data summary

Southern Surveyor Voyage ss200901

CSIRO

MARINE NATIONAL FACILITY

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ss200901

Title

"Monitoring Ocean Climate Change around Australia: Deep Ocean Time Series Section (DOTSS) along 170^{o}W between 50^{o}S and the Equator."

Principal Investigator

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Ports

Wellington, Nuku'alofa (Tonga), Suva (Fiji)

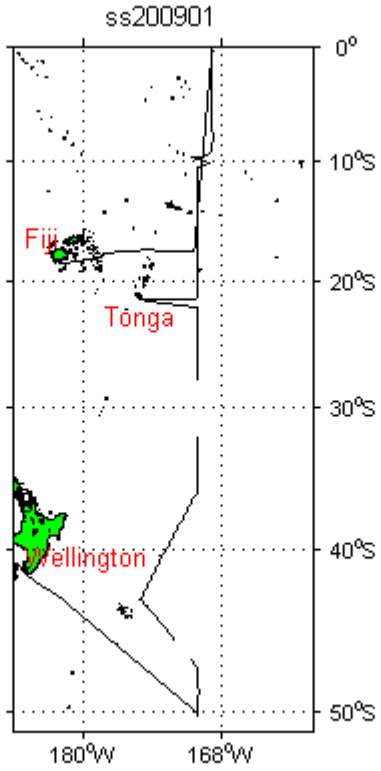
Original schedule:
Depart Wellington, New Zealand 1000hrs 3 February 2009
Arrive Nuku'alofa, Tonga 0800hrs 26 February 2009, resupply and science crew change over
Depart Nuku'alofa, Tonga 1600hrs 26 February 2009
Arrive Suva, Fiji 0800hrs 24 March 2009 and demobilise

Date

03-Feb-2009 02:29:30 to 23-Mar-2009 11:50:55 (UTC)

Voyage Track

It should be noted that the missing sections in the voyage track is caused by the lack of navigation data. This is documented in the later sections of this document.



Underway Data

Navigation data is acquired using the Seapath 200 position and reference unit, which is also differentially corrected by data from the FUGRO DGPS receiver.

The Meteorological data consists of 2 relative humidity and temperature sensors; a barometer, wind sensor, and licor light sensor.

Thermosalinograph data is acquired with a Seabird TSG and remote temperature SBE 3T. Data from a flow meter is also recorded.

Digital depth data is recorded from a Simrad EA500 sounder. Echograms are also recorded using SonarData's Echolog software. Digital depth data can be re-picked using SonarData's Echoview software.

Data from "IMOS" (Integrated Marine Observing System) sensors was also included. The sensors are port and starboard radiometers and pyranometers; wind speed and gust along with direction; rain and rainrate.

See Electronics report for this voyage for instruments used and serial numbers.

Navigation, meteorological, thermosalinograph, IMOS and depth data are quality controlled by combining all data from hourly recorded files to 5 second values in a netCDF formatted file; the combined data is referred to as "underway data".

A combined file was made on 20 Jan 2010 by running a Java application, written by Lindsay Pender of CMAR, uwyLogger version 7.11 with data time range of 03-Feb-2009 02:29:30 to 23-Mar-2009 11:50:55 (UTC).

Completeness and Data Quality

Navigation data (latitude and longitude, speed over ground, course over ground, ship's heading); meteorological data (port and starboard air temperature, humidity, wind speed, wind direction, maximum wind gust, light, atmospheric pressure, uncorrected wind speed and direction) and IMOS data (port and starboard radiometers, port and starboard pyranometers, derived wind speed and direction, derived maximum wind gust, derived maximum wind gust direction, rain and rainrate, uncorrected wind speed and direction), thermosalinograph (salinity and water temperature) data and depth data were evaluated and quality controlled.

Processing Comments

The ship was in port between 25-Feb-2009 18:49:55 and 26-Feb-2009 23:00:20 at Nuku'alofa, Tonga , for resupply and science crew change over. It should be noted that the underway systems continued to run and collect data during this period. This data is contained in the released underway data files for completeness.

