In-Situ Calibration Activities in Bass Strait, Australia

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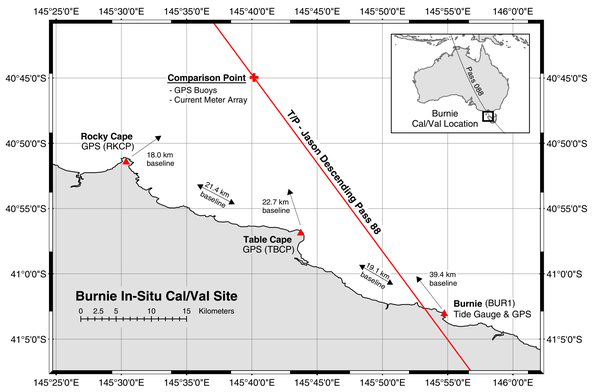
Introduction

The Burnie calibration site is located in northern Tasmania, Australia (41° 03' S, 145° 55' E) under Topex-Poseidon / Jason-1 descending pass 088.

The focus of the calibration activities is the regular deployment of two GPS buoys at our chosen comparison point, approximately 40km from Burnie.

Data from the episodic GPS buoy deployments, combined with the Burnie tide gauge and collocated GPS time series and supplementary oceanographic instrumentation allows the estimation of both the Topex/ Poseidon and Jason-1 absolute bias. The project also aims to monitor any long-term drift in the bias of both altimeters.



Calibration Methodology

The comparison point along the altimeter ground track was selected as a compromise between GPS network geometry (minimising baseline lengths for GPS processing) and maximising the distance from land to avoid interference to the satellite data.

Two wave rider GPS buoys are deployed at the comparison point for a four hour duration centered at the time of overflight.

GPS Buoy

Buoy Deployment Configuration

Three static GPS reference sites are used. The Burnie site is continuously operating and is co-located with a Sutron Aquatrak tide gauge. The sites at Table Cape and Rocky Cape record over a 24 hour period for each deployment. Baseline distances to the comparison point are 18.0 km, 22.7 km and 39.4 km respectively.

BUR1 Tide Gauge & GPS

Table Cape (TBCP) GPS

Rocky Cape (RKCP) GPS

GPS Processing Methodology

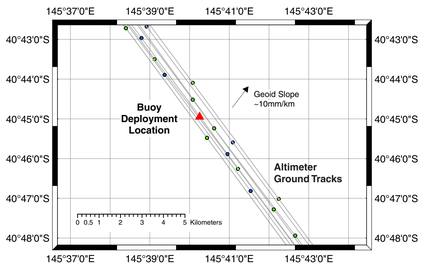
The static sites in the analysis are processed using the GAMIT/GLOBK suite in a regional network solution together with other sites contributing to the Australian Regional GPS Network (ARGN). Global IGS solutions are used in the final GLOBK to enable the estimation of site coordinates in ITRF2000.

The BUR1, TBCP and RKCP sites are then used as fixed reference sites in the kinematic processing of the the two GPS buoys using TRACK software developed at MIT. The emphasis in kinematic processing development remains the successful determination of the differential tropospheric delay parameter on a moving platform. The development of improved kinematic processing strategies for the GPS buoys form a major component of the research undertaken by the group.

Deployments Completed

A total of seven (7) deployments have been completed to date.

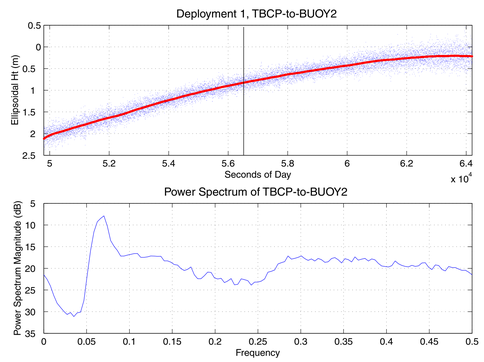
Deployment 1: 21/09/2001. T/P cycle 332
Deployment 2: 17/02/2002. T/P cycle 347, Jason-1 cycle 4
Deployment 3: 09/03/2002. T/P cycle 349, Jason-1 cycle 6
Deployment 4: 07/04/2002. T/P cycle 352, Jason-1 cycle 9
Deployment 5: 27/04/2002. T/P cycle 354, Jason-1 cycle 11
Deployment 6: 07/05/2002. T/P cycle 355, Jason-1 cycle 12
Deployment 7: 27/05/2002. T/P cycle 357, Jason-1 cycle 14



Example GPS Buoy Results

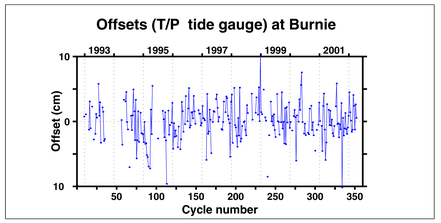
An example of the GPS buoy time series from the first deployment shows the 1Hz height time series for the 4 hour deployment. The red line shows the low pass filtered signal, highlighting the tidal displacement over the duration of the deployment. The vertical bar indicates the time of overflight. SWH for this deployment was 0.8m.

The power spectrum of the 1 Hz GPS Buoy data indicates a dominant frequency corresponding to the swell, with a period of approximately 14 seconds



Burnie Tide Gauge

The time series of differences in sea level measured by TOPEX/Poseidon and the Burnie tide gauge shows a drift of 0.7±0.7 mm/year. Note that the mean has been removed from this time series.



Preliminary Results - Absolute SSH

Preliminary SSH bias estimates for currently available Topex MGDR and Jason-1 IGDR data are shown below. Processing strategies remain unrefined and hence bias estimates have larger than expected error limits.

Comparisons between altimeter and GPS derived troposphere delay (wet/dry) and wave height are currently under calculation.

Date	Topex Cycle	Jason-1 Cycle	Topex Bias	Jason-1 Bias
21/09/2001	332	-	-6 ± 5 cm	-
17/02/2002	347	004	-9 ± 5 cm	+5 ± 5 cm
09/03/2002	349	006	-7 ± 5 cm	+1 ± 5 cm
27/04/2002	354	011	(Not yet available)	+4 ± 5 cm
07/05/2002	355	012	(Not yet available)	+7 ± 5 cm

Issues to be Addressed

GPS Reference Sites
- Tuning of processing parameters for the regional GPS solution in GAMIT
- Verification of reference frame selection

GPS Buoy Processing
- Further development of integrated multi reference, multi rover solutions
- Improved resolution of tropospheric delay parameters
- Improved signal weighting algorithms
- Repeated calibration of height of buoy antenna above mean water level
- Further investigation of optimum filtering of the 1 Hz buoy data

Altimeter Data
- There is some anomalous Jason-1 radiometer data near shore - a brightness temperature interpolation flag (tb_interp_flag, bit 1) is set some distance (>60km) offshore. At this point the wet troposphere correction goes into a "flat spot" and then seems to recover closer in to shore. We also see a consistent ~1 cm offset between the TOPEX/Poseidon and Jason-1 radiometer corrections.

Acknowledgements

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