Pandonia Global Network (PGN)
Status & Plans

Presentation to AC-VC-14 & GEO-CAPE Joint Meeting

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What is the Pandora Spectrometer System?

- Small, ground-based Sun/Sky/Lunar observing spectrometer system initiated in 2006 at NASA Goddard Space Flight Center
  - (Pandora 1S - 270 – 530 nm, 0.6 nm; 2S – 400 – 900 nm, 1 nm)
- NRT Standard Products at high frequency (~ 2 mins)
  - Tot. Column O3 (+/-15 DU, ~5%); Tot. Column NO2 (+/-0.05 DU, ~10%)
- Additional non-validated products
  - HCHO - Total column, trop. & near sfc; NO2, O3 – trop. & near sfc
- Operates autonomously off of line power and wifi; software runs on a small PC found inside the weather resistant container.
Instrument Specifications*

- Elevation (zenith) Range: 0° to 270°
- Azimuth Range: 360°
- Set Temperature Range: -20°-40°C; calibrated at 15° and 20°C
- Field of View: 1.5°

- Spectral Range: 270 - 530nm
- Spectral Resolution: 0.6nm
- Power: 120/220VAC
- Internet connectivity (Wifi/Wired)

*Configuration of a standard Pandora 1S
What is the Pandonia Global Network (PGN)?

• Ground-based network - a joint NASA/ESA collaborative effort modeled in the spirit of other networks (e.g. AERONET)

• From 2017 onwards, focus primarily on operationalization

• Objective: expand and coordinate a global network of standardized, calibrated instruments and systematically process and disseminate the data to the greater global community in support of in-situ and remotely sensed air quality monitoring
Why is it important?

Support of ESD Science and Satellite Validation/Verification
### Current and Future AQ/AC Satellite Missions

<table>
<thead>
<tr>
<th>Mission</th>
<th>Agency</th>
<th>Launch Year</th>
<th>Instrument(s)</th>
<th>Synergistic Pandora Observations</th>
<th>Orbit</th>
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<tbody>
<tr>
<td>AURA</td>
<td>NASA</td>
<td>2004</td>
<td>OMI</td>
<td>O3, NO2, SO2, HCHO, BrO</td>
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<td>DSCOVR</td>
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<td>2015</td>
<td>EPIC</td>
<td>O3, SO2</td>
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<td>Sentinel 5P</td>
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<td>GaoFen-5</td>
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<tr>
<td>GEO-KOMPSAT 2</td>
<td>KMA</td>
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<td>GEMS</td>
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<td>GEO</td>
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<td>Sentinel 4</td>
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<td>2021</td>
<td>UVN</td>
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<td>GEO</td>
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<td>UVNS</td>
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<td>MAIA</td>
<td>NASA</td>
<td>TBD</td>
<td>MAIA</td>
<td>SO2, NO2 (aerosol precursors)</td>
<td>LEO</td>
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</table>
Pandonia Global Network (PGN)

**NASA Pandora**
- Responsibilities:
  - NASA Instrument Builds
  - Calibration/deployment maintenance
  - Network Operations
  - Data Mirroring
- Managed by: NASA GSFC

**Shared Responsibilities**
- Network Operations
- Calibration, QA/QC
- Training of Local Operators
- Field Campaigns
- Science

**ESA Pandonia**
- Responsibilities:
  - Software Development
  - Calibration
  - Network Operations
  - Central Processing
  - Data Serving
- Managed by: Luftblick
STANDARDIZATION and CONVERGENCE:

• Summer Intern Training by ESA-Pandonia for NASA GSFC (July ‘17)
• NASA/ESA instrument deployment / local operations training (Oct ‘17)
• Maturing remote monitoring/support of operations:
  — instruments, local operators and scientists (Oct-Dec ‘17)
• Week-long ESA/NASA PGN Workshop - focus on manual development / harmonization of calibration procedures/data processing / Global Network development (Dec ‘17)
• Quick Start Guide for Instrument Set up, local operations and troubleshooting (started in Oct 17’ - ongoing)
NASA/ESA/PGN Accomplishments for past year cont.

• Production of scientific manuscripts

• Engaging with international agencies (e.g. EUMESAT, KIER, ESA, ECCC)
• Exposure and training of cohorts of interns (2017 and 2018)
Recent NASA/ESA/PGN supported Field Campaigns
OWLETS Overview

SERC RV

07/17 & 07/18 in-situ Ozone

NASA C-23 Sherpa

07/20 Ozone (≤ 500 m ASL)
Interconversion/Titration Event

NO + O\textsubscript{3} \rightarrow NO\textsubscript{2} + O\textsubscript{2}

TOL, Pandora & Ceilometer, Aug. 1, 2017
“Growing Our Own Timber”:
Grooming the Next Gen of ES Scientists
2018 Pandora Deployments in Northeastern U.S.

- **Yellow** - to be deployed (11) + 2 mobile (boat)
- **Blue** - currently sited (8)
- Majority coincident w/ EPA PAM sites - for additional sites, see L. Valin poster
- 37 monitored by NASA GSFC Pandora, 21 by ESA-Pandonia
- Possibility to provide hourly observations of O$_3$, NO$_2$, SO$_2$, HCHO from GEO is a major advancement for air quality (vs LEO 1x/day)
- By year end min. 50 NASA owned instruments deployed and operational

58 Instruments active globally with another 26 to be delivered in 2018
Goals for this year

- Establishment of international site / real property agreement templates where PGN Expectations are articulated in draft PGN Site Information Form to be released mid-May
- Collaborative development of new operational algorithms and evaluation of existing ones
- Maturing the remote monitoring and support of operations: instruments, local operators and scientists
- Launch of collaborative PGN website (est. mid-July)
- AGU Special Session (Observations and Modeling of Air Quality at Land-Water Boundaries, session ID#51995) with possible side meeting
- Continued collaboration w AERONET, TOLNET, MPLNET
- Science Workshop on Pandora - details TBD - possibly in conjunction w AGU
- Continued expansion of the NASA Pandora, leveraging ancillary observations at local, state and fed DEQ/EPA AQ monitoring sites
Thank you.

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