data summary

Southern Surveyor Voyage ss200902

CSIRO

MARINE NATIONAL FACILITY

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ss200902

Title

Hydrothermal plume and structural geology mapping in the Tonga/Fiji region

Principal Investigator

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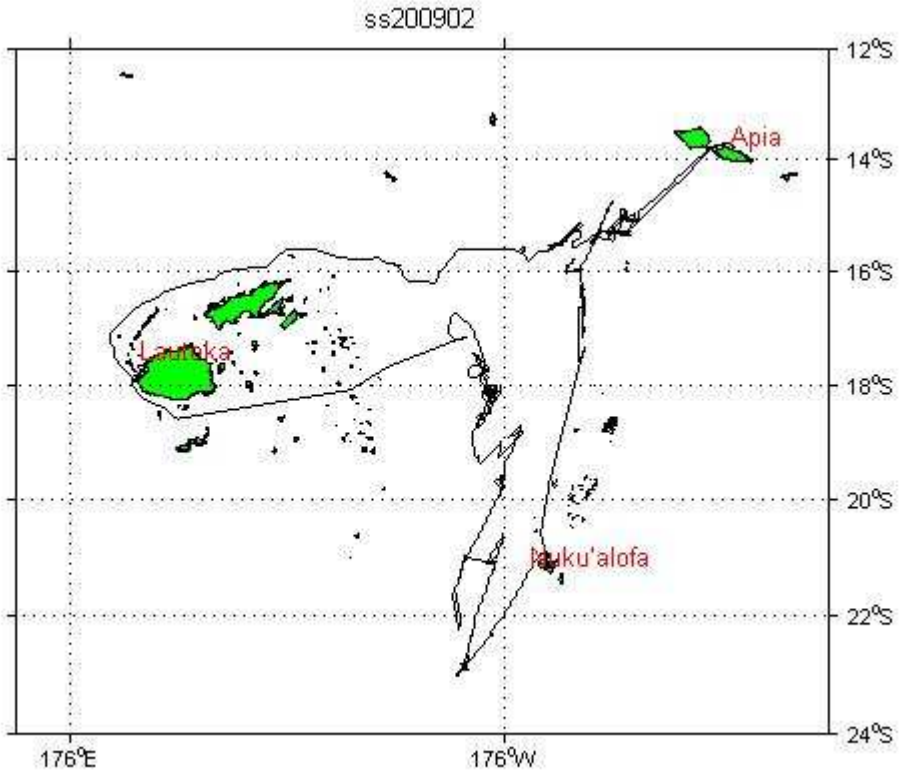
Ports

Original schedule:
Depart Lautoka (Fiji), 22 April 2009
Arrive Nuku'alofa, Tonga 18 May
Depart Nuku'alofa, Tonga 29 May 2009
Arrive Lautoka (Fiji), 25 June 2009

Date

20 April 2009 23:38 to 24 June 2009 21:00 (UTC)

Voyage Track



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 are 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 their 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 12 March 2010 by running a Java application, written by Lindsay Pender of CMAR, uwyLogger version 7.11 with data time range of 20 April 2009 23:38 to 24 June 2009 21:00 (UTC).

Completeness and Data Quality

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

Processing Comments

The ship was in port between 18 May 00:37 to 29 May 09 23:50 (UTC) at Nuku'alofa, Tonga. During this period the acquisition systems were turned off and no data was collected. Therefore there is gap in the data series during this period.

Between 01-May-2009 08:02:55 and 02-May-2009 15:09:55 the ship was at port in Apia (to drop off an unwell crew member) but all acquisition systems continued to collect data and this data is in the data set.

The starboard humidity sensor calibration is suspect. 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 1-2 degree). These occurred usually during periods of rapid temperature

increase or decrease. Investigation of these indicated that they have usually occurred when the ship was stationary with little wind or during/following periods of rainfall. This phenomenon has probably come about due to the rapid warming of air due to the ship becoming stationary or 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.
The result of the variation between the port and starboard temperature 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 (i.e. wind direction alternating between the port and starboard bow of the ship). 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 rapid large temperature increases were noted (e.g. around 3-4 degrees during a short period of time 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 ship's metal structures and/or the engine exhaust blowing over the sensors, when the wind is blowing on the stern of the ship or the ship is stationary with little wind. 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 no or 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 rapid temperature 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 wind speed had a large number downward spikes. These were investigated and the cause was attributed to anomalous raw wind direction data. The wind speed is derived from uncorrected wind speed and wind direction plus a few other parameters. Examination of the underlying data revealed anomalous wind direction data which coincided with the downward spikes in the derived wind speed. An example of this phenomenon was readily observed between 28-Apr-2009 02:49:30 and 28-Apr-2009 05:25:05. Most of the obvious anomalies during this period were manually rectified and set to NaN with their QG flags set to {'bad','none','operatorFlagged'}. However due to the numerous number of spikes throughout the data it was not possible to ascertain if they were all caused due to the problem with the

wind direction or not. Therefore it was decided to keep the rest of the data in its preliminary state, leaving the wind speed QC flag in its initial {‘noQC’,’none’,’preliminary’} state, otherwise the data is of good quality.

The directional interpolation algorithms for windDir, uncorrWindDir, IMOSWindDir, IMOSMaxWindGustDir, IMOSUncorrWindDir, shipHeading, courseOG
is suspect whereby when the direction oscillates between 0 and 360 degrees the interpolated value is incorrect (e.g. the interpolated value between 0.5 and 359.5 could be calculated as 180). Therefore windDirQC, uncorrWindDirQC, IMOSWindDirQC, IMOSMaxWindGustDirQC, IMOSUncorrWindDirQC, shipHeadingQC, courseOGQC
QC flags have been left in their original state of {‘noQC’,’none’,’preliminary’}.

All missing or suspect PortAirTemp, StbdAirTemp, humidity, Par, atmPressure, UncorrWindSpeed, maxWindGust and IMOSMaxWindGust were set to NaNs and their QC flags set to {‘bad ‘, 'none', 'operatorFlagged'} accordingly.

The depth data was re-picked using Sonar Data’s Echoview software. The major missing depth data occurred between 30/4/2009 14:19 to 19:03 and 4/5/2009 11:08 to 12:54 and 9/5/2009 07:55 to11:12 and 15/5/2009 11:41 to 14:11 and 15/5/2009 20:39 to 22:46 and 16/5/2009 16:18 to 17:00 and 17/5/2009 02:44 03:46 and 17/5/2009 11:00 to 14:30 and 7/6/09 00:07 to 02:25 and 18/6/2009 00:12 to 05:08 and 18/6/2009 19:09 to 19:40 and 23/6/2009 20:30 to 21:34 and 24/6/2009 04:43 to10:01.

During processing of recent voyage TSG/CTD calibration runs, 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 issue 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.

There were a number of salinity spikes. They were set to NaN and their QC flags set to {'bad','none','operatorFlagged'}.

Due to the use of seabird software for CTD deployments during this voyage, no CTD/TSG calibration runs were performed (CSIRO CAP software is needed for that purpose). Therefore, the TSG calibration correction factor from the previous voyage (ss200901) was used for this voyage. Bob Beatie of DAP calculated the calibration scaling factor of 1.000174 for the previous voyage (ss200901). 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’}.

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'}.

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 minutes
ss200901pdr10.csv	latitude, latitudeQC, longitude, longitudeQC, 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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