There is missing underway data between approximately 18-Feb-2009 05:00:45 to 20-Feb-2009 19:47:25 . This was caused by lack of power due to UPS failure which resulted in FDCS system crashing. Following restoration of power there were FDCS configuration problems which took a notable time to resolve (partially due to the DAP support personnel sustaining a broken shoulder bone at that time).

Moreover, there are some missing Nav, Met and IMOS data and the reason is unknown. The main missing data are approximately on;
IMOS and Met data: 8-Feb-09 16:59:10 to 17:03:50, 10-Feb-2009 21:04:15 to 23:56:15 and 11-Feb-2009 10:17:25 to 10:35:20 and 25-Feb-2009 02:30:35 to 03:11:30
and
Nav data: 8-Feb-09 17:20:50 to 9-Feb-09 14:35:50 and 10-Feb-2009 21:04:15 to 23:56:15 and 11-Feb-2009 00:47:50 to 01:53:15 and 11-Feb-2009 10:17:25 to 10:35:20 and 25-Feb-2009 02:30:35 to 03:11:30

The starboard humidity sensor calibration is suspect and therefore the port humidity sensor data was used only to represent humidity. The humidity data was then flagged as 'good' 'none' 'none'.

A number of discrepancies between the port and starboard air temperature sensors were noted (differences of about 1 degree). These occurred usually during periods of rapid temperature increase or decrease. Investigation of these indicated that they have frequently occurred during/following periods of rainfall and coincided with medium to high wind speeds of about 20-40 knots blowing on the bow of the ship. This phenomenon has probably come about due to the cooling of the air temperature due to the evaporation of the rain water around the sensor housing. It is unclear as to why there should be a notable temperature differential between the port and starboard temperature sensors.
It should be noted that the result of this variation between the port and starboard sensor causes the derived air temperature (as calculated by underway logger whereby it uses the sensor data output from the opposite side to the prevailing wind direction, e.g. using port sensor when the relative wind is on the starboard and vice versa) to alternate between the port and starboard air temperature values depending on the relative wind direction. This has resulted in regular spikes (noise) in the derived air temperature during these periods which is misleading. For this reason, it has been decided to include both port and starboard air temperature in the CSV output files. The derived air temperature is not provided because of the uncertainty about which sensor is giving the correct out put. Furthermore, the introduced noise in the derived air temperature data, under the described circumstances, is not desirable.

A number of spike like large temperature increases were noted (e.g. max rise of about 4 degrees in about four minutes followed by similar falls) for both port and starboard temperature sensors.
These rapid temperature changes were most likely caused due to the warming up effect of the metal structures and/or the ship's engine exhaust, blowing over the sensors, when the wind is blowing on the stern of the ship. The sensor values for the ship speed, uncorrected wind direction, wind speed and port/starboard temperature were closely examined for correlation and the following two conditions were indentified as prevalent during the periods of rapid temperature changes:

1) The ship stationary with low wind speed in the region of 5 knots blowing on the stern (i.e. uncorrected wind direction around 135 to 225 degrees).
2) The ship cruising at about 10 knots with wind speed in the region of 15-50 knots blowing on the stern (i.e. uncorrected wind direction around 135 to 225 degrees).

Similarly, a number of spike like decreases were noted for both port and starboard temperature sensors. Correlation with other sensor data seems to indicate that these mainly coincided with period of rain falls.

All recorded port and starboard air temperature values have been left in the data set. Periods of rapid changes are suspect for reasons highlighted above, otherwise the data is good. The QC flags for the port and starboard air temperature have been left as ‘noQC’,’none’,’preliminary’.

Missing or suspect maxWindGust and IMOSMaxWindGust were set to NaNs and their QC flags set to ‘bad ‘none’ ‘noData’ and suspect', 'none', 'operatorFlagged' accordingly.

The depth data was re-picked using Sonar Data’s Echoview software. The echogram depth data on the first leg of the voyage was not recorded due to a miscomprehension about the capabilities of the newly deployed TECHSAS underway system. Therefore due to the lack of echogram data for the first leg, only the depth data for the second leg of the voyage, covering the period of 26-Feb-2009 21:25:38 to 23-Mar-2009 01:44:34 (UTC), could be quality controlled. The non-quality controlled basic depth data is available for the whole voyage (leg 1 and 2) in the netCDF file under the variable name rawWaterDepth. It should however be noted that this non-QCed data is likely to contain significant errors and its use is not recommended.

There were a number of water temperature spikes. These were investigated by comparing the values against the TSG sensor temperature and they were found to be erroneous. Therefore they were set to NaN and their QC flags set to 'bad','none','operatorFlagged'

During recent processing of voyage data and TSG/CTD calibration, the examination of the overlapped salinity plots have shown a notable discrepancy in the TSG salinity relative to the CTD salinity.
The investigation of this anomaly has not been conclusive so far. However examination of TSG data has revealed that if the TSG conductivity is advanced by about 32 seconds relative to the TSG sensor temperature, when calculating the derived salinity, a significant improvement in TSG salinity relative to the CTD salinity is obtained.

Whilst this issues is being investigated further, a conductivity lag correction factor is introduced as part of TSG calibration and utilised for the calculation and processing of TSG salinity. This lag factor is henceforth documented in this processing report.

Unfortunately due to various difficulties during this voyage no TSG/CTD calibration runs were performed. However, as a large number of CTDs were carried out during this voyage, this data was used to derive a TSG /CTD calibration factor. Bob Beatie of DAP calculated the calibration scaling factor of 1.000174. This value was applied to the TSG salinity data along with a TSG lag factor of 32 seconds to obtain the final calibrated TSG salinity data. The thermosalinograph salinity QC was set to ‘good’ ‘manually adjusted’ ‘no error’.

Final Underway Data

The navigation, meteorological, thermosalinograph, IMOS and depth data will be entered into the CMAR Divisional data warehouse.

Filename	Parameters	Resolution
ss200901uwy10.csv	latitude, latitudeQC, longitude, longitudeQC, speedOG, speedOGQC, courseOG, courseOGQC, shipHeading, shipHeadingQC, uncorrWindDir, uncorrWindDirQC, uncorrWindSpeed, uncorrWindSpeedQC, waterDepth, waterDepthQC, portAirTemp, portAirTempQC, stbdAirTemp, stbdAirTempQC, humidity, humidityQC, windSpeed, windSpeedQC, maxWindGust, maxWindGustQC, windDir, windDirQC, PAR, PARQC, atmPressure, atmPressureQC, waterTemp, waterTempQC, salinity, salinityQC, IMOSStbdRadiometer, IMOSStbdRadiometerQC, IMOStbdPyranometer, IMOSStbdPyranometerQC, IMOSRainRate, IMOSRainRateQC, IMOSRain, IMOSRainQC, IMOSWindSpeed, IMOSWindSpeedQC, IMOSWindDir,IMOSWindDirQC, IMOSPortRadiometer, MOSPortRadiometerQC, IMOSPortPyranometer, IMOSPortPyranometerQC, IMOSMaxWindGust, IMOSMaxWindGustQC, IMOSMaxWindGustDir, MOSMaxWindGustDirQC, IMOSUncorrWindSpeed,MOSUncorrWindSpeedQC, IMOSUncorrWindDir,IMOSUncorrWindDirQC	10 seconds
ss200901uwy5min.csv	Ditto 10 second data	5 minute
ss200901pdr10.csv	Latitude, longitude, waterDepth, waterDepthQC	10 seconds

References

Pender, L., 2000. Data Quality Control flags.
http://www.marine.csiro.au/datacentre/ext_docs/DataQualityControlFlags. Pdf

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