

Table 1. Pandora instruments used in this study

N	Owner	Manufactured	Relevant Hardware Components	Contribution to This Study
2	NASA	2011	upgrade in summer 2019: Nylon parts, temperature sensor, wedged window	Temperature (Section 3); Field study (direct sun, Section 5.1)
21	NASA	2011	upgrade in 2016: ARC window; POM-H Delrin parts	Laboratory tests of HCHO emissions (Section 4)
32	NASA	2016	ARC window; POM-H Delrin parts	Field study (direct sun, Section 5.1)
46	NASA	2015	upgrade in 2016 ARC window; POM-H Delrin parts	Laboratory tests of HCHO emissions (Section 4)
108	ECCC	2016	ARC window; POM-H Delrin parts	Field measurements (Section 2)
118	KNMI	2016	ARC window; POM-H Delrin parts	Laboratory tests of HCHO emissions (Section 4)
148	Virginia Tech	2018	temperature sensor (April 2019), wedged window; POM-H Delrin parts	Temperature (Section 3); Laboratory tests of HCHO emissions (Section 4); Field study (MAX-DOAS, Section 5.2)
155	Boston University	2019	temperature sensor; wedged window; POM-H Delrin parts	Temperature (Section 3)
165	EPA	summer 2019	Nylon parts; temperature sensor; wedged window	Laboratory tests of HCHO emissions (Section 4)
167	EPA	summer 2019	Nylon parts; temperature sensor; wedged window	Laboratory tests of HCHO emissions (Section 4)
168	EPA	summer 2019	Nylon parts; temperature sensor; wedged window	Laboratory tests of HCHO emissions (Section 4)

ECCC: Environment and Climate Change Canada; KNMI: Royal Netherlands Meteorological Institute; EPA: US Environmental Protection Agency; NASA: US National Aeronautics and Space Administration

Table 2. History of Pandora hardware changes related to direct sun HCHO measurements

Period	Hardware components	Impact on HCHO	HCHO Data Used
2007 - winter 2016	parallel window, POM-H Delrin	window caused etalloning in direct sun measurements, HCHO emissions from POM-H Delrin - direct sun HCHO is not correctable	MAX-DOAS: Pinardi et al., 2013; Direct Sun: Park et. al., 2018
spring 2016 - 2017	anti reflective coating on parallel widow, POM-H Delrin	ARC degrades within 1 year of installation, temperature dependent HCHO internal emission from POM-H Delrin (disagreement between direct sun total column and MAX-DOAS tropospheric column), can be corrected for functioning ARC	MAX-DOAS: Kreher et al., 2020; Direct Sun: Spinei et al., 2018, Herman et al., 2018; Spinei et al., 2020
2018 - spring 2019	wedged window*, POM-H Delrin	temperature dependent HCHO internal emission from POM-H Delrin (disagreement between direct sun total column and MAX-DOAS tropospheric column), can be corrected	MAX-DOAS: Nowak et al. (2020)
summer 2019-	wedged widow, nylon	believed not to have any interference caused by design (confirmed by extensive laboratory studies)	

Note: HCHO from direct sun is not a standard PGN product and was not provided by the NASA and Luftblick PGN groups outside of KORUS-AQ study (Spinei et al., 2018, Herman et al., 2018). Park et al., 2018 performed HCHO analysis independently and were not aware of any PGN discoveries.

* wedged window are installed on new instruments, if the instruments were not returned to NASA or SciGlob - they are not upgraded, therefore some instruments are probably still have degrading ARC windows