

Deep-Propagating Gravity Wave Experiment (DEEPWAVE) COSMIC Radio Occultation Soundings Data Set

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2.0 Dataset Overview

The Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) mission is a constellation of six microsattellites in a 512 km orbit that provide radio occultation soundings throughout the globe. This data set includes select COSMIC soundings from the region around New Zealand and southeastern Australia (Figure 1) during the DEEPWAVE field season (6 June to 20 July 2014). A total of 68 soundings are contained in the final DEEPWAVE data set.

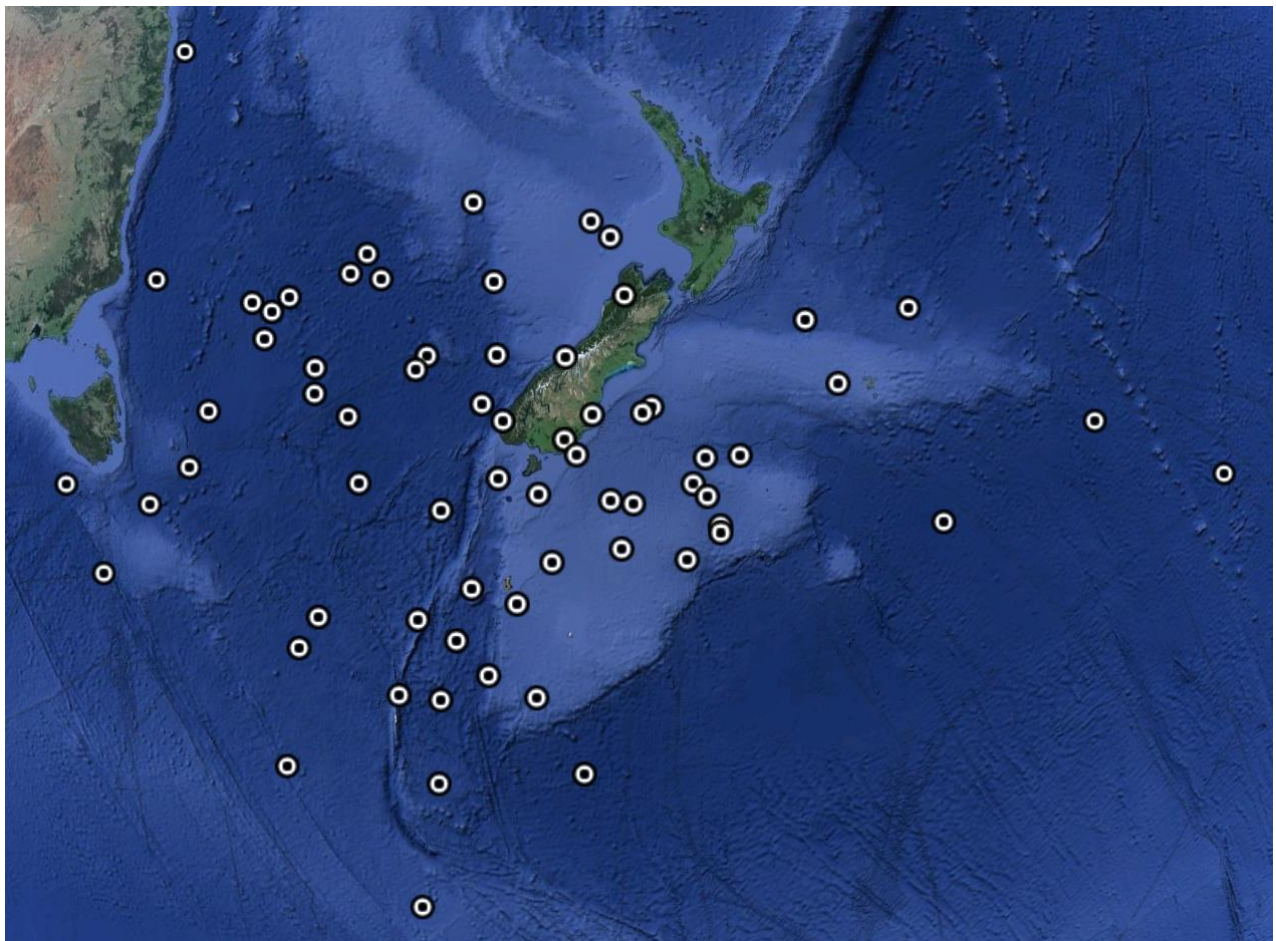


Figure 1. Location of the COSMIC radio occultation soundings in this data set.

