

# data summary

Southern Surveyor Voyage ss2010\_v02



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## **ss2010\_v02**

### ***Title***

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

### ***Principal Investigators***

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### ***Ports***

Original schedule:

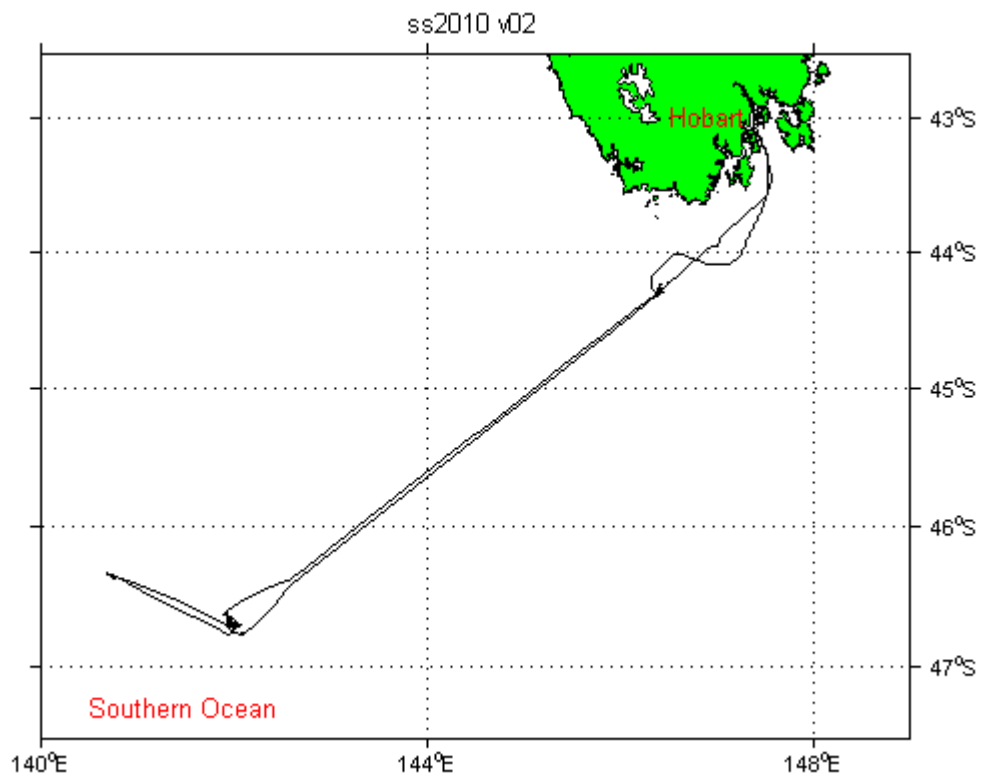
Depart Hobart Monday 15 March

Arrive Hobart 0800hrs, Wednesday 24 March, 2010

### ***Date***

15-Mar-2010 22:03 to 21-Mar-2010 22:32 (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 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 12Jan 2011 by running a Java application, written by Lindsay Pender of CMAR, UwyMerger version 1.3 with data time range of 15-Mar-2010 22:03 to 21-Mar-2010 22:32 (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**

TECHSAS started recording on 15-Mar-2010 05:02:00 but voyage started on 15-Mar-2010 22:03:30 so netCDF file from UwyMerger starts from 15-Mar-2010 22:03:30.

No data for maxWindGust was recorded due to a driver bug in TECHSAS. The maxWindGust was set to NaN and its QC flag set to {'bad','none','operatorFlagged'}.

On several occasions, the readings from the foremast IMOSRain sensor were significantly higher (up to around 10 times) than those from the main mast rain sensor.

This is unusual, as the IMOSRain sensor readings are usually similar to those from the main mast sensor.

Investigation of this issue indicated a very close correlation between periods of strong winds and the times that the IMOSRain sensor is recording notably higher rain than main

mast 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.

A number of discrepancies between the port and starboard air temperature sensors were noted (max differences of about 1.5 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.

A similar discrepancy (max differences of about 7.1%) between the port and starboard humidity sensor was observed. It should also be noted that the starboard humidity sensor appears to consistently give a higher humidity reading (around 0.8%). The recorded values appear to be within instrument tolerance.

A number of rapid temperature changes were noted (e.g. around 3-5 degrees during a short period of time) for both port and starboard temperature sensors.

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 cold/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 identified 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.

The wind speed had a 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 possible anomalous wind direction data which coincided with the downward spikes in the derived wind speed. Most of the obvious anomalies during this period were manually set to NaN with their QG flags set to {'bad','none','operatorFlagged'}. However due to the 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 due to this uncertainty it was decided to keep the rest of the data and its QCflag left in its initial {'noQC','none','preliminary'} state, otherwise the data is of good quality.

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.

It was noted that IMOS starboard Radiometer recordings were mostly about 3 ( $W/m^2$ ) greater than the port Radiometer recordings throughout the voyage.

The depth data was re-picked using Sonar Data's Echoview software. Between 18/3/2010 01:03 to 11.34 the depth data was too noisy and marked as bad. This is suspected to be due to the noise from the thrusters. Also between 18/3/2010 22:32 to 19/3/2010 02:39 and again between 19/3/2010 02:59 to 05:01 there were no depth data.

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 primary sensor was obtained from file ss2010\_v02001Ctd and a CTD offset and scale factor of -0.00129125053623218, 1.00013602862465 respectively was applied to the CTD data. This data was then used to calibrate the TSG against the (calibrated) CTD data. A salinity scale factor of 0.999827343408061 was calculated, using CTD/TSG calibration run in CTD deployment 3 (ss2010\_v02003Ctd\_tsgCal\_\_old.nc) with a TSG conductivity lag of 32 seconds and applied to the TSG salinity data. The thermosalinograph salinity QC was set to { 'good' , 'manually adjusted' , 'no error' }.

Note: All 2010 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
ss2010_v02uwy10.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, IMOSStdRadiometer, IMOSStdRadiometerQC, IMOSStbdPyranometer, IMOSStdPyranometerQC, IMOSRainRate, IMOSRainRateQC, IMOSRain, IMOSRainQC, IMOSWindSpeed, IMOSWindSpeedQC, IMOSWindDir,IMOSWindDirQC, IMOSPortRadiometer, MOSPortRadiometerQC, IMOSPortPyranometer, IMOSPortPyranometerQC, IMOSUncorrWindSpeed,MOSUncorrWindSpeedQC, IMOSUncorrWindDir,IMOSUncorrWindDirQC rain, rainQC	10 seconds
ss2010_v02uwy5min.csv	Ditto 10 second data	5 minutes
ss2010_v02pdr10.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](http://www.marine.csiro.au/datacentre/ext_docs/DataQualityControlFlags.Pdf)

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