# Southern Ocean Clouds, Radiation, Aerosol Transport Experimental Study (SOCRATES) High Resolution Sounding Composite Data Set

## 1.0 Contacts:

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## 2.0 Dataset Overview

This data set contains a composite of the highest vertical resolution (i.e. the "native resolution") upper air sounding data from all sources for the Southern Ocean Clouds, Radiation, Aerosol Transport Experimental Study (SOCRATES) project in the EOL Sounding Composite (ESC) columnar ASCII format. The data set contains 1888 soundings including the dropsonde data (109 soundings) from the NSF/NCAR Gulfstream-V HIAPER aircraft and the radiosonde data from the ships R/V Investigator (234 soundings), RSV Aurora Australis (208 soundings) and from 19 Australia, New Zealand, and Antarctica operational locations (1337 soundings) .

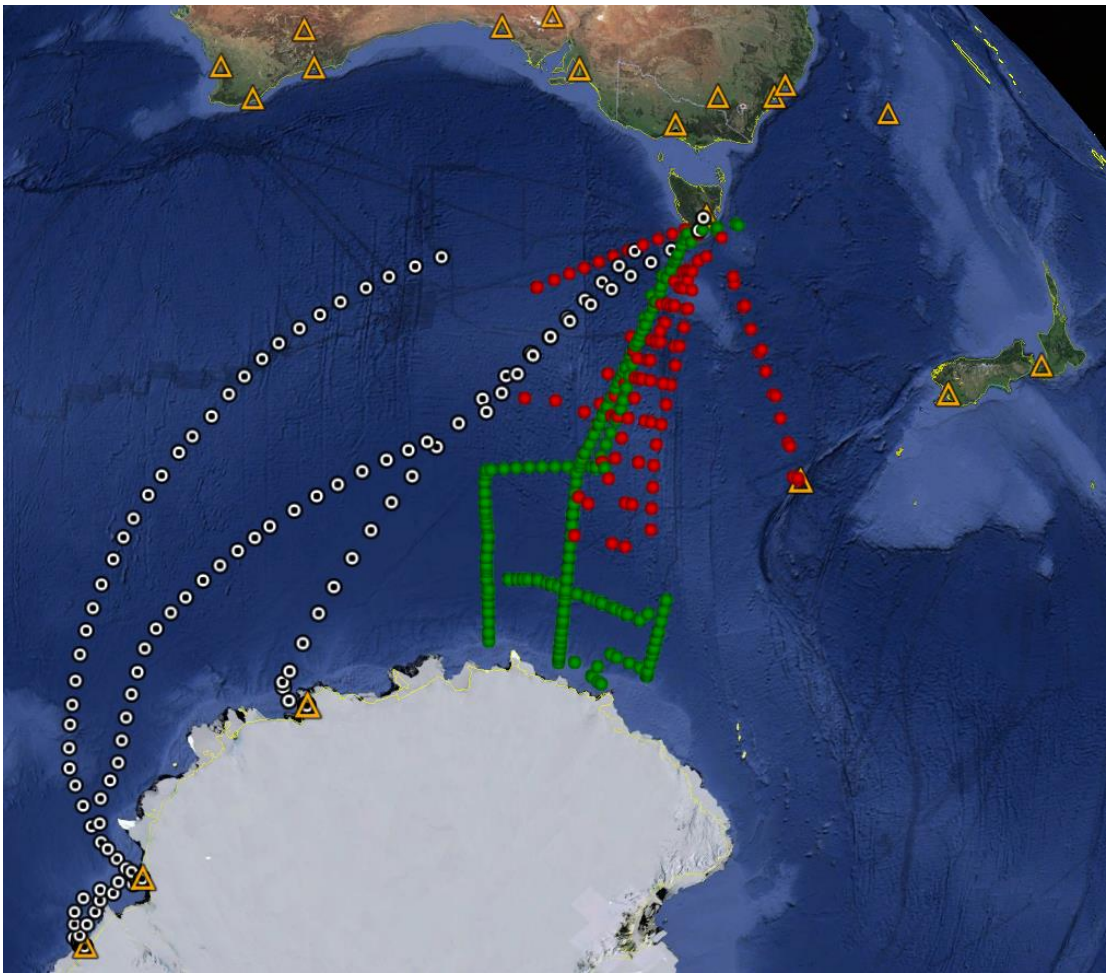

Figure 1. Locations of the soundings included in the SOCRATES high vertical resolution sounding composite data set. The NSF/NCAR GV HIAPER drospondes are red circles, the RSV Aurora Australis radiosondes are white circles, the R/V Investigator radiosondes are green circles, and the operational radiosonde sites are the orange triangles.

## 3.0 Project Overview

The Southern Ocean Clouds, Radiation, Aerosol Transport Experimental Study (SOCRATES) is a research program to improve our understanding of clouds, aerosols, air-sea exchanges, and their interactions over the Southern Ocean. SOCRATES utilized the NSF/NCAR GV HIAPER aircraft based out of Hobart, Tasmania. There were additional projects occurring at the same time that were cooperating with SOCRATES, these included the DOE/ARM MARCUS (Measurements of Aerosols, Radiation, and Clouds over the Southern Ocean) project which used the RSV Aurora Australis, the DOE/ARM MICRE (Macquarie Island Cloud and Radiation Experiment) and the Australian CAPRICORN (Clouds, Aerosols, Precipitation Radiation and atmospherIc Composition Over the southeRN ocean) project which utilized the RV Investigator. Further information on SOCRATES is available at the SOCRATES web site at NCAR/EOL: https://www.eol.ucar.edu/field_projects/socrates and information on the SOCRATES deployments is available at the SOCRATES Field Catalog: http://catalog.eol.ucar.edu/socrates.

