data summary

Southern Surveyor Voyage ss2011_v01

CSIRO

MARINE NATIONAL FACILITY

Table of Contents

ss2011_v01

Title

"Integrated Marine Observing System (IMOS) Facility 3. Southern Ocean Time Series (SOTS) moorings for climate and carbon cycle studies southwest of Tasmania (47ºS, 140ºE) itinerary"

Principal Investigators

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Ports

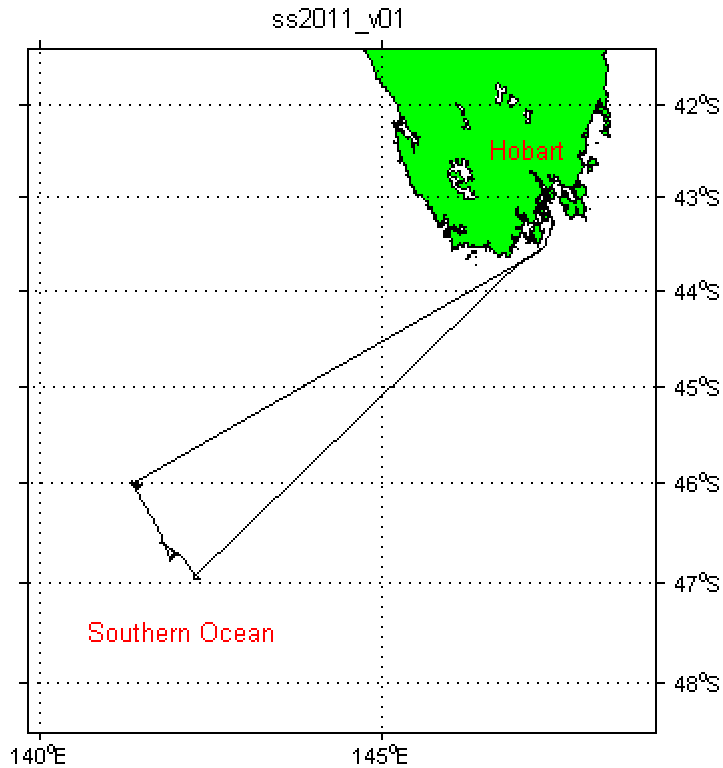
Original schedule (local time):

Depart Hobart 1600hrs, Saturday 16 April 2011.
Arrive Hobart 1300hrs, Monday 25th April

Date

16-Apr-2011 05:56:35 to 21-Apr-2011 20:53:35 (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 by SBE 3T. Data from a flow meter is also recorded.

Digital depth data is recorded from a Simrad EK60 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 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 27-Sep-2011 by running a Java application, written by Lindsay Pender of CMAR, UwyMerger version 1.3 with data time range of 16-Apr-2011 05:56:35 to 21-Apr-2011 20:53:35 (UTC).

Completeness and Data Quality

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

Processing Comments

A number of minor discrepancies between the port and starboard air temperature sensors were noted (max differences of about 1 degrees, otherwise both sensors gave very close reading with the mean absolute difference of about 0.038 degrees). 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.

A similar discrepancy (max differences of about 7%) between the port and starboard humidity sensors was observed. It should also be noted that the starboard humidity sensor appears to consistently give a higher humidity reading with the mean absolute difference of about 0.59%. The recorded values appear to be within instrument tolerance of +-2%. There were a few small periods during which the portHumidity sensor had reached saturation and recorded values exceeding 100%, these were manually adjust back to 100% and their QC flag set to {'good','adjusted','range'}

A number of rapid temperature changes were noted (e.g. rise or drops of around 3-5 degrees during a short period of time) for both port and starboard temperature sensors. In particular, a notable drop of 4.6 degrees on the stbdAirTemp occurred between 18-Apr-2011 12:58:05 and 12:59:45.

These rapid temperature changes were most likely 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 or being hit by a sudden cold or warm front. 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 usually prevalent during the periods of rapid temperature changes (in particular temperature rise):

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 8-10 knots with wind speed in the region of 10-40 knots blowing on the stern (i.e. uncorrected wind direction around 135 to 225 degrees).

Periods of rapid changes are suspect for reasons highlighted above, otherwise the data is good.

There are sections in the speedOG data, mainly between 20-Apr-2011 10:41:20 and 21-Apr-2011 13:43:05, which appear to be noisier than usual. This is most probably caused due to the lack of DGPS (Differential GPS) availability at that geographical region. A maximum speed difference of 9 knots between two adjacent recorded values (i.e. 9 knots speed change in 5 seconds) was noted; given the capabilities of the Southern Surveyor, such values are improbable. This variability in the speedOG data is most likely due to the inaccuracies with the standard GPS and the rolling effect of the ship. The speedOG data was QCed as good as the noise in the data is as expected for the standard non corrected GPS. However it is recommended that the speedOG data is used with reference to the Doppler velocity log that records the ships speed through water. The Doppler velocity log variable name is ‘shipsLog‘ in the netCDF underway file. It should be noted that Doppler velocity is not QCed as part of the underway processing and there can be obvious anomalous spikes in this data which should be ignored. However as this data is less noisy than some of the recorded speedOG (i.e. for periods without DGPS) it could provide a point of reference when using the speedOG data.

The wind speed had a number downward spikes. These were investigated and the cause was attributed to apparent anomalous raw wind direction (uncorrWindDir) data. The wind speed is derived from uncorrected wind speed and wind direction plus a few other parameters. Examination of the underlying data revealed possible anomalous raw wind direction data which coincided with the downward spikes in the derived wind speed.

After careful consideration of this problem by MNF electronics support, it was suggested that this is simply a phenomenon associated with disturbed airflow when the wind is generally from the stern of the vessel and the fact that this sensor is a wind vane or “weather-cocking” type (rather than ultrasonic).

Therefore obvious identifiable windSpeed spikes were manually set to NaN along with the corresponding values for uncorrWindDir, uncorrWindSpeed, windDir and maxWindGust with their QG flags set to {'bad','none','operatorFlagged'}. The QCing process was undertaken with reference to IMOSWindSpeed sensor.

The courseOG values when the ship is stationary are not true values as the ship is not travelling a course however this is a feature of the current acquisition system. The QC flags have been set as good however this feature should be noted if the values during the stationary periods are to be used.

The readings from the foremast IMOSRain sensor (which is an optical type) was inconsistent with the foremast funnel/siphoning type rain sensor.
This was initially considered to be unusual because the optical IMOSRain sensor reading was expected to be similar to those from the foremast funnel/siphoning sensor. However, further investigation of this issue across a number of voyages indicated a very close correlation between periods of strong winds or rough sea/swells and the times that the optical IMOSRain

sensor recordings indicated significantly higher rain level than the foremast funnel/siphoning rain sensor. It is suspected that the higher IMOSRain sensor recordings are due to water spray from the breaking of waves against the bow of the ship and wind-carried spray from the rough seas which are more likely to interrupt the optical sensor beam path and less likely to enter the funnel at the top of the funnel/siphoning sensor. The foremast rain sensors are virtually co-located. (Note: The reverse of this situation has also been observed, whereby during periods of relative calmness (i.e. low wind and slow/stationary ship) the funnel/siphoning sensor shows higher rain than the optical sensor).

It was noted that IMOS starboard Radiometer recordings were mostly greater than the port Radiometer recordings throughout the voyage with a mean absolute difference of about 2.1(W/m^2).

Due to the IMOS foremast wind sensor being installed incorrectly (i.e. installation was misaligned by 180 degrees) all recorded and derived IMOS wind data are incorrect. Therefore, IMOSWindSpeed, IMOSUncorrWindSpeed, IMOSWindDir and IMOSUncorrWindDir data were left unprocessed and their QG flags set to {'bad','none','operatorFlagged'}

It should be noted that whilst it was not possible to correct this problem during the data processing phase (as the data is interpolated and derived) however it would be possible (at a notable effort/expense), to modify the TECHSAS acquisition system and rerun the corrected raw data through it in order to derive the correct IMOS wind values. Therefore should the IMOS wind data for this voyage be absolutely required, a specific request could be made via the CMAR data centre.
It should further be noted that the wind data from the main mast was not affect in any way and is good and has been processed and QCed as normal.

The depth data was re-picked using Myriax Echoview software. There are a few periods without recorded depth data, this is mostly likely due to the sounders being turned off during mooring recovery operational activities. The notable periods without depth data are listed below:

17-Apr-2011 22:20:45 to 18-Apr-2011 07:49:30
18-Apr-2011 10:44:25 to 18-Apr-2011 15:31:50
18-Apr-2011 16:01:10 to 18-Apr-2011 16:15:50
19-Apr-2011 02:14:50 to 19-Apr-2011 05:08:45
19-Apr-2011 06:19:10 to 19-Apr-2011 06:26:40

There were a few periods with noisy intake water temperature data; these have been set to NaNs and their QC flags set to {'bad','none','operatorFlagged'}.

During the processing of recent voyages 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.

The CTD calibration data for the secondary sensor was obtained from the voyage CTD report (i.e. CTD offset and scale factor of 0.0022830937, 0.9992798). This data was then used to derive the TSG salinity calibration against the calibrated CTD data. Using CTD/TSG calibration run in CTD ss2011_v01003Ctd.nc with a TSG conductivity lag of 32 seconds, a salinity scaling factor of 1.000108486107388 was calculated fom the CTD secondary conductivity cell. This scaling factor was applied to the TSG salinity data and the thermosalingraph salinity QC was set to {'good' ,'manually adjusted','no error'}.

Note: All 2011 underway voyage data is acquired and preliminary processed by the TECHSAS and uwyMerger acquisition system respectively. It should further be noted that the following data and their QC flags are not supported in the TECHSAS/uwyMerger acquisition system: maxWindGustDir, maxWindGustDirQC, IMOSMaxWindGust, IMOSMaxWindGustQC, IMOSMaxWindGustDir, MOSMaxWindGustDirQC.

Final Underway Data

The navigation, meteorological, thermosalinograph, IMOS and depth data will be entered into the CMAR divisional data warehouse. All data timestamps are in UTC.

Filename	**Parameters**	**Resolution**
ss2011_v01uwy10.csv	latitude, latitudeQC, longitude, longitudeQC, speedOG, speedOGQC, courseOG, courseOGQC, shipHeading, shipHeadingQC, uncorrWindDir, uncorrWindDirQC, uncorrWindSpeed, uncorrWindSpeedQC, waterDepth, waterDepthQC, portAirTemp, portAirTempQC, stbdAirTemp, stbdAirTempQC, portHumidity, portHumidityQC, stbdHumidity, stbdHumidityQC, 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, IMOSUncorrWindSpeed,MOSUncorrWindSpeedQC, IMOSUncorrWindDir,IMOSUncorrWindDirQC rain, rainQC	10 seconds
ss2011_v01uwy5min.csv	Ditto 10 second data	5 minutes

ss2011_v01pdr10.csv	latitude, latitudeQC, longitude, longitudeQC, waterDepth, waterDepthQC	10 seconds

References

Subversion repository version of DPG Matlab generic tools 1488
Pender, L., 2000. Data Quality Control flags.
http://www.marine.csiro.au/datacentre/ext_docs/DataQualityControlFlags. Pdf

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