The Deep-Propagating Gravity Wave Experiment (DEEPWAVE) was a field campaign aimed at examining the dynamics of gravity waves from the surface of the Earth to the mesosphere and lower thermosphere. The NSF/NCAR HIAPER Gulfstream-V and DLR Falcon research aircraft were deployed along with a variety of surface-based instrumentation including surface meteorological networks, radars and lidars, sounding systems and regional models. Observations were focused around New Zealand due to it being an ideal natural laboratory to study deep propagating gravity waves and being one of the global gravity wave hot-spots in the upper stratosphere. Further information on DEEPWAVE is available at the DEEPWAVE web site: https://www.eol.ucar.edu/field_projects/deepwave and information on DEEPWAVE operations is available at the DEEPWAVE Field Catalog: <http://catalog.eol.ucar.edu/deepwave/>.

3.0 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.

3.1 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. Records for this data set include the following non-standard header lines:

Line	Label (padded to 35 char)	Contents

The nominal release time for these soundings is the same as the actual time.

3.2 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	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")

3.3 Data Specifics

The files contain data at one hundred meter vertical intervals up to 39900 m.

The data are in files by individual sounding. The file naming convention is:

COSMIC_yyyymmddhhnn.cls.qc where yyyy is the year, mm is the month, dd is the day of the month, hh is the hour, and nn is the minute. All dates and times are UTC.

The altitudes in these files are the geometric altitudes provided by COSMIC.

The relative humidity and dew point were derived from the vapor pressure data provided by COSMIC using the saturation vapor pressure formulation from WMO (2008). Dew point values less than -99.9 C are reset to the missing value (999.0) as they exceed the format width.

The dates, times, and locations used in the header are taken from the global attributes of the COSMIC netCDF data files.

The wind parameters are entirely missing in this data set.

3.4 Sample Data

The following is a sample of the COSMIC radio occultation sounding data in ESC format.

```

Data Type:                COSMIC Radiosonde/Ascending
Project ID:                DEEPWAVE
Release Site Type/Site ID: COSMIC
Release Location (lon,lat,alt): 177 42.29'E, 46 39.46'S, 177.705, -46.658, 0.0
UTC Release Time (y,m,d,h,m,s): 2014, 06, 06, 06:11:40
Sonde Type:                COSMIC Radio Occultation Soundings
/
/
/
/
/
Nominal Release Time (y,m,d,h,m,s):2014, 06, 06, 06:11:40
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
-----
9999.0 918.4   5.6   -5.3   45.3 9999.0 9999.0 999.0 999.0 999.0 9999.000 999.000 999.0 999.0 900.0 99.0 99.0 99.0 9.0 9.0 9.0
9999.0 907.3   5.7   -6.1   42.6 9999.0 9999.0 999.0 999.0 999.0 9999.000 999.000 999.0 999.0 1000.0 99.0 99.0 99.0 9.0 9.0 9.0
9999.0 896.2   5.6   -6.8   40.6 9999.0 9999.0 999.0 999.0 999.0 9999.000 999.000 999.0 999.0 1100.0 99.0 99.0 99.0 9.0 9.0 9.0

```

4.0 Data Quality Control Procedures

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

2. Each sounding was visually examined utilizing the NCAR/EOL XQC sounding quality control software. This is further described in Section 4.1.

4.1 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. Only data up to 50 mb is checked in this fashion.

4.2 Data Quality Issues of Note

The data quality control procedures outlined above allows us to identify and, in some cases, resolve issues that could potentially impact research performed using these data sets. The following issues were noted in these soundings.

A few soundings have data that stops well above the surface:

- 201406111140 – 868mb
- 201406130750 – 434mb
- 201406140719 – 363mb
- 201406190635 – 783mb
- 201406240620 – 810mb
- 201407040731 – 763mb

5.0 References

COSMIC Web Site - <http://www.cosmic.ucar.edu>