## 4.0 EOL Sounding Composite (ESC) File Format Description

The ESC is a columnar ASCII format consisting of 15 header records for each sounding followed by the data records with associated data quality flags.

### 4.1 Header Records

The header records (15 total records) contain a variety of metadata about the sounding (i.e. location, time, radiosonde type, etc). The first five header lines contain information identifying the sounding, and have a rigidly defined form. The following 7 header lines are used for auxiliary information and comments about the sounding, and may vary from dataset to dataset. The last 3 header records contain header information for the data columns. Line 13 holds the field names, line 14 the field units, and line 15 contains dashes ('-' characters) delineating the extent of the field.

The file standard header lines are as follows:

| Line | Label (padded to 35 char) | Contents |
|---|---|---|
| 1 | Data Type: | Description of the type and resolution of data |
| 2 | Project ID: | Short name for the field project |
| 3 | Release Site Type/Site ID: | Description of the release site. |
| 4 | Release Location (lon,lat,alt): | Location of the release site. |
| 5 | UTC Release Time (y,m,d,h,m,s): | Time of release. |

The release location is given as:
lon (deg min), lat (deg min), lon (dec. deg), lat (dec. deg), alt (m)

Longitude in deg min is in the format: ddd mm.mm'W where ddd is the number of degrees (with leading zeros if necessary), mm.mm is the decimal number of minutes, and W represents W or E for west or east longitude, respectively. Latitude has the same format as longitude, except there are only two digits for degrees and N or S for north/south latitude.

The time of release is given as: yyyy, mm, dd, hh:nn:ss.
Where yyyy is the year, mm is the month, dd is the day of month, and hh:nn:ss are the UTC hour, minute, and second respectively.

The seven non-standard header lines may contain any label and contents. The labels are padded to 35 characters to match the standard header lines. For this composite data set these non-standard header lines vary depending on the data source. See the individual data set readmes for details.

