAS Data Submission Manual

https://ebas-submit.nilu.no/



Data Format

- EBAS NASA Ames 1001 (ASCII text)

Data levels

Data Level	Desc
0	
1	
1.5	
2	

NOx implementation of ACTRIS In Situ data levels

NEW

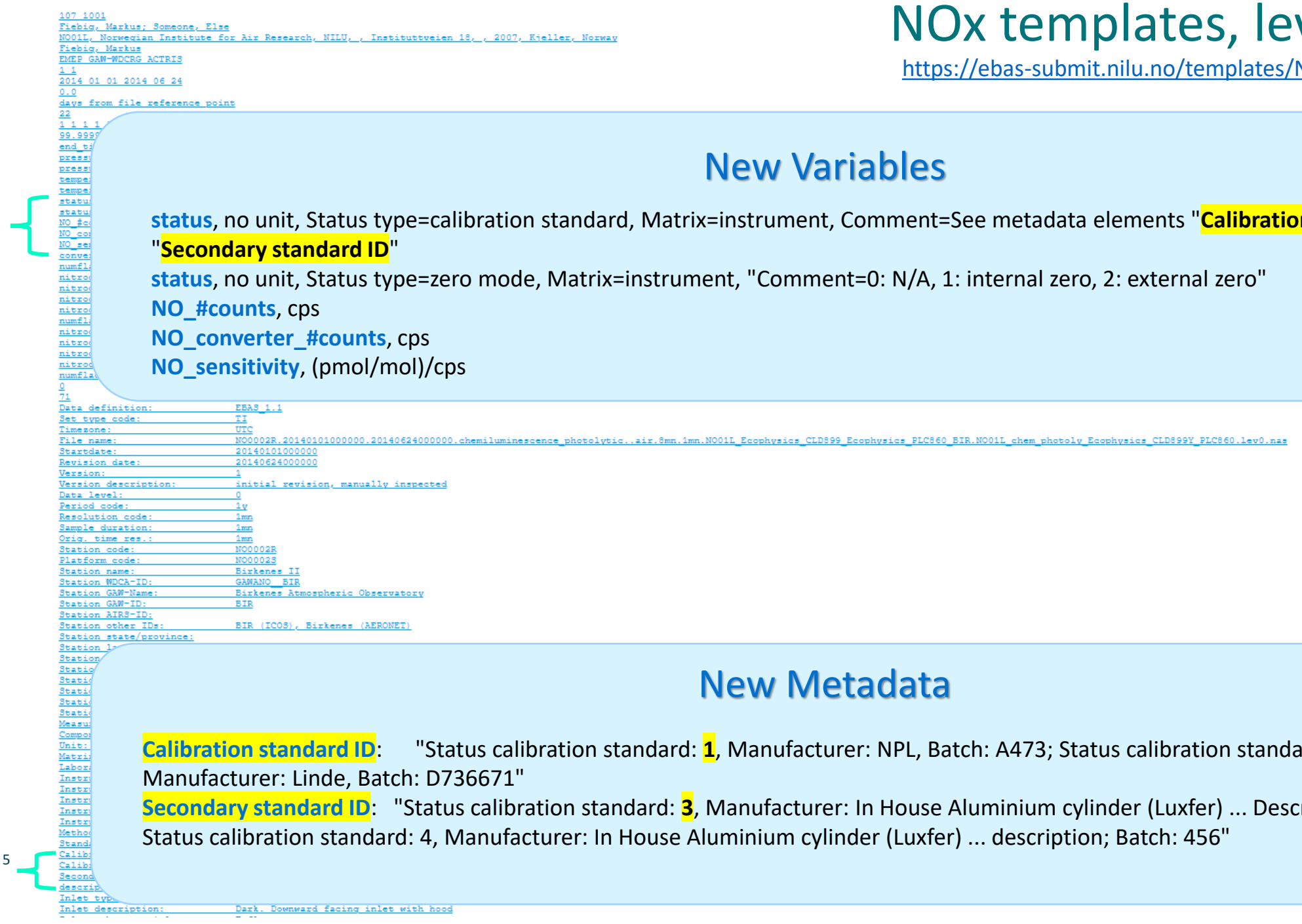
Level 0: data as provided by instrument, amount fraction and raw counts, flags applied.
Level 1: calibrations applied, original time resolution, flags applied
Level 2: hourly averages, offset correction applied, **not sample line corrected**.
Level 3: generated directly from level 1, hourly averages, offset correction applied, **sample line corrected**.

