



LuftBlick report 2019007

Pandonia Operations

Workshop Report and Recommendations

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Document Change Record

Issue	Page	Date	Observations
1	All	2019-10-21	First version including 1st PGN workshop
1.2	Expand sections 2.5 and 2.6	2019-12-12	Incorporated changes requested during POp PM6 telecon on 9 Dec 2019

1 Introduction

This report is deliverable 14 (D14) of the ESA project “Pandonia Operations” (POp) [AD1,AD2]. The 1st PGN workshop from 17 to 20 Sept 2019 in Innsbruck is described in section 2.

1.1 Acronyms and Abbreviations

AD	Applicable Document
EPA	US Environmental Protection Agency
ESA	European Space Agency
LuftBlick	LuftBlick Earth Observation Technologies OG, Mutters, Austria
NASA	National Aeronautics and Space Administration
Pandora	Pandora Spectrometer System (one or two spectrometers version)
POp	Pandonia Operations project

1.2 Applicable Documents

- [AD1] Pandonia Operations [Proposal], LuftBlick Proposal 201804OPE, Issue 1, 12 April 2018.
[AD2] ESA Contract and Statement of Work No. 4000124223/18/I-SBo-’Pandonia Operations’, 27 Jun 2018.

2 1st PGN Workshop, 17 to 20 Sept 2019

This section describes the 1st Pandonia Global Network (PGN) workshop held from 17 to 20 Sept 2019 in at the University of Innsbruck (figure 1), Innrain 52, 6020 Innsbruck, Austria , Room (Hörsaal) F. There was a total of 40 participants (see section 2.1 and figure 2).

Figure 1: Building, where the 1st PGN workshop was taking place (Copyright University of Innsbruck)



Figure 2: Workshop participants



2.1 Final list of participants

Name	Affiliation
Alberto Redondas	AEMET
Alexander Cede	LuftBlick
Alexandru Dandocsi	INOE
Anca Nemuc	INOE
Angelika Dehn	ESA/ESRIN
Ankie Pitors	KNMI
Anna Maria Iannarelli	Serco Italy
Axel Kreuter	LuftBlick
Barry Lefer	NASA Earth Science Division
Bob Swap	NASA GSFC
Bojan Bojkov	EUMETSAT
Christian Posch	LuftBlick
Christian Resch	LuftBlick
Claudia Rivera	Universidad Nacional Autónoma de México
Cristiana Bassani	CNR-IIA (Institute of Atmospheric Pollution Research)
Daniel Santana	LuftBlick
Elena Spinei Lind	Virginia Tech
Francois Hendrick	BIRA-IASB
Gaia Pinardi	BIRA-IASB
Hyeon-Ju Park	Seoul National University
Jari Hovila	Finnish Meteorological Institute
Jonas von Bismarck	ESA
Jürgen Fischer	Free University Berlin
KangHo Bae	UNIST(Ulsan National Institute of Science and Technology)
Kristof Bogner	University of Toronto
Manuel Gebetsberger	LuftBlick
Mariel Friberg	NASA GSFC / USRA
Martin Tiefengraber	LuftBlick
Michel Van Roozendael	BIRA-IASB
Monica Campanelli	ISAC-CNR
Moritz Müller	LuftBlick
Nader Abuhassan	JCET
Raptis Panos	National Observatory of Athens
Si-Chee Tsay	NASA/GSFC

Simon Oliver	Geoscience Australia
Stefan Schreier	Inst. of Meteorology, Univ. of Nat. Res. & Life Sciences, Vienna, Austria
Stefano Casadio	SERCO Italia
Verena Schenzinger	Innsbruck Medical University
Xiaoyi Zhao	Environment and Climate Change Canada
Yugo Kanaya	JAMSTEC

2.2 Final Program

2.2.1 Day 1 Tuesday 17 Sep 2019

2.2.1.1 Station presentations

13:00	Logistics and welcome
13:10	PGN plans from ESA and NASA
14:00	Station presentations, Each participant shows some slides to present himself and his station. This can be as short as one slide with a picture and as long as a more detailed presentation about the location, motivation, science goal, studies already done, related projects, etc.
15:00	<i>Coffee break</i>
15:30	Station presentations *
17:00	<i>End of day 1</i>