### 4.2 Data Records

The data records each contain time from release, pressure, temperature, dew point, relative humidity, U and V wind components, wind speed and direction, ascent rate, balloon position data, altitude, and quality control flags (see the QC code description). Each data line contains 21 fields, separated by spaces, with a total width of 130 characters. The data are right-justified within the fields. All fields have one decimal place of precision, with the exception of latitude and longitude, which have three decimal places of precision. The contents and sizes of the 21 fields that appear in each data record are as follows:

| Field | Width | Format | Parameter | Units | Missing Value |
|---|---|---|---|---|---|
| 1 | 6 | F6.1 | Time since release | Seconds | 9999.0 |
| 2 | 6 | F6.1 | Pressure | Millibars | 9999.0 |
| 3 | 5 | F5.1 | Dry-bulb Temperature | Degrees C | 999.0 |
| 4 | 5 | F5.1 | Dew Point Temperature | Degrees C | 999.0 |
| 5 | 5 | F5.1 | Relative Humidity | Percent | 999.0 |
| 6 | 6 | F6.1 | U Wind Comp | m/s | 9999.0 |
| 7 | 6 | F6.1 | V Wind Comp | m/s | 9999.0 |
| 8 | 5 | F5.1 | Wind speed | m/s | 999.0 |
| 9 | 5 | F5.1 | Wind direction | Degrees | 999.0 |
| 10 | 5 | F5.1 | Ascent Rate | m/s | 999.0 |
| 11 | 8 | F8.3 | Longitude | Degrees | 9999.0 |
| 12 | 7 | F7.3 | Latitude | Degrees | 999.0 |
| 13 | 5 | F5.1 | Elevation Angle | Degrees | 999.0 |
| 14 | 5 | F5.1 | Azimuth Angle | Degrees | 999.0 |
| 15 | 7 | F7.1 | Geopotential Altitude | Meters | 99999.0 |
| 16 | 4 | F4.1 | QC for Pressure | Code | 99.0 |
| 17 | 4 | F4.1 | QC for Temperature | Code | 99.0 |
| 18 | 4 | F4.1 | QC for Humidity | Code | 99.0 |
| 19 | 4 | F4.1 | QC for U Wind | Code | 99.0 |
| 20 | 4 | F4.1 | QC for V Wind | Code | 99.0 |
| 21 | 4 | F4.1 | QC for Ascent Rate | Code | 99.0 |

Fields 16 through 21 contain the data quality flags from the NCAR/Earth Observing Laboratory (EOL) sounding quality control procedures. The data quality flags are defined as follows:

| Code | Description |
|---|---|
| 1.0 | Checked, datum seems physically reasonable. (“GOOD”) |

| | |
|---|---|
| 2.0 | Checked, datum seems questionable on a physical basis. (“MAYBE”) |
| 3.0 | Checked, datum seems to be in error. (“BAD”) |
| 4.0 | Checked, datum is interpolated. (“ESTIMATED”) |
| 9.0 | Checked, datum is missing. (“MISSING”) |
| 99.0 | Unchecked (QC information is “missing”.) (“UNCHECKED”) |

### 4.3 Data Specifics

Details on the radiosonde systems included in this data set are included in this section. Links are included to the documentation for the individual sounding data sets for details on processing and quality control.

**NSF/NCAR Gulfstream-V HIAPER Aircraft Dropsondes**

109 total dropsondes with 0.5 second vertical resolution pressure/temperature/humidity and 0.25 second resolution winds

56 Vaisala RD94 dropsondes

53 Vaisala RD41 dropsondes

http://data.eol.ucar.edu/datafile/nph-get/552.010/readme_SOCRATES_GV_dropsonde_ESC_V1.pdf

**RSV Aurora Australis Radiosondes**

208 total radiosondes at 2 second vertical resolution

Vaisala RS92-SGP and Vaisala DigiCORA 3.64 sounding system

http://data.eol.ucar.edu/datafile/nph-get/552.036/readme_SOCRATES_Australis_ESC.pdf

**RV Investigator Radiosondes**

234 total radiosondes at 1 second vertical resolution

Vaisala RS41-SGP and Vaisala DigiCORA MW41 2.4.0 sounding system

http://data.eol.ucar.edu/datafile/nph-get/552.008/readme_socrates_2018_radiosondes_20181128.pdf