ACTRIS NOx data submission requirements

- **NOx**: lev 0, lev 1
- **Ozone**: lev 1
- **Meteorology**: lev 0, lev2

NOx templates, level 0

https://ebas-submit.nilu.no/templates/NOx/lev0



New Variables

status, no unit, Status type=calibration standard, Matrix=instrument, Comment=See metadata elements "**Calibration standard ID**" and "**Secondary standard ID**"

status, no unit, Status type=zero mode, Matrix=instrument, "Comment=0: N/A, 1: internal zero, 2: external zero"

NO_#counts, cps

NO_converter_#counts, cps

NO_sensitivity, (pmol/mol)/cps

New Metadata

Calibration standard ID: "Status calibration standard: **1**, Manufacturer: NPL, Batch: A473; Status calibration standard: 2, Manufacturer: Linde, Batch: D736671"

Secondary standard ID: "Status calibration standard: **3**, Manufacturer: In House Aluminium cylinder (Luxfer) ... Description, Batch: 123; Status calibration standard: 4, Manufacturer: In House Aluminium cylinder (Luxfer) ... description; Batch: 456"

NOx templates, level 0

Group 0: Valid data		
Flag	**Validity**	**Description**
000	V	valid data, no flag
Group 1: Exception flags for accepted, irregular data		
Flag	**Validity**	**Description**
147	V	Below theoretical detection limit or formal Q/A limit, but a value has been measured and reported and is considered valid
Group 5: Chemical problem		
Flag	**Validity**	**Description**
559	V	Unspecified contamination or local influence, but considered valid
Group 6: Mechanical or instrumental problem		
Flag	**Validity**	**Description**
686	I	Invalid due to zero check. Used for Level 0.
687	I	Invalid due to span check. Used for Level 0.
699	I	Mechanical problem, unspecified reason
Group 9: Missing flags		
Flag	**Validity**	**Description**
999	M	Missing measurement, unspecified reason

Points to Note

- **Zero** measurements shall be flagged with **flag 686** and the variable **status, Status type=zero mode** shall be set to indicate whether it was an internal or external zero measurement (0: N/A, **1**: internal zero, **2**: external zero). See data lines 3 and 4 in the template below for an example for internal and external zero measurements.
- **Calibrations** shall be flagged with **flag 687** and the variable **status, Status type=calibration standard** shall be set to indicate which calibration gas was used (integer, refers to metadata elements **Calibration standard ID** and **Secondary standard ID**). See data lines 5 and 6 in the template below for an example for calibrations with different standads.

