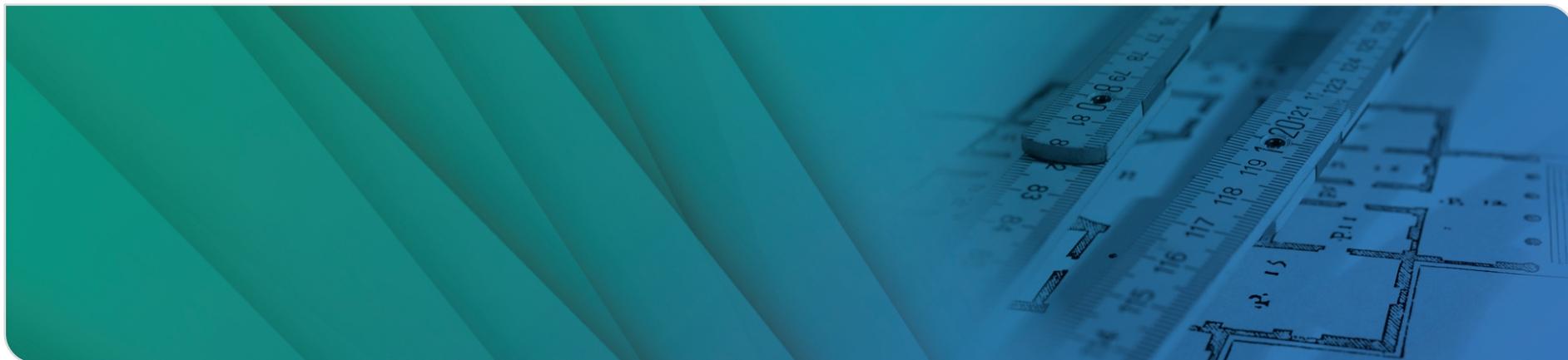


PROFFAST 2.4 and PROFFASTpylot 1.3

COCCON Telecon, June 6th 2024

Lena Feld, Benedikt Herkommer, Darko Dubravica, Frank Hase



Outline

- PROFFAST 2.4 updates (Frank Hase)
- PROFFASTpylot 1.3 updates
 - Publication in Joss
 - General updates
 - Calibration
- FAQs:
 - How to process different instruments (TCCON-HR/TCCON-LR)
 - How to use a custom ILS

Updates PROFFASTpilot 1.3

Publication in JOSS

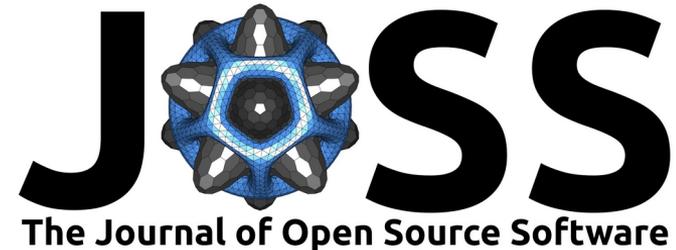
Feld et al., (2024). PROFFASTpilot: Running PROFFAST with Python.

Journal of Open Source Software, 9(96), 6481

<https://doi.org/10.21105/joss.06481>

Version 1.3.2 on Zenodo:

<https://doi.org/10.5281/zenodo.11035671>



Updates PROFFASTpylot

General updates

- Updated list of ILS Parameters; provided by Carlos

Improved documentation (HTML version on homepage):

<https://www.imk-asf.kit.edu/english/4261.php>

- Improved map-handling: Interpolated map-file are copied to result folder to avoid confusion after the retrieval
- Improved error messages: The pilot tracks if PCXS and INVERS were executed. If not error messages of these parts are suppressed.
- Support of CO2_STR
- Usage of improved solar linelist ==> Recalibration needed

Updates PROFFASTpylot

General updates

- Better pressure handling:
 - Small bugfix in Interpolation algorithm.
 - Retrieval does NOT stop if pressure is missing for a single day.
 - Instead it is interpolated up to 2 hours by default. For larger gaps the processing of the spectra is skipped

