Operational satellite validation with data from the Pandonia Global Network (PGN)

Alexander Cede\textsuperscript{1,2}, Martin Tiefengraber\textsuperscript{1,3}, Angelika Dehn\textsuperscript{4}, Barry Lefer\textsuperscript{5}, Jonas von Bismarck\textsuperscript{4}, Stefano Casadio\textsuperscript{4}, Nader Abuhassan\textsuperscript{2}, Robert Swap\textsuperscript{2}, and Luke Valin\textsuperscript{6}

\textsuperscript{1}LuftBlick, Innsbruck, Austria (alexander.cede@luftblick.at)
\textsuperscript{2}NASA Goddard Space Flight Center, Greenbelt, MD, USA
\textsuperscript{3}Department of Atmospheric and Cryospheric Sciences, University of Innsbruck, Innsbruck, Austria
\textsuperscript{4}Earth Observation Ground Segment Department, ESA / ESRIN, Frascati, Italy
\textsuperscript{5}NASA Headquarters, Washington D.C., USA
\textsuperscript{6}Office of Research & Development, US Environmental Protection Agency, Durham, NC, USA

The Pandonia Global Network (PGN) is a worldwide operating network of passive remote sensing spectrometer systems named “Pandora”. PGN is measuring atmospheric trace gases at high temporal resolution with the purpose of air quality monitoring and satellite validation. PGN is an activity carried out jointly by NASA, through the Pandora project at Goddard Space Flight Center, and ESA, through the Austrian contractor LuftBlick, as part of their Joint Program Planning Group Subgroup on calibration and validation and field activities. Many of the more than 50 actual PGN instruments are directly owned by NASA or ESA, another part belongs to other collaborating governmental and academic institutions. A major objective of the PGN is to support the validation and verification of more than a dozen low-earth orbit and geostationary orbit based UV-visible sensors, most notably Sentinel 5P, TEMPO, GEMS and Sentinel 4. PGN instruments are homogeneously calibrated and their data are centrally processed in real-time. Starting in June 2019, the PGN team has made more and more network locations “official PGN sites”, which means all required technical and logistical steps for this purpose have been performed. At the end of 2019 there are 18 such official network sites, where quality assured data are uploaded daily to EVDC (ESA Atmospheric Validation Data Centre), where they are used for operational validation of Sentinel 5P retrievals (see e.g. http://mpc-vdaf-server.tropomi.eu/no2/no2-offl-pandora). The current official PGN data products are total vertical column amounts of NO\textsubscript{2} and O\textsubscript{3} from direct sun observations. Research data products include total vertical columns amounts of SO\textsubscript{2} and HCHO from direct sun observations as well as surface concentrations, tropospheric columns amounts, and vertical profiles for NO\textsubscript{2} and HCHO from sky observations. These named research products are planned to become official over the course of the year 2020.