**Adelaide, Australia Radiosondes**

89 radiosondes at 2 second vertical resolution (typically at 00 and 12 UTC)
Source – GTS real time BUFR data
Radiosonde Type - Vaisala RS92
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds - GPS
Sounding System Software - Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Albany, Australia Radiosondes and Pibals**

29 radiosondes at 2 second vertical resolution (typically at 00 UTC)
18 pibals at 2 second vertical resolution (wind only; typically at 06 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS92

Pibal Type – Vaisala RS90
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS for radiosonde, radar for pibal
Sounding System Software – Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Casey, Antarctica Radiosondes**

92 radiosondes at 2 second vertical resolution (typically at 00 and 12 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS92
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS
Sounding System Software – Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Ceduna, Australia Radiosondes**

14 radiosondes at 2 second vertical resolution (typically one per week on Tuesdays at 00 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS41 AUTOSONDE
Humidity Sensor – Humicap capacitance sensor with active de-icing method
Pressure Sensor – Derived from GPS height
Temperature Sensor – Resistive sensor
Winds – GPS
Sounding System Software – Digicora III MW41 2.6.1
Solar and infrared correction - applied by radiosonde system
Humidity corrections – Solar radiation and time lag correction provided by manufacturer
Geopotential Height - calculated from GPS height
No data quality issues of note

**Davis, Antarctica Radiosondes**

93 radiosondes at 2 second vertical resolution (typically at 00 and 12 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS92
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS
Sounding System Software – Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system

No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Esperance, Australia Radiosondes and Pibals**

27 radiosondes at 2 second vertical resolution (typically at 00 UTC)
27 pibals at 2 second vertical resolution (wind only; typically at 06 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS92
Pibal Type – Vaisala RS90
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS for radiosonde, radar for pibal
Sounding System Software – Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Hobart, Tasmania Radiosondes and Pibals**

89 radiosondes at 2 second vertical resolution (typically at 00 and 12 UTC)
71 pibals at 2 second vertical resolution (wind only; typically at 06 and 18 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS92
Pibal Type – Vaisala RS90
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS for radiosonde, radar for pibal
Sounding System Software – Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Invercargill, New Zealand Radiosondes**

90 radiosondes at 2 second vertical resolution (typically at 10 and 22 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS41
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS
Sounding System Software – Digicora III MW41 2.3.0
Solar and infrared correction applied by radiosonde system
Humidity corrections - Solar radiation and time lag correction provided by manufacturer
Geopotential Height - calculated from pressure
No data quality issues of note

**Kalgoorlie, Australia Radiosondes**

30 radiosondes at 2 second vertical resolution (typically at 00 UTC)
Source – GTS real time BUFR data
Radiosonde Type - Vaisala RS92 Autosonde
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds - GPS
Sounding System Software - Digicora III AS14 3.66.0B
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Lord Howe Island Radiosondes**

24 radiosondes at 2 second vertical resolution (typically at 00 UTC)
Source – GTS real time BUFR data
Radiosonde Type - Vaisala RS92 Autosonde
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds - GPS
Sounding System Software - Digicora III AS14 3.66.0B
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Macquarie Island Radiosondes**

90 radiosondes at 2 second vertical resolution (typically at 00 and 12 UTC)
Source – GTS real time BUFR data
Radiosonde Type - Vaisala RS92
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds - GPS
Sounding System Software - Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Mawson, Antarctica Radiosondes**

45 radiosondes at 2 second vertical resolution (typically at 12 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS92
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS
Sounding System Software – Digicora III MW31 3.66B

Solar and infrared correction applied by radiosonde system
Humidity corrections – None
Geopotential Height calculated from pressure
A few soundings have very low RH values near the surface.