- Introduction of different logging modes + more stable logging:
 - 1) Using the pilot as standalone program (default)
 - 2) Embedded into a larger environment
 - 3) Providing the logging instance to an external module (pilot as an “host”)

- Consistent naming and documentation of the code: Increase readability and maintainability

Updates PROFFASTpylot

New calibration

- New calibration was necessary due to update of solar linelist
- Calibration of PROFFAST2.3 was very good
==> Try to be consistent with PROFFAST2.3
- Calibration of CO2_STR from the scratch
- We have three different calibration factors:
 - 1) Airmass dependend correction factors (ADCFs)
 - 2) Airmass independend correction factors (AICFs)
 - 3) H2O correction factor

Updates PROFFASTpylot

New calibration

1) Improve ADCFs (Independent of TCCON)

1. **Divide** every measurement of one day by the **mean of this day** of all measurements in the range of $20 \leq SZA \leq 50$
2. **Iteratively adjust ADCFs** such that the data does **not show SZA dependency**.

2) Empirical H₂O correction factor:

Correct all species with a linear correction in dependence of XH₂O to be in agreement with TCCON.

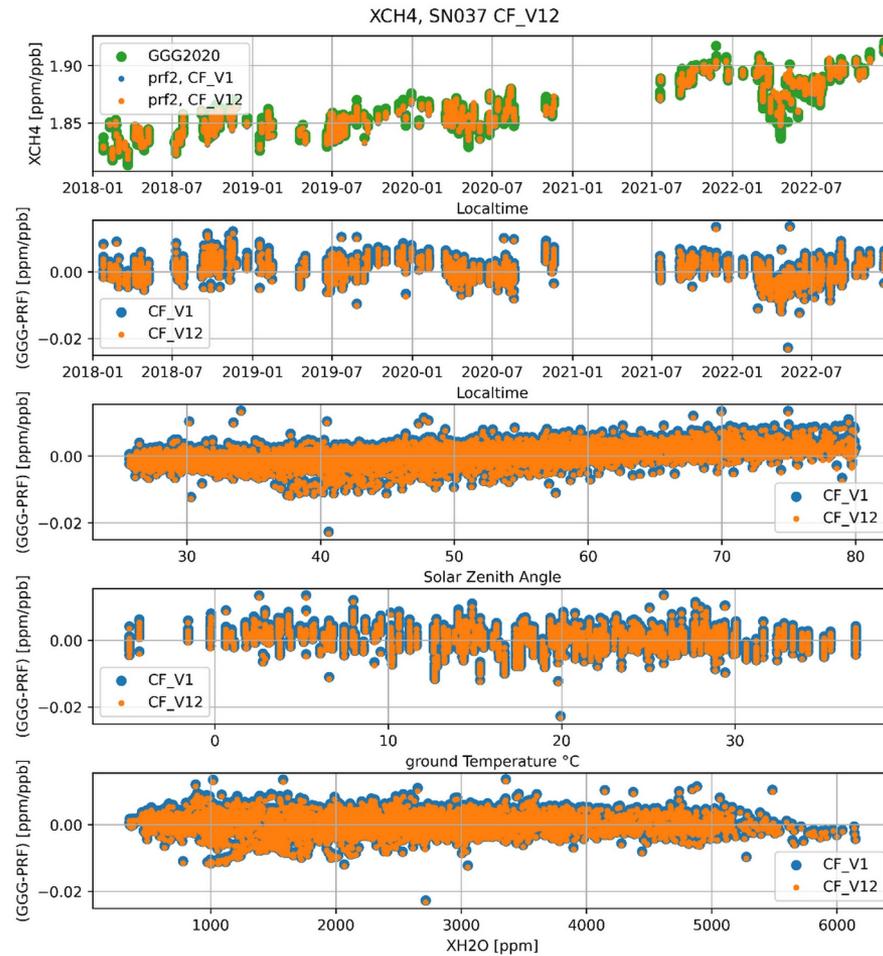
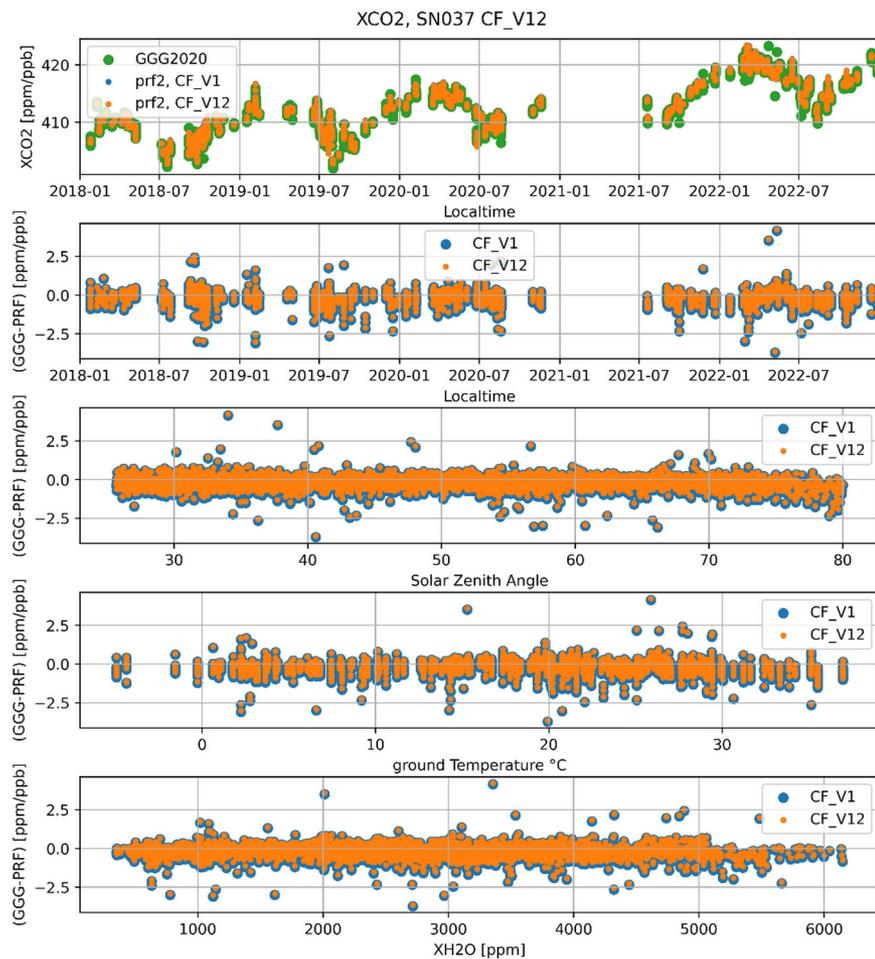
3) Improve AICFs (Calibration to match with TCCON):

