Wave and Current Measurements in Support of Coastal Management Plans in False Bay

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Introduction

- False Bay has a **complex hydrodynamic environment** (Fig. 1), but observations of its physical oceanography remain **sparse in time and space** (Pfaff et al., 2019).
- While **high-resolution wave and current data** exist (2014–2017), they require **outdated and costly proprietary software** to process.
- This project contributes to an **ongoing research program** on False Bay, supporting **future coastal management and planning**.

Aims

- **Collate, organise, and reprocess** archival ADCP current data (2014–2017).
- **Adapt open-source software** to process Teledyne RDI Workhorse ADCP data.
- **Develop a reusable pipeline** for processing and visualising raw Teledyne ADCP data.

What is an Acoustic Doppler Current Profiler (ADCP)?

- Instrument that **uses sound waves** to **measure current speed and direction** throughout the water column (Fig. 2).
- **Versatile deployment options**: seabed-mounted, vessel-mounted, or moored.

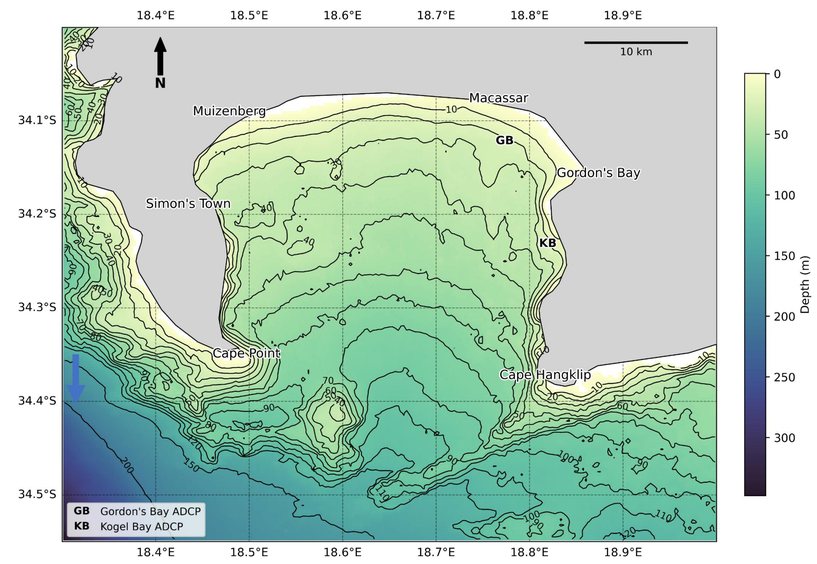

Figure 1. Map of False Bay bathymetry showing ADCP deployment sites near Gordon's Bay and Kogel Bay. Prominent coastal landmarks are also indicated. Bathymetry data from de Wet and Compton (2021).