**Melbourne, Australia Radiosondes**

99 radiosondes at 2 second vertical resolution (typically at 00 and 12 UTC)
Source – GTS real time BUFR data
Radiosonde Type - Vaisala RS92 (through 2316 UTC 25 February) and Vaisala RS41 (starting 0355 UTC 26 February)
Humidity Sensor – Vaisala RS90 (with RS92 sondes) and Humicap capacitance sensor with active de-icing method (with RS41 sondes)
Pressure Sensor – Capacitance Aneroid (with RS92 sondes) and derived from GPS (with RS41 sondes)
Temperature Sensor – Capacitance Bead (with RS92 sondes) and resistive sensor (with RS41 sondes)
Winds - GPS
Sounding System Software - Digicora III MW31 3.64.1 (with RS92 sondes) and MW41 2.6.1 (with RS41 sondes)
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from GPS height
No data quality issues of note

**Paraparamu, New Zealand Radiosondes**

91 radiosondes at 2 second vertical resolution (typically at 10 and 22 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS41
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS
Sounding System Software – Digicora III MW41 2.2.1
Solar and infrared correction applied by radiosonde system
Humidity corrections - Solar radiation and time lag correction provided by manufacturer
Geopotential Height - calculated from pressure
No data quality issues of note

**Perth, Australia Radiosondes and Pibals**

90 radiosondes at 2 second vertical resolution (typically at 00 and 12 UTC)
77 pibals at 2 second vertical resolution (wind only; typically at 06 and 18 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS92
Pibal Type – Vaisala RS90
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS for radiosonde, radar for pibal
Sounding System Software – Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system

No humidity corrections applied
Geopotential Height calculated from pressure
No data quality issues of note

**Sydney, Australia Radiosondes**

44 radiosondes at 2 second vertical resolution (typically at 19 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS92
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS
Sounding System Software – Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system
Humidity corrections – None
Geopotential Height calculated from pressure
No data quality issues of note

**Wagga Wagga, Australia Radiosondes and Pibals**

16 radiosondes at 2 second vertical resolution (typically at 00 UTC)
14 pibals at 2 second vertical resolution (wind only; typically at 00 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS92
Pibal Type – Vaisala RS90
Humidity Sensor – Vaisala RS90
Pressure Sensor – Capacitance Aneroid
Temperature Sensor – Capacitance Bead
Winds – GPS for radiosonde, radar for pibal
Sounding System Software – Digicora III MW31 3.66B
Solar and infrared correction applied by radiosonde system
No humidity corrections applied
Geopotential Height calculated from pressure
2320 UTC 20 Feb sounding has noisy data stream

**Williamtown, Australia Radiosondes**

49 radiosondes at 2 second vertical resolution (typically at 00 UTC)
Source – GTS real time BUFR data
Radiosonde Type – Vaisala RS41 AUTOSONDE
Humidity Sensor – Humicap capacitance sensor with active de-icing method
Pressure Sensor – Derived from GPS height
Temperature Sensor – Resistive sensor
Winds – GPS
Sounding System Software – Digicora III MW41 2.6.1
Solar and infrared correction - applied by radiosonde system
Humidity corrections – Solar radiation and time lag correction provided by manufacturer
Geopotential Height - calculated from GPS height
No data quality issues of note

**Woomera, Australia Radiosondes**

41 radiosondes at 2 second vertical resolution (typically at 00 UTC)

Source – GTS real time BUFR data

Radiosonde Type – Vaisala RS41 AUTOSONDE (RS92 Autosonde 14/15 January)

Humidity Sensor – Humicap capacitance sensor with active de-icing method (Vaisala RS90 14/15 January)

Pressure Sensor – Derived from GPS height (capacitance aneroid 14/15 January)

Temperature Sensor – Resistive sensor (capacitance bead 14/15 January)

Winds – GPS

Sounding System Software – Digicora III MW41 2.6.1 (AS14 3.66.0B 14/15 January)

Solar and infrared correction - applied by radiosonde system

Humidity corrections – Solar radiation and time lag correction provided by manufacturer (no correction 14/15 January)

Geopotential Height - calculated from GPS height (from pressure 14/15 January)

No data quality issues of note

The data are in files by day, so all soundings for a particular day are concatenated into a single file ordered by time. The file naming convention is:

SOCRATES_HighRes_yyyymmdd.cls where yyyy is the year, mm is the month, and dd is the day of the month.