Used to eliminate a potential absolute offset from TCCON to COCCON.

For more details see slides of 2023 TCCON meeting by B. Herkommer:

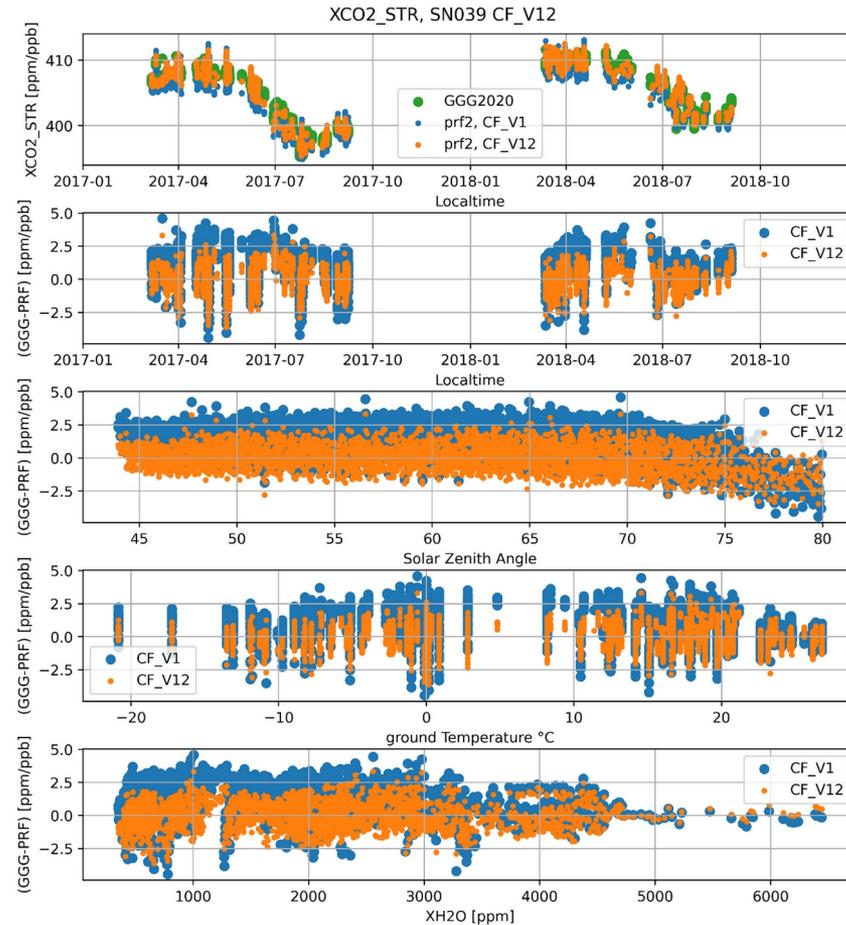
https://tcccon-wiki.caltech.edu/pub/Main/2023Spa/Herkommer_2023_Spa_Meeting_Calibration.pdf

Updates PROFFASTpylot



Updates PROFFASTpylot

New calibration



FAQs

How to process TCCON LR/HR data with PROFFAST(pylot)

```
#####  
# SITE AND INSTRUMENT #  
#####  
  
instrument_number: TK_LR  
  
site_name: Tsukuba  
instrument_parameters: tcon_default_lr  
  
# abbreviation of the site name as used in map file:  
# <site_abbrev><date>.map  
site_abbrev: tk  
  
# give coordinates  
# Leave empty if coordinates should be taken from file. An example file can  
# be found in examples/input_data/coords.csv  
coords:  
  lat: 36.0513  
  lon: 140.1215  
  alt: 0.031 # km over sea level  
  
coord_file:  
  
# if times of the recorded data is not stored in UTC, insert the offset here  
# default: 0.0  
utc_offset: 9.0  
  
#####  
# BEHAVIOUR #  
#####  
  
# File size filter for igrms: all igrms with a filesize less than the value  
# specified here are assumed to be corrupt. Filesize in MegaBytes  
# Default is 3.7  
min_interferogram_size: 1.6
```

Possible values are:

- em27 (default)
- tcon_ka_hr
- tcon_ka_lr
- tcon_default_hr
- tcon_default_lr
- invenio
- vertex
- ircube

You probably also have to adapt the
“min_interferogram_size”

See our documentation at:

<https://www.imk-asf.kit.edu/english/4261.php>

- List of all Input Parameters
- Instrument Parameters

FAQs

How to process TCCON LR/HR data with PROFFAST(pylot)

```
! input_tk_LR.yml
1 # Input file to run PROFFASTpylot
2
3 # leave empty if the default value should be used
4 # An example of a file structure and derived paths can be found in
5 # 'docs/folder_structre.md'
6
7
8
9 #####
10 # SITE AND INSTRUMENT #
11 #####
```

```
MINGW64:/e/_temp_/proffastpylot
ly1868@imk-asf-bodpbh MINGW64 /e/_temp_
$ cd proffastpylot/
ly1868@imk-asf-bodpbh MINGW64 /e/_temp_/proffastpylot (master)
$ git checkout dev
Switched to a new branch 'dev'
Branch 'dev' set up to track remote branch 'dev' from 'origin'.
ly1868@imk-asf-bodpbh MINGW64 /e/_temp_/proffastpylot (dev)
$ git pull
Already up to date.
ly1868@imk-asf-bodpbh MINGW64 /e/_temp_/proffastpylot (dev)
```

```
Windows PowerShell
2024-06-05 08:42:09,143, INFO: +++ Welcome to PROFFASTpylot +++
2024-06-05 08:42:09,152, INFO: Run information:
Retrieval for Instrument TK_LR at Tsukuba with time offset 9.0.
The following dates will be processed:
2022-03-28.

2024-06-05 08:42:09,864, WARNING: The analysis folder E:\00_proffastpylot_dev\proffastpylot\example\analysis\Tsukuba_TK_LR exists already! The content may be overwritten.

2024-06-05 08:42:09,865, WARNING: The result directory E:\00_proffastpylot_dev\proffastpylot\example\results\Tsukuba_TK_LR_220328-220328 exists already! Renamed existing
one to E:\00_proffastpylot_dev\proffastpylot\example\results\Tsukuba_TK_LR_220328-220328_backup3 and created a new one.
2024-06-05 08:42:10,390, INFO: Running preprocess with 2 task(s) ...
2024-06-05 08:42:10,390, INFO: Using unity ILS parameter for non-em27 instruments as default. If you want to use different, specify it in the general input file.
2024-06-05 08:42:18,988, INFO: Finished preprocessing.

2024-06-05 08:42:18,998, INFO: Running pcxs with 2 task(s) ...
2024-06-05 08:43:30,060, INFO: Finished pcxs.

2024-06-05 08:43:30,069, INFO: Running invers with 2 task(s) ...
2024-06-05 08:43:44,287, INFO: Finished invers.

2024-06-05 08:43:45,050, INFO: The combined results of PROFFAST were written to E:\00_proffastpylot_dev\proffastpylot\example\results\Tsukuba_TK_LR_220328-220328\comb_inv
parms_Tsukuba_TK_LR_220328-220328.csv.
2024-06-05 08:43:45,051, INFO: Removing temporary files ...
2024-06-05 08:43:45,088, INFO: Done.
```

FAQs

How to use a custom ILS

```
Windows PowerShell
2024-06-05 08:42:09,143, INFO: +++ Welcome to PROFFASTpylot +++
2024-06-05 08:42:09,152, INFO: Run information:
Retrieval for Instrument TK_LR at Tsukuba with time offset 9.0.
The following dates will be processed:
2022-03-28.

2024-06-05 08:42:09,864, WARNING: The analysis folder E:\00_proffastpylot_dev\proffastpylot\example\analysis\Tsukuba_TK_LR exists already! The content may be overwritten.

2024-06-05 08:42:09,865, WARNING: The result directory E:\00_proffastpylot_dev\proffastpylot\example\results\Tsukuba_TK_LR_220328-220328 exists already! Renamed existing one to E:\00_proffastpylot_dev\proffastpylot\example\results\Tsukuba_TK_LR_220328-220328_backup03 and created a new one.

42:10,930, INFO: Running preprocess with 2 task(s) ...
42:10,390, INFO: Using unity ILS parameter for non-em27 instruments as default.
42:18,988, INFO: Finished preprocessing.

2024-06-05 08:43:30,069, INFO: Running invers with 2 task(s) ...
2024-06-05 08:43:44,287, INFO: Finished invers.

2024-06-05 08:43:45,050, INFO: The combined results of PROFFAST were written to E:\00_proffastpylot_dev\proffastpylot\example\results\Tsukuba_TK_LR_220328-220328\comb_inv_parms_Tsukuba_TK_LR_220328-220328.csv.
2024-06-05 08:43:45,051, INFO: Removing temporary files ...
2024-06-05 08:43:45,088, INFO: Done.
```

FAQs

How to use a custom ILS

```
# if times of the recorded data is not stored in UTC, insert the offset here
# default: 0.0
utc_offset: 9.0

# ILS parameters
# WARNING: we recommend using the official ILS parameters distributed with
# PROFFASTpylot in prfpilot/ILSList.csv.
# This will be used automatically if ils_parameter are not given in the input
# file.
# ils_parameters:
- 0.9816 # Modulation Efficiency Channel 1
- -0.00244 # Phase Error Channel 1
- 0.9816 # Modulation Efficiency Channel 2
- -0.00244 # Phase Error Channel 2

#####
# BEHAVIOUR #
#####
```

Unity ILS in PROFFAST is:
ME: 0.983
PE: 0.0

The same values for Channel 1
and Channel 2 must be given.