Methods: *pycurrents* ADCP processing

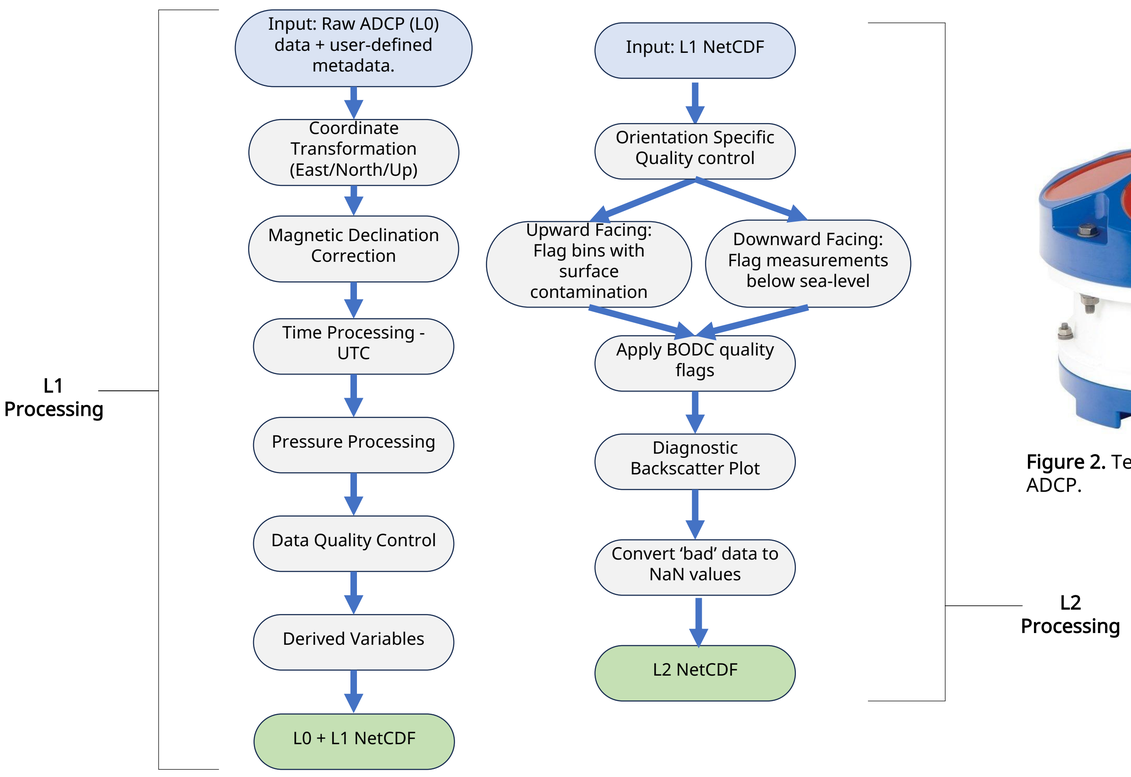

Figure 2. Teledyne RDI Workhorse ADCP.

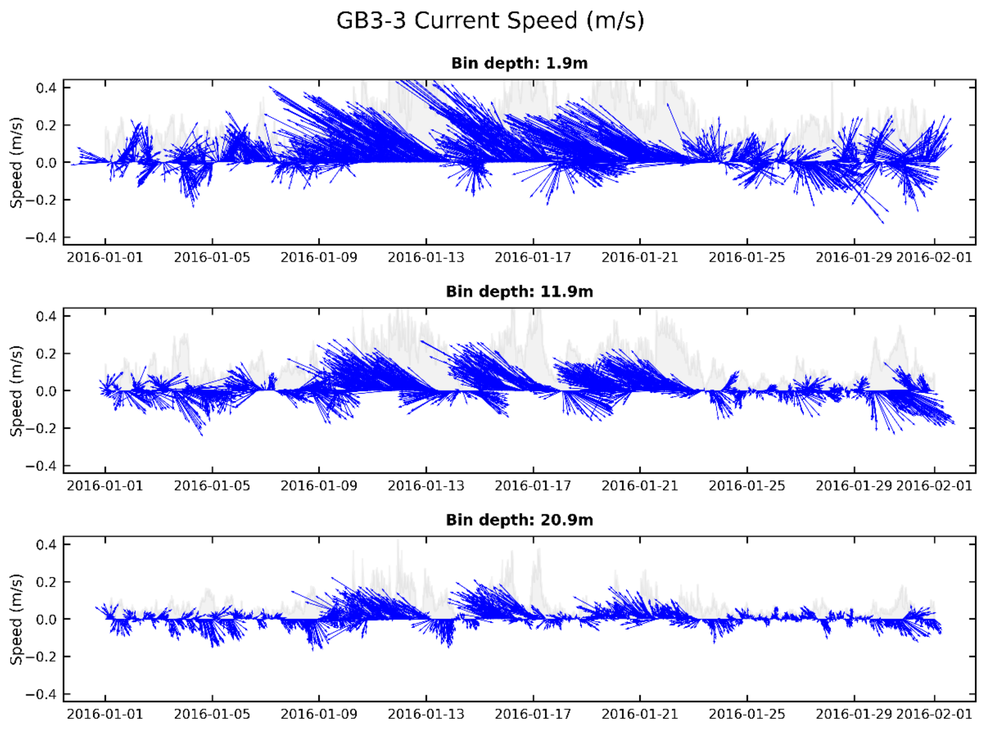

Figure 3. Velocity quiver plots for unfiltered L2 data from Gordon's Bay D3. Blue arrows represent current vectors at three depth bins; surface, middle and bottom. Grey shading above the velocity axis indicates absolute current magnitude. Each vector represents a 20 minute ensemble.

