

LiDAR Moored Ship Motion Measurements at Port of Napier

PIANC APAC Conference, Brisbane, 26th August 2026

Tim Gourlay, Perth Hydro

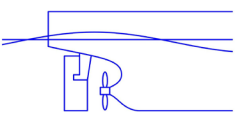