### 4.4 Sample Data

The following is a sample of the high resolution radiosonde data in ESC format.

```
Data Type:                          AVAPS SOUNDING DATA, Channel 1/Descending
Project ID:                         SOCRATES
Release Site Type/Site ID:          Gulfstream V/N677F
Release Location (lon,lat,alt):     145 48.54'E, 46 44.40'S, 145.809, -46.740, 6142.6
UTC Release Time (y,m,d,h,m,s):     2018, 01, 19, 01:32:20
Sonde Id/Sonde Type:                171330194/RSS421
Reference Launch Data Source/Time: IWGADTS Format (IWG1)/01:32:21
System Operator/Comments:           Remote Operator/none, none
Post Processing Comments:           Aspen V3.3-693; Created on 13 Sep 2018 17:37 UTC; Configuration mini-dropsonde
/
/
Nominal Release Time (y,m,d,h,m,s):2018, 01, 19, 01:32:20
 Time  Press  Temp  Dewpt  RH    Ucmp   Vcmp   spd   dir   Wcmp     Lon      Lat   Ele   Azi    Alt    Qp   Qt   Qrh  Qu   Qv   QdZ
  sec    mb     C     C     %     m/s    m/s   m/s   deg   m/s      deg      deg   deg   deg     m    code code code code code code
------ ------ ----- ----- ----- ------ ------ ----- ----- ----- -------- -------- ----- ----- ------- ---- ---- ---- ---- ---- ----
 460.0 1010.1  11.5   5.6  66.8 9999.0 9999.0 999.0 999.0 999.0 9999.000 999.000 999.0 999.0     0.0  1.0  1.0  1.0  9.0  9.0  9.0
 459.5 9999.0 999.0 999.0 999.0 9999.0 9999.0 999.0 999.0 999.0 9999.000 999.000 999.0 999.0 99999.0  9.0  9.0  9.0  9.0  9.0  9.0
 459.2 1009.0  11.5 999.0 999.0 9999.0 9999.0 999.0 999.0 -11.5 9999.000 999.000 999.0 999.0     9.1  1.0  1.0  9.0  9.0  9.0 99.0
```

### 4.5 Station List

| Site ID | WMO ID | Site Name | Country | Latitude | Longitude | Elev (m) |
|---|---|---|---|---|---|---|
| N677F | N/A | GV HIAPER | US | Mobile | Mobile | Mobile |
| VNAA | N/A | RSV Aurora Australis | AU | Mobile | Mobile | Mobile |

| | | | | | | |
|---|---|---|---|---|---|---|
| VLMJ | N/A | R/V Investigator | AU | Mobile | Mobile | Mobile |
| | 94672 | Adelaide | AU | -34.952 | 138.520 | 2 |
| | 94802 | Albany | AU | -34.950 | 117.800 | 69 |
| | 89611 | Casey | AQ | -66.283 | 110.523 | 41 |
| | 94653 | Ceduna | AU | -32.130 | 133.698 | 16 |
| | 89571 | Davis | AQ | -68.575 | 77.966 | 18 |
| | 94638 | Esperance | AU | -33.831 | 121.891 | 27 |
| | 94975 | Hobart | AU | -42.839 | 147.499 | 22 |
| | 93844 | Invercargill | NZ | -46.418 | 168.330 | 2 |
| | 94637 | Kalgoorlie | AU | -30.784 | 121.454 | 366 |
| | 94995 | Lord Howe Island | AU | -31.542 | 159.077 | 7 |
| | 94998 | Macquarie Island | AU | -54.499 | 158.937 | 6 |
| | 89564 | Mawson | AQ | -67.602 | 62.874 | 10 |
| | 94866 | Melbourne | AU | -37.670 | 144.830 | 113 |
| | 93417 | Paraparaumu | NZ | -40.905 | 174.984 | 7 |
| | 94610 | Perth | AU | -31.928 | 115.976 | 15 |
| | 94767 | Sydney | AU | -33.948 | 151.173 | 5 |
| | 94910 | Wagga Wagga | AU | -35.160 | 147.460 | 223 |
| | 94776 | Williamtown | AU | -32.793 | 151.836 | 9 |
| | 94659 | Woomera | AU | -31.156 | 136.805 | 167 |

## 5.0 Data Quality Control Procedures

1. Each sounding was converted from its original format into the ESC format described above.

2. Each sounding was passed through a set of automated data quality checks which included basic gross limit checks as well as rate of change checks. This is further described in Section 4.1.