Standardised plots generated with *pycurrents* ADCP processing software: Velocity Quiver, Velocity Depth-Time, Rotary Spectra, Diagnostics. These plots were generated for a deployment at Gordon's Bay that ran from December 2015 to March 2016.

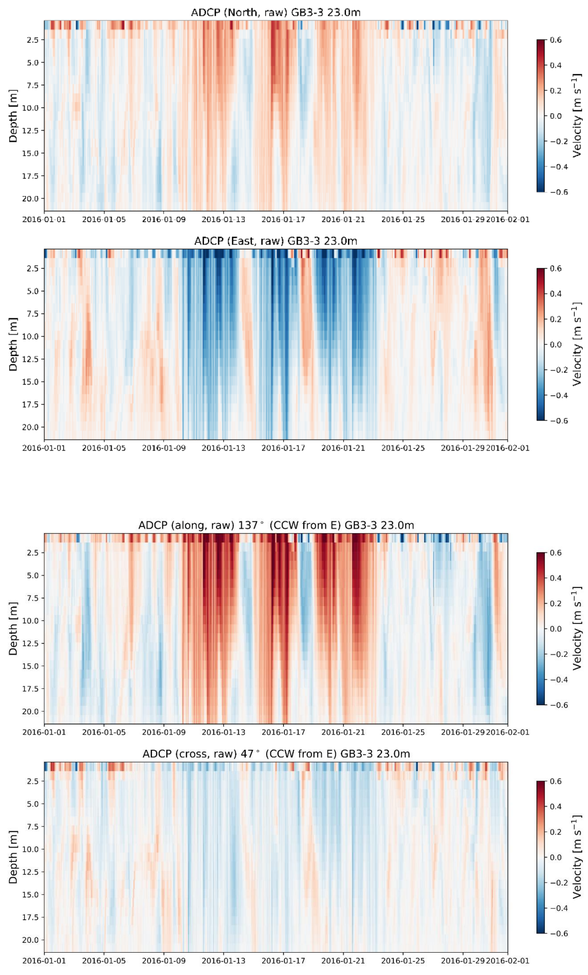

Figure 4. True and alongshore velocity profiles of unfiltered L2 ADCP data from Gordon's Bay D3. Magnetic velocities are rotated by declination to produce true north-east components and are plotted on the top panel. The bottom panel shows along / cross-shore velocities aligned with the mean alongshore axis determined by PCA.

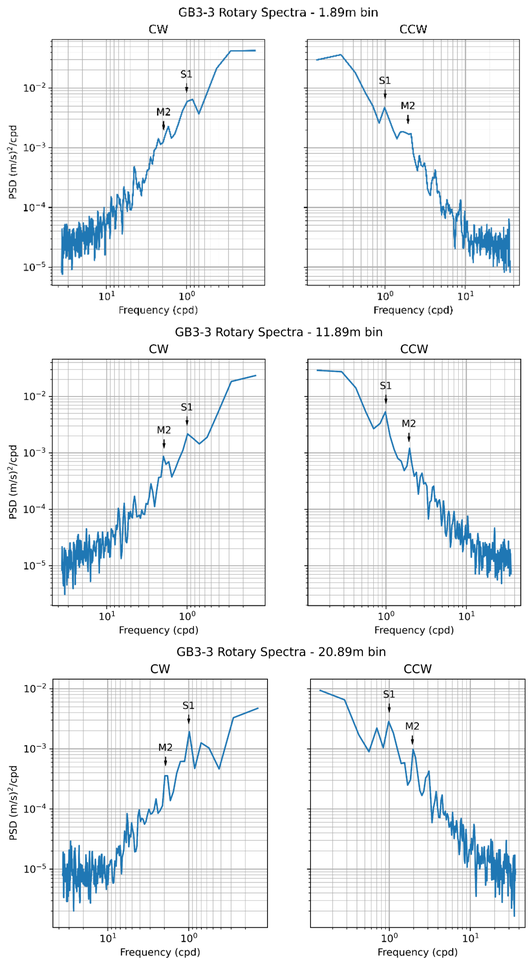

Figure 5. Rotary spectra for L2 data from Gordon's Bay D3. Subplots show clockwise (negative) and counterclockwise (positive) components of power spectral density (signal's distribution of power at different frequencies) at surface, middle and bottom depths, plotted against log frequency in cycles per day. M2 and S1 denote the PSD peaks associated with the frequencies of the principal lunar semi-diurnal and solar diurnal tides, respectively.