2.2.2 Day 2 Wednesday 18 Sep 2019

2.2.2.1 Station presentations (continued)

9:00	Station presentations (continued)
10:00	<i>Coffee break</i>
10:30	Station presentations (continued)
12:00	<i>Lunch</i>

2.2.2.2 Pandora and PGN evolution

13:30	Pandora Evolution
14:10	HW Evolution
15:00	<i>Coffee break</i>

2.2.2.3 PGN operation

15:30	PGN evolution
16:00	PGN structure and data flow
16:50	The role of the Network Operators
17:00	<i>End of day 2</i>

19:00: Social Dinner at Gasthof Lärchenwald, Lärchenwald 3, 6162 Mutters, Austria

2.2.3 Day 3 Thursday 19 Sep 2019

2.2.3.1 PGN live monitoring

9:00 PGN instrument monitoring
Live data visualization

2.2.3.2 Pandora operation

9:30 Operation recommendations
10:00 *Coffee break*
10:30 Operation recommendations (continued)
11:00 Measurement routines and scheduling
12:00 *Lunch break*

2.2.3.3 Calibration basics

13:30 Calibration overview
Instrument calibration file

2.2.3.4 Data processing

14:30 Processing chain
Processing configuration
15:00 *Coffee break*

2.2.3.5 Algorithms and QA

15:30 Operational PGN algorithms and QAQC
Algorithms and QAQCs under development, part 1
17:00 *End of day 3*

2.2.4 Day 4 Friday 20 Sep 2019

2.2.4.1 Algorithms and QA (continued)

9:00 Algorithms and QAQCs under development, part 2
Algorithm/Product release discussion

2.2.4.2 Data policy and future of Pandora and PGN

9:30 Pandora data policy (DOI)
Future and unexploited possibilities of Pandora
10:00 *Coffee break*
10:30 Future of PGN
Collaborations
Final discussion
12:00 *End of workshop*

2.3 Presentations

All presentations were made available to the participants on 23 Sept 2019 by sending out an email with this [link](#). This folder contains two subfolders:

- Workshop presentations: contains the presentations given at the workshop for the different sessions.
- Station presentations: contains the presentations given to LuftBlick by the participants, which were presented on the first or second day.

2.4 Minutes and recommendations

Minutes of this workshop were taken by all the authors of this report. Here they are sorted by category in sub-sections. An arrow → means that this person gave an answer to a question asked. The following acronyms are used in this section:

AC	Alexander Cede
AD	Angelika Dehn
AP	Ankie Pieters
AR	Alberto Redondas
BB	Bojan Bojkov
BL	Barry Lefer
DS	Daniel Santana
ES	Elena Spinei Lind
JF	Jürgen Fischer
JvB	Jonas von Bismarck
MT	Martin Tiefengraber
MvR	Michel van Roozendaal
NA	Nader Abuhassan
SC	Stefano Casadio
XZ	Xiaoyi Zhao

2.4.1 PGN, workshops, meetings, etc.

- AC: There was relatively little presence from the USA at the workshop. The NASA Pandora group was only represented by Bob Swap and NA and there was nobody from EPA. The main reason was a funding shortage (NASA) and not getting travel authorization (EPA).
- BL: NASA started a 5 years commitment to the PGN this year 2019.
- AP: PGN should have more community connection.
- JF: Satellite validation people should be included in the next PGN workshop.
- AD: Should we have more hands on sessions in the next workshop?
- BL: We should think of a yearly or semi-annual webex with network operators and PIs / local operators. → DS: No problem at all, but I would propose to split them in two time zones at least.
- BB: Are there strategies to place Pandoras 'more' strategically?
- JvB: The PGN application form should be kept updated with respect to additional instrumentation on site. → AC: the application form can be updated by the PI for such cases.

2.4.2 PGN webpage and communication

- BL: Can we bring the workshop presentations up on the web?
- BL: Can we make a PGN Wiki communication platform and/or a blog on the PGN webpage?
- AC: Currently the plan is that users will get updates via email.
- BL: List of publications should be listed on the PGN webpage.