start_time	end_time	p_inlet	p_det	T_inlet	T_det	cal	zero	NO#	NOc#	NO_sens	cvt_eff	numflag	NO	NO_ac	NO_pr	NO_dl	numflag_NO	NO2	NO2_ac	NO2_pr	NO2_dl	numflag_NO2
0.000000	0.000694	839.400	921.400	299.700	290.210	0	0	258	5200	1.283	45.351	0.000000000	0.331	0.0800	0.0070	0.005	0.000000000	10.080	0.0700	0.0060	0.010	0.000000000
0.000694	0.001385	839.766	921.787	299.750	291.232	0	0	510	4780	1.283	45.351	0.000000000	0.596	0.0454	0.0066	0.004	0.000000000	9.765	0.0690	0.0077	0.012	0.000000000
0.001385	0.002083	839.821	921.833	299.761	291.987	0	**1**	21	23	1.283	45.351	0.686000000	0.476	0.0234	0.0087	0.004	0.686000000	9.832	0.0654	0.0072	0.012	0.**686**000000
0.002083	0.002778	839.801	921.788	299.886	292.232	0	**2**	9	21	1.283	45.351	0.686000000	0.836	0.0632	0.0077	0.005	0.686000000	9.922	0.0643	0.0075	0.015	0.**686**000000
0.002778	0.003472	839.633	921.654	300.021	292.012	**1**	0	644	4766	1.283	45.351	0.687000000	0.839	0.0712	0.0082	0.006	0.687000000	10.032	0.0704	0.0084	0.012	0.**687**000000
0.003472	0.004167	839.601	921.522	299.988	291.987	**3**	0	523	4802	1.283	45.351	0.687000000	0.341	0.0673	0.0052	0.004	0.687000000	9.989	0.0720	0.0060	0.011	0.**687**000000
0.004167	0.004861	839.801	921.788	421.122	291.232	0	0	7342	96379	1.283	45.351	0.699000000	73.832	3.2349	9.7289	8.234	0.699000000	83.234	32.2724	62.1346	7.234	0.**699**000000
0.004861	0.005556	9999.999	9999.999	9999.999	9999.999	99	99	9999	99999	99.999	999.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000

NOx templates, level 1

https://ebas-submit.nilu.no/templates/NOx/lev1

```
100 1001
Fiebig, Markus; Someone, Else
NO01L, Norwegian Institute for Air Research, NILU, , Instituttveien 18, , N-2027, Kjeller, Norw
Fiebig, Markus
EMEP GAW-WDCRG ACTRIS
1 1
2014 01 01 2014 06 24
0.0
days from file reference point
19
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
999.999999 9999.999 9999.999 9.999999999 99.999 99.9999 99.9999 99.999 9.999999999 99.999
end_time of measurement, days from the file reference point
pressure, hPa, Location=inlet, Matrix=instrument
temperature, K, Location=inlet, Matrix=instrument
numflag, no unit
nitrogen_monoxide, nmol/mol, Calibration scale=NPL
nitrogen_monoxide, nmol/mol, Statistics=expanded uncertainty 2sigma
nitrogen_monoxide, nmol/mol, Statistics=precision
nitrogen_monoxide, nmol/mol, Statistics=detection limit
numflag, no unit
nitrogen_dioxide, nmol/mol, Calibration scale=NPL+GPT
nitrogen_dioxide, nmol/mol, Statistics=expanded uncertainty 2sigma
nitrogen_dioxide, nmol/mol, Statistics=precision
nitrogen_dioxide, nmol/mol, Statistics=detection limit
numflag, no unit
NOx, nmol/mol
NOx, nmol/mol, Statistics=expanded uncertainty 2sigma
NOx, nmol/mol, Statistics=precision
NOx, nmol/mol, Statistics=detection limit
numflag, no unit
0
67
Data definition:                EBAS_1.1
Set type code:                  TI
Timezone:                       UTC
File name:
NO0002R.20140101000000.20140624000000.chemiluminescence_photolytic..air.8mn.1mn.NO01L_Ecophysics_CLD899_Ecophysics_PLC860_BIR_NO01L_chem_photolu_Ecophysics_CLD899Y_PLC860_lev0_dup1.nas
Startdate:                      20140101000000
Revision date:                  20140624000000
Version:                        1
Version description:            initial revision, manually inspected
Data level:                     0
Period code:                    1y
Resolution code:                1mn
Sample duration:                1mn
Orig. time res.:                1mn
Station code:                   NO0002R
Platform code:                  NO0002S
Station name:                   Birkenes II
Station WDCA-ID:                GAWANO__BIR
Station GAW-Name:               Birkenes Atmospheric Observatory
Station GAW-ID:                 BIR
Station AIRS-ID:
Station other IDs:              BIR (ICOS), Birkenes (AERONET)
Station state/province:
Station land use:               Forest
Station setting:                Rural
Station GAW type:               R
Station WMO region:             6
Station latitude:               58.388530
Station longitude:              8.2520000
Station altitude:               219.0 m
Measurement height:             4.0 m
Component:                      NOx
```

Final parameters

Points to Note

When processing data from lev0 to lev1:

- Calibration and zero measurements in lev0 shall be used
- All values with **invalid flags** in lev0 will be taken out in lev1 (value = MISSING VALUE, flag = 999)
- All **valid flags** are taken over into lev1.
- NOx shall be calculated from NO and NO2 measurements.