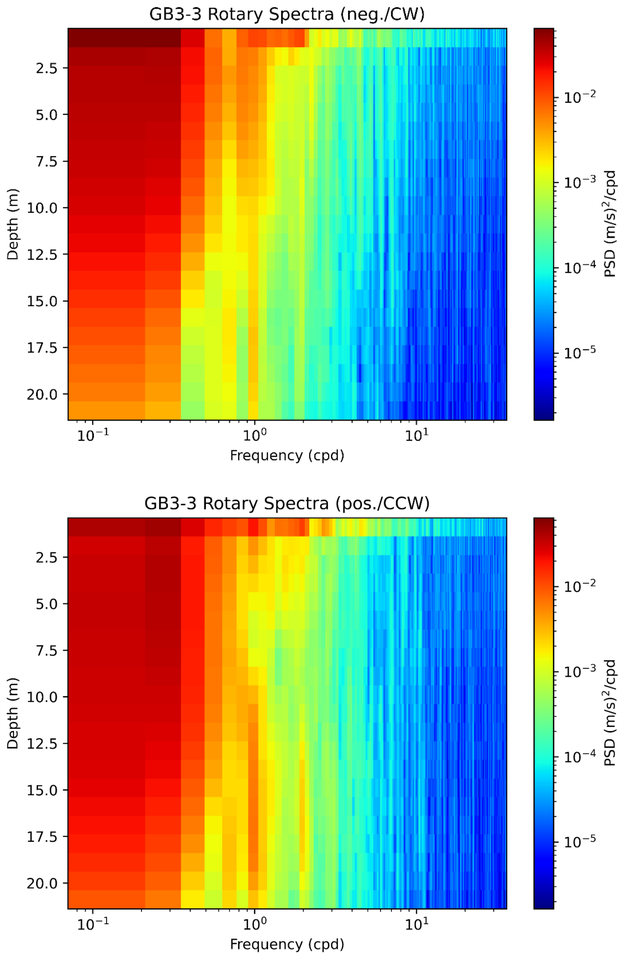

Figure 6. Rotary spectra for L2 Gordon's Bay D3. Subplots show clockwise (negative) and counterclockwise (positive) components of power spectral density, over depth and against log frequency in cycles per day.

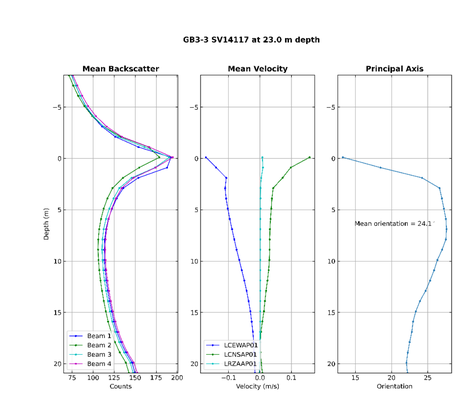

Figure 7. Diagnostic plot for L2 Gordon's Bay D3 data. The left subplot shows mean backscatter counts from the four beams over depth. The centre subplot displays mean velocity over depth for the east, north and vertical current components. The right subplot shows the mean orientation of the principal axis at each depth bin. The overall mean orientation is also shown. Angles are measured counterclockwise from north.

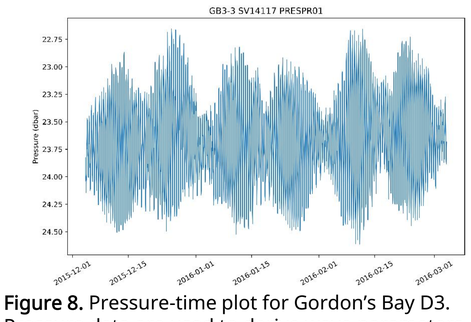

Figure 8. Pressure-time plot for Gordon's Bay D3. Pressure data are used to derive wave parameters.

Challenges

- **Incomplete metadata**: difficulty confirming deployment details due to poor prior data management.
- **Data access issues**: difficulties reading raw files into pycurrents
- **Software bugs**: troubleshooting open-source tools during pipeline setup.

Next steps

- **Analyse** reprocessed ADCP data.
- **Compare** findings with published observations and modelling studies.

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