3. Each sounding was visually examined utilizing the NCAR/EOL XQC sounding quality control software. This is further described in Section 4.2.

## 5.1 Automated Data Quality Checks

This data set was passed through a set of automated data quality checks. This procedure includes both gross limit checks on all parameters as well as rate-of-change checks on temperature, pressure, and ascent rate. A version of these checks is described in Loehrer et al. (1996) and Loehrer et al. (1998).

### 5.1.1 Gross Limit Checks

These checks were conducted on each sounding and the data quality flags in the ESC files were adjusted as appropriate. Only the data point under examination was flagged. All checks also produced warning messages that specified the location of the

problem and the severity of the issue. These warning messages where then summarized statistically and examined to determine any consistent issues.

For this data set NCAR/EOL conducted the following gross limit checks. In the table P = pressure, T = temperature, RH = relative humidity, U = U wind component, V = V wind component, B= bad, and Q = questionable.

| Parameter | Check | Parameter(s) Flagged | Flag Applied |
|---|---|---|---|
| Pressure | <0 or > 1050 | P | B |
| Altitude | < 0 or >40000 | P, T, RH | Q |
| Temperature | < -90 or > 45 | T | B |
| Dew Point | < -99.9 or > 33<br>> T | RH<br>T, RH | Q<br>Q |
| Wind Speed | < 0 or > 100<br>> 150 | U, V<br>U, V | Q<br>B |
| U Wind | < 0 or > 100<br>> 150 | U<br>U | Q<br>B |
| V Wind | < 0 or > 100<br>> 150 | V<br>V | Q<br>B |
| Wind Direction | < 0 or > 360 | U, V | B |
| Ascent Rate | < -10 or > 10 | P, T, RH | Q |

### 5.1.2 Vertical Consistency Checks

These checks were conducted on each sounding and the data quality flags in the ESC files were adjusted as appropriate. These checks were started at the surface and compared each neighboring data record. In the case of checks that ensured that the values increased/decreased as expected, only the data point under examination was flagged. However, for the other checks, all of the data points used in the examination were flagged. All items within the table are as previously defined. All checks also produced warning messages that specified the location of the problem and the severity of the issue. These warning messages where then summarized statistically and examined to determine any consistent issues.

| Parameter | Check | Parameter(s) Flagged | Flag Applied |
|---|---|---|---|
| Time | Decreasing/equal | None | None. |
| Altitude | Decreasing/equal | P, T, RH | Q |
| Pressure | Increasing/equal<br>> 1mb/s or < -1mb/s<br>> 2mb/s or < -2mb/s | P, T, TH<br>P, T, TH<br>P, T, TH | Q<br>Q<br>B |
| Temperature | < -15°C/km<br>< -30°C/km<br>> 50°C/km<br>> 100°C/km | P, T, RH<br>P, T, RH<br>P, T, RH<br>P, T, RH | Q<br>B<br>Q<br>B |
| Ascent Rate | > 3m/s or < -3m/s<br>> 5m/s or < -5m/s | P<br>P | Q<br>B |

### 5.2 Visual Data Quality Checks

Each sounding was visually examined using the NCAR/EOL XQC sounding data quality control software. This software allows the user to view a skew-t/log-p diagram of

each sounding and apply data quality flags as appropriate. The user can zoom in on sections of soundings for detailed examination and can adjust the data quality flags for an individual point, sections of soundings, or entire soundings for each parameter individually. The software also allows the user to override the quality flags applied by the automated procedure.

### 5.3 Data Quality Issues of Note

See the readme files linked above for details on the data quality issues in each individual sounding data set.

## 6.0 References


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