2.4.3 Data products

- SC: Test products like moon should be offered to the community.
- Which “other gases” should be prioritized in the future?
 - MvR: Glyoxal due to its importance in relation to HCHO
 - XZ: BrO due to its importance in polar regions
 - SC: What about NO₃
- BL: Could we make the “Brewer-like” ozone algorithm operational?
- SC: What is the status of synergistic retrievals? → AC: This is explored already to some extent (e.g. DIVA project).

2.4.4 DOI

- AC: after comments from AP and MvR, it was decided that the PGN DOI should be made instrument specific. This means that the granularity needs to be different compared to the one suggested at the workshop. Here an example for the new way for the DOIs, which was agreed on:

“doi: 10.1234/Pandora110.rnvs0.p1-6”

10.1234=assigned by EVDC

Pandora110=instrument identifier

r=identifies the data product level (in this case L2 data)

nvs0=data product (in this case total column NO₂, direct sun)

p1-6=processor version

- MT: with this setup, maintaining metadata would be on the side of the instrument PIs.
- AR: he has experience with DOIs and can support LuftBlick in this.

2.4.5 Technical comments

- AD: there is no correlation for total column NO₂ for Fairbanks between Pandora and TropOMI ($r=0.11$). We should look into this. One reason could be that there is a local source (airport) nearby and the Pandora is measuring very high values almost every day.
- MvR: Since BIRA has a direct sun instrument, Brussels could be a test site for HCHO direct sun measurements
- BL: Is it possible to have replacement instruments for the lab calibration time?
- AP: Do I need a mobile FCT (Field Calibration Tool)? → MT: currently the mobile FCT's main purpose is to maintain or check the stability of the mobile reference instrument. Hence unless you want to do AOD, right now you do not need it.

- ES: What about PGN support for private instruments (i.e. non ESA, NASA, or so)? → AC: In the ESA projects, there is some limited budget to also support such instruments at a case-by-case base.
- ES: Could e.g. MFDOAS be included in the PGN processing environment in case it has its data in Pandora native format? → AC: In theory Blick does allow this. It needs to be tested.
- NA: The head chamber tests should put it in the Certificate of Conformity (CoC)
- NA: Could we do status lines visualization for multiple instruments?
- AP: How do users know when a calibration was done? → MT: By looking into the corresponding calibration files folder (soon on the official PGN webpage).
- SC/NA: We should mark the position of the fibers on the spectrometer side in the future. I.e. to put a tape or similar on the spectrometer side and fiber side to go sure it is always plugged in the same way.
- NA suggestion to JF: Think about putting Pandora 133 to SouthAfrica. They have motivated operators and the Gobabeb site is not appropriate for a PGN site.
- NA: Think about a “L0-similar” routine, which is doing filter measurements very often and very quickly without resetting the filterwheel. This could detect if the filterwheel is losing steps.

2.5 Conclusions

The workshop presentations are given in section 2.3 and the minutes in 2.4. The following section does not repeat or summarize the content of the presentations, but extracts the main conclusions for the PGN, split into separate logical groups. Each point is assigned with an ID for reference.

2.5.1 PGN project

- C1.** PGN is a cooperation between NASA and ESA. Both agencies, through the technical officers Barry Lefer (NASA) and Angelika Dehn (ESA) respectively, expressed their strong interest to keep this collaboration going and provide long term funding.
- C2.** ESA plans on long term projects with LuftBlick. The current PGN related projects are in year 2 of 4.
- C3.** The NASA Pandora project is in year 1 of 5.
- C4.** Currently the PGN is growing steadily and already covers more than 50 permanent measurements locations worldwide.

2.5.2 For future workshops

- C5.** The workshop was a success and all participants were interested in having a follow up.
- C6.** We need to discuss in the next WS how to handle/harmonize internal and external development of algorithms.

2.5.3 Calibration

- C7.** Currently vast majority of lab data analysis is done by LuftBlick. In the recent past some people from NASA has been trained to do this and has started to assist LuftBlick in this.
- C8.** The calibration coordination is done by LuftBlick.
- C9.** If somebody wants to request special data analysis, i.e. other than the operational products, this will usually be done by LuftBlick, but may take some time depending on the workload of LuftBlick. Possible reasons for delays are:

- C9.1. Re-calibrations of old datasets for PGN need to be done.
- C9.2. Issues with old lab-measurements were found.

2.5.4 Data processing and algorithms

- C10. The PGN data processing is currently done at LuftBlick servers.
- C11. Each user can also do their own processing as described in the SW manual.
- C12. There are two types of PGN Algorithms: the official real time algorithms (RTA) and offline algorithms. RTAs are done at the LuftBlick servers. Offline algorithms are currently developed/used by people outside the PGN groups such as Elena Spinei Lind (Virginia Tech) and Xiaoyi Zhao (Env. Canada). If online algorithms fulfill the criteria for RTAs, they are possibly added to the RTAs in the future.
- C13. An analysis of the possibility to retrieve spectral Aerosol optical depth (AOD) was given at the workshop. It was pointed out that the reason there is no such product at the moment is NOT the lack of an algorithm, but rather that the Pandora optical properties, L1 data correction steps and trace gas algorithms for strong absorbers are not yet in a shape to derive spectral AOD for Pandora.

2.5.5 Data products and referencing

- C14. The current PGN data products release plan was presented and discussed. On the question, on which gases the algorithm-focus should be after NO₂, O₃, SO₂ and HCHO, the species Glyoxal, BrO, and NO₃ were suggested.
- C15. The idea of the PGN team with respect to the planned DOI was presented and discussed. It was decided during the workshop that PGN DOIs should be instrument specific (see 2.4.4) in order to give the proper acknowledgement to the PIs and operators of each PGN location.

2.6 Recommendations

The following section summarizes the main recommendations for the PGN, split into separate logical groups. Each point is assigned with an ID for reference.

2.6.1 For the PGN and the next workshop

The following recommendations for the PGN in general have been given during the workshop:

- R1. There should be one PGN-webpage, <http://pandonia-global-network.org/>, as the central access point for the PGN. It needs to be updated including the items raised in section 2.4.2.
- R2. The next workshop should take place in the year 2021, tentatively in the US.
- R3. We need to plan for at least one full day of station presentation.

2.6.2 For local operators

The following recommendations for the local operators (LO) have been given during the workshop:

- R4. In order to know how to mount, (re)-align, operate and maintain the instrument, the LO needs to read the installation and operation manuals.
- R5. 90% of the alignment problems are caused by fiber or head sensor cable jams. The recommended fiber layout reduces the need of re-alignments substantially and should be enforced by the LO.

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- R6.** The LO needs to clean the entrance windows of the instrument periodically (at least weekly) to get the best data quality for their location. Look specifically for water in the collimators, or insects, and dust. A covered or polluted entrance window usually causes unsuccessful sun searches and fields of view (FOV) with a bad shape.
- R7.** The fiber should never be unplugged from the head sensor side.
- R8.** The LO needs to prevent operation at high temperatures. This can be obtained by placing the instrument box indoors or in the shade, and add a reflective cover. Do not obstruct the air inlets nor the extractor fan for a proper heat evacuation. Ensure you have a hole below the temperature controller fan and that the heatsink is clean.
- R9.** The LO should prevent humidity entering the spectrometer box by replacing the silica gel bags periodically and ensuring the spectrometer box is properly closed.
- R10.** The LO needs to update the instrument history in BlickM and inform to the network operator (NO) about relevant changes in the instrument (hardware changes, unmounting periods, detected issues, etc).
- R11.** The LO needs to be able to apply the necessary corrections in the instruments based on the NO recommendations.

2.6.3 For network operators

The following recommendations for the network operators (NO) have been given during the workshop:

- R12.** The NO needs to keep all the instruments running as long as possible by performing daily or weekly remote checks.
- R13.** The NO must act as a how-know database and give support and recommendations to the LOs.
- R14.** The NO needs to ensure homogeneous configuration of all instruments. E.g. he needs to update the operation SW BlickO on the instruments.
- R15.** The NO needs to give feedback of any HW problems to Sciglob, Luftblick and NASA.