Group 0: Valid data

Flag	Validity	Description
000	V	valid data, no flag

Group 1: Exception flags for accepted, irregular data

Flag	Validity	Description
147	V	Below theoretical detection limit or formal Q/A limit, but a value has been measured and reported and is considered valid

Group 5: Chemical problem

Flag	Validity	Description
559	V	Unspecified contamination or local influence, but considered valid

Group 9: Missing flags

Flag	Validity	Description
999	M	Missing measurement, unspecified reason

No invalid flags in lev1

NOx level 0 and level 1 data example

Level 0

start_time	end_time	p_inlet	p_det	T_inlet	T_det	cal	zero	NO#	NOc#	NO_sens	cvt_eff	numflag	NO	NO_ac	NO_pr	NO_dl	numflag_NO	NO2	NO2_ac	NO2_pr	NO2_dl	numflag_NO2
0.000000	0.000694	839.400	921.400	299.700	290.210	0	0	258	5200	1.283	45.351	0.000000000	0.331	0.0800	0.0070	0.005	0.000000000	10.080	0.0700	0.0060	0.010	0.000000000
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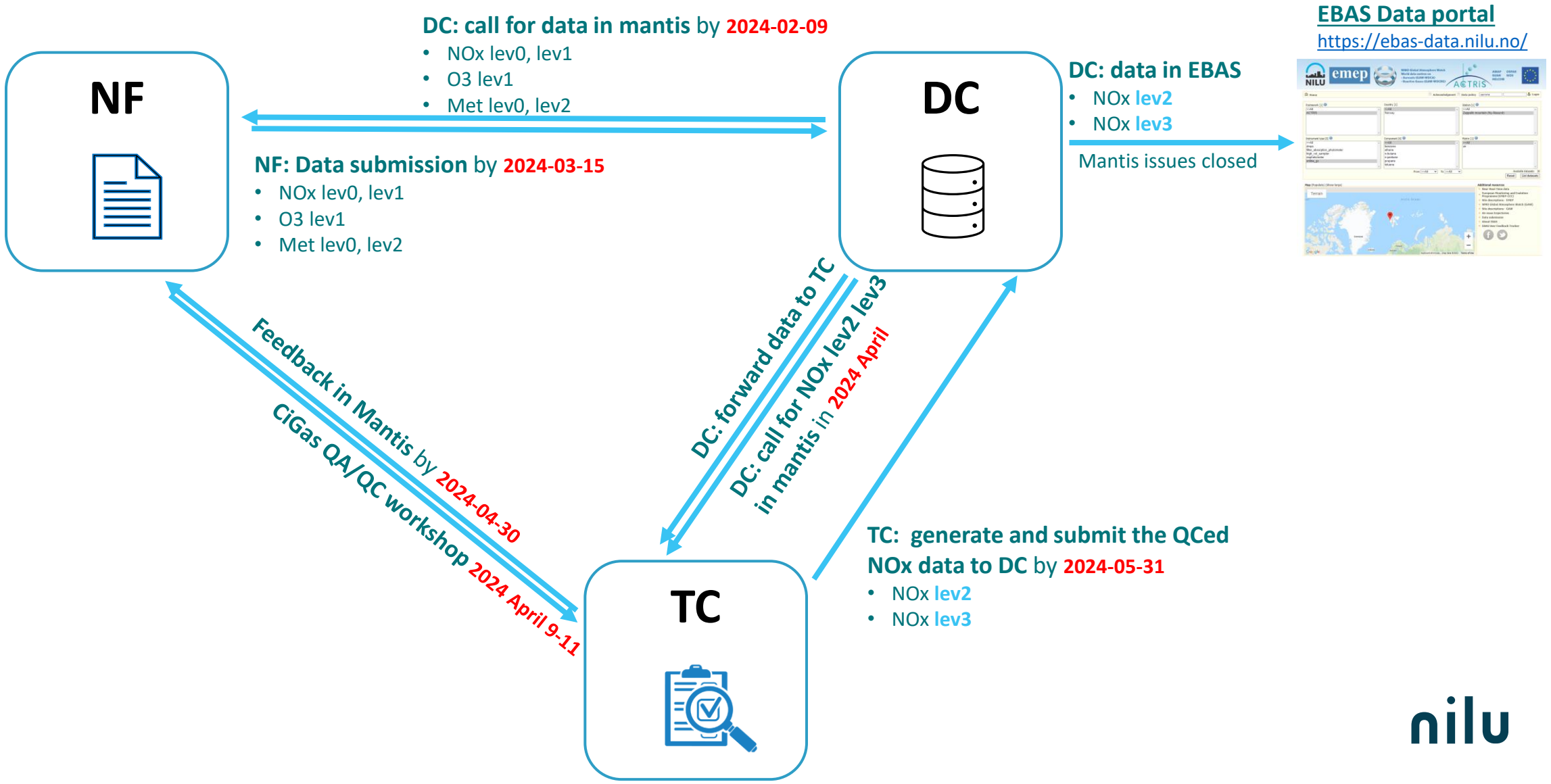
0.001385	0.002083	839.821	921.833	299.761	291.987	0	1	21	23	1.283	45.351	0.686000000	0.476	0.0234	0.0087	0.004	0.686000000	9.832	0.0654	0.0072	0.012	0.686000000
0.002083	0.002778	839.801	921.788	299.886	292.232	0	2	9	21	1.283	45.351	0.686000000	0.836	0.0632	0.0077	0.005	0.686000000	9.922	0.0643	0.0075	0.015	0.686000000
0.002778	0.003472	839.633	921.654	300.021	292.012	1	0	644	4766	1.283	45.351	0.687000000	0.839	0.0712	0.0082	0.006	0.687000000	10.032	0.0704	0.0084	0.012	0.687000000
0.003472	0.004167	839.601	921.522	299.988	291.987	3	0	523	4802	1.283	45.351	0.687000000	0.341	0.0673	0.0052	0.004	0.687000000	9.989	0.0720	0.0060	0.011	0.687000000
0.004167	0.004861	839.801	921.788	421.122	291.232	0	0	7342	96379	1.283	45.351	0.699000000	73.832	3.2349	9.7289	8.234	0.699000000	83.234	32.2724	62.1346	7.234	0.699000000
0.004861	0.005556	9999.999	9999.999	9999.999	9999.999	99	99	9999	99999	99.999	999.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000

Level 1

start_time	end_time	p_inlet	T_inlet	numflag	NO	NO_ac	NO_pr	NO_dl	numflag_NO	NO2	NO2_ac	NO2_pr	NO2_dl	numflag_NO2	NOx	NOx_ac	NOx_pr	NOx_dl	numflag_NOx
0.000000	0.000694	839.400	299.700	0.000000000	0.331	0.0800	0.0070	0.005	0.000000000	10.080	0.0700	0.0060	0.010	0.000000000	10.411	0.1500	0.0125	0.010	0.000000000
0.000694	0.001385	839.766	299.750	0.000000000	0.596	0.0454	0.0066	0.004	0.000000000	9.765	0.0690	0.0077	0.012	0.000000000	11.361	0.1144	0.0142	0.012	0.000000000
0.001385	0.002083	839.821	299.761	0.000000000	99.999	99.9999	99.9999	99.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000	999.999	99.9999	99.9999	99.999	0.999000000
0.002083	0.002778	839.801	299.886	0.000000000	99.999	99.9999	99.9999	99.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000	999.999	99.9999	99.9999	99.999	0.999000000
0.002778	0.003472	839.633	300.021	0.000000000	99.999	99.9999	99.9999	99.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000	999.999	99.9999	99.9999	99.999	0.999000000
0.003472	0.004167	839.601	299.988	0.000000000	99.999	99.9999	99.9999	99.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000	999.999	99.9999	99.9999	99.999	0.999000000
0.004167	0.004861	839.801	339.122	0.000000000	99.999	99.9999	99.9999	99.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000	999.999	99.9999	99.9999	99.999	0.999000000
0.004861	0.005556	9999.999	9999.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000	99.999	99.9999	99.9999	99.999	0.999000000	999.999	99.9999	99.9999	99.999	0.999000000

ACTRIS NOx data workflow: from instrument to data portal … via TC



ACTRIS Station list for NOx

Station_ID	Station name
CH0001G	Jungfraujoch
CV0001G	Cape Verde Atmospheric Obs.
CZ0003R	Kosetice (NOAK)
DE0043G	Hohenpeissenberg
DE0044R	Melpitz
FI0050R	Hyytiälä
FR0020R	SIRTA
FR0026R	La Réunion
FR0030R	Puy de Dôme
IT0004R	Ispra
IT0009R	Mt Cimone
IT0014R	Capo Granitola

- **New stations**

  Initial contact with EBAS ebas@nilu.no

  DC will provide IDs (station code, platform code, lab code)

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Key Metadata

- **Instrument type**
  - ACTRIS requires the use of **photolytic converters**
    => No “call for data” for measurements with **chemiluminescence_molybdenum**
- **Standard method**
  - ACTRIS NOx: SOP=ACTRIS_NOxy_2014
- **Calibration scale**
- **Converter efficiency** in lev0
- …

Will be mandatory in the near future

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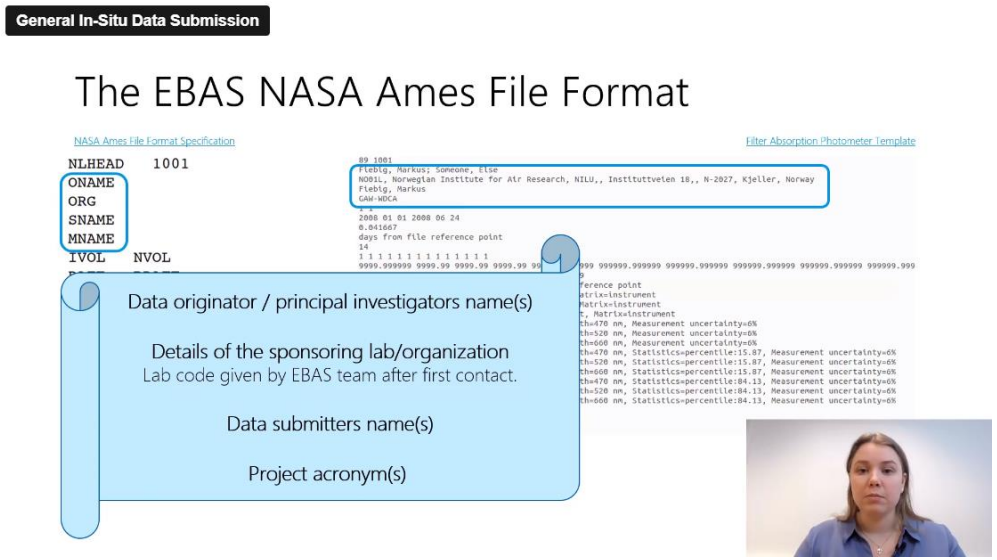
Tools and tutorials

- Tools: https://ebas-submit.nilu.no/tools
- E-learning tutorials https://ebas.nilu.no/delivery/tools-and-tutorials/
  - ➢ about the general in-situ data submission (14:16 mins)



Need help?

- Mantis
- Contact the EBAS-team: ebas@nilu.no