

SUPPLEMENTAL INFORMATION

Satellite image details

Satellite imagery from DigitalGlobe. All imagery was acquired 50cm spatial resolution. Pan sharpening was done by DigitalGlobe, except Halley 2017, which was a panchromatic WV1 image and Dawson Lambton 2018 and Halley 2018 which were four band WV3 30cm resolution images.

Only one image for each colony was used each season. Dates for each image are contained in the first five characters of image reference number as YYMMDD.

Halley Bay:

2009:

2010: 10OCT05103303-S2AS-056856603070

2011: 11OCT21100821-S2AS-056856603080

2012: 12OCT06110626-P2AS-056856603090

2013: 13OCT22100446-S2AS-05685660310

2014: 14SEP22105939-S2AS-05685660311

2015: 15OCT24095527-S2AS-056856603120

2016: No land-fast sea ice, image not required.

2017: 17NOV13100551-S2AS

2018: 18OCT25104437-S2AS-058615655010

Dawson Lambton:

2009: 09OCT13102849-S2AS-056856592240

2010: 10OCT01102054-S2AS-056856598020

2011: 11OCT01100114-S2AS-056856598030

2012: 12OCT14101432-S2AS-056856592250

2013: 13NOV05095002-S2AS-056856598040

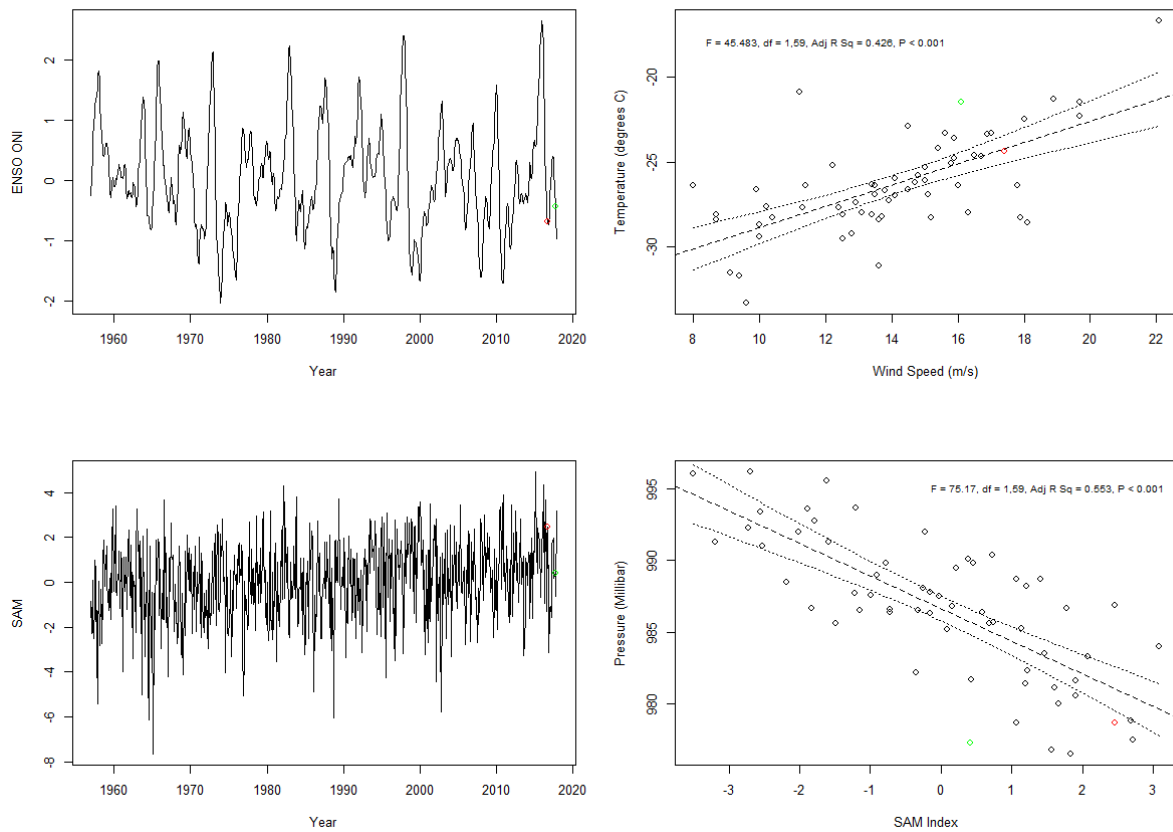
2014: 14OCT26095340-S2AS-056856598010

2015: 15OCT17092452-S2AS-056856598050

2016: 16DEC07094158-S2AS-056856598060

2017: 17DEC09023527-S2AS-057784605200

2018: 18OCT25095456-S2AS_R1C2-058622702010



Supplemental Fig 1. (a) El Niño Southern Oscillation (ENSO) Index (ONI), and (b) Southern Annular Mode (SAM). Averaged surface station records for Halley during September for Halley (1957 to 2017); (c) temperature ($^{\circ}\text{C}$), wind speed (m s^{-1}), (d) pressure (millibars); the record for September 2016 is shown in red and that for September 2017 in green.