We are grateful to the officers, scientists and crew of Drake ANT XXIII/3 cruise aboard R/V Fs Polarstern for their...Mr. Stavros Melachroinos under the direction of Dr. Ing. Richard Biancale.

Several satellite altimeter missions are currently operating...visits to the Antarctic Peninsula from January to February 2005. The Jason-1 satellite mission was developed by the Center National d’Etudes Spatiales (CNES) and the German Aerospace Agency (DLR) as part of the ENVISAT constellation, which was launched in March 2002. The Jason-1 mission is a follow-on to the Jason-2 mission, which was launched in April 1997.

1. Data description of the Drake GPS campaign

The total GPS campaign along the Drake passage consists of:

- 2 GPS buoy – ship sessions inside the Port of Punta Arenas
- A total of 60 GPS buoy sessions in the open sea all along the Drake passage
- Continuous GPS sessions from 3 receiver antennas onboard the Polarstern research vessel
- CGPS sessions from a total of 6 IGS and non IGS stations at 1km level
- INS measurements for the Polarstern’s attitude and accelerometers determination

In this project we calibrate the floating line net, Ashtech antenna onboard the Polarstern at the two terminals (Asmar terminal and Gas terminal) in the Punta Arenas harbor and in the mean time we perform GPS/altimeter water level measurements. These periods of treatment are hereinafter referred to as the first and second calibration periods. In the Polarstern terminal, equipment was being unloaded off the vessel and the main activity in Gas terminal was fuelling. Independent positions are determined for the buoy and ship receiver during the two calibrations. These solutions are subsequently used to derive the floating lines. During the second calibration period we also evaluate the position time series for the Ashtech and Trimble receivers onboard the Polarstern to analyze the correlation in motion between the two ship receivers.

2. 1st calibration period: GPS buoy-ship campaigns in the Asmar terminal

Basically 1s Rice observations from three different kinds of GPS stations are used:

- Fixed stations (Dock Stations and CGPS stations)
- Ship sessions (Wave rider GPS buoy)
- GPS Antenna sessions on the Polarstern

We are using the Cnes/GRGS software GINS to form normal equations with its 1s and 3s interval. The time series were obtained for two cases, with ambiguities fixed for baselines with stable stations, and with ambiguities not fixed for baselines with moving stations (buoy-ship).

Fig. 1: The geometry of the ship’s floating line determination

Fig. 2: The Drake passage and the ship-buoy GPS sessions along Jason-1 104 ground track

Fig. 3: Data availability for the 1st and 2nd calibration periods

Fig. 4: The GPS network used in the 1st and 2nd calibration period

Fig. 5: Figures from the GPS campaign inside Punta Arenas port (GPS data collected by M. Faille and Y. Monard)

Fig. 6: Determination of the buoy’s and ship’s vertical positions and RMS errors statistics

2.1 GPS water level measurements

2.2 1st Floating line

A set of GPS receivers installed onboard the research vessel Polarstern, and a wave-riding GPS buoy for the calibration of the ship’s floating lines, were used.

This sea level data combined with altimetric data, allow us to cross-compare the sea surface height (SSH) estimates and measure the significant wave height (SWH) during the cruise across the Drake passage. These independent SWH measurements allow us to validate and correct the altimetric data in-situ, i.e. on the ship.

Fig. 7: Determination of the ship’s floating line in the 1st calibration period and RMS errors statistics

3. 2nd calibration period: GPS buoy-ship campaigns in the Gas terminal

3.1 GPS water level measurements

3.2 2nd Floating line

Ashtech Ashtech Ashtech Ashtech

3.3 Ship’s attitude

Fig. 8: Correlation in horizontal motion between the two ship receivers

4. Conclusions - Perspectives

- We conclude that the difference in the Floating line between the 1st (before fuelling) and the 2nd calibration period (after fuelling) is of the order of 0.5 cm.
- We have implemented the 1s GPS data mode processing inside GINS and in pre-processing stage.
- We developed a calibration procedure for the determination of the ship’s floating line!
- We have accomplished water level measurements in a calm environment (inside port) with cm and sub-cm precision.
- We continue with the determination of the buoy’s position in the open sea sessions we derive all the necessary sea state parameters (SSH, SWH etc.) and we compare with Jason’s altimetry measurements for bias extraction.
- Then by integrating the attitude variations from the ship’s INS measurement unit we are going to determine sea state parameters all along the Drake passage and then again compare to the Jason’s altimetry measurements for bias extraction on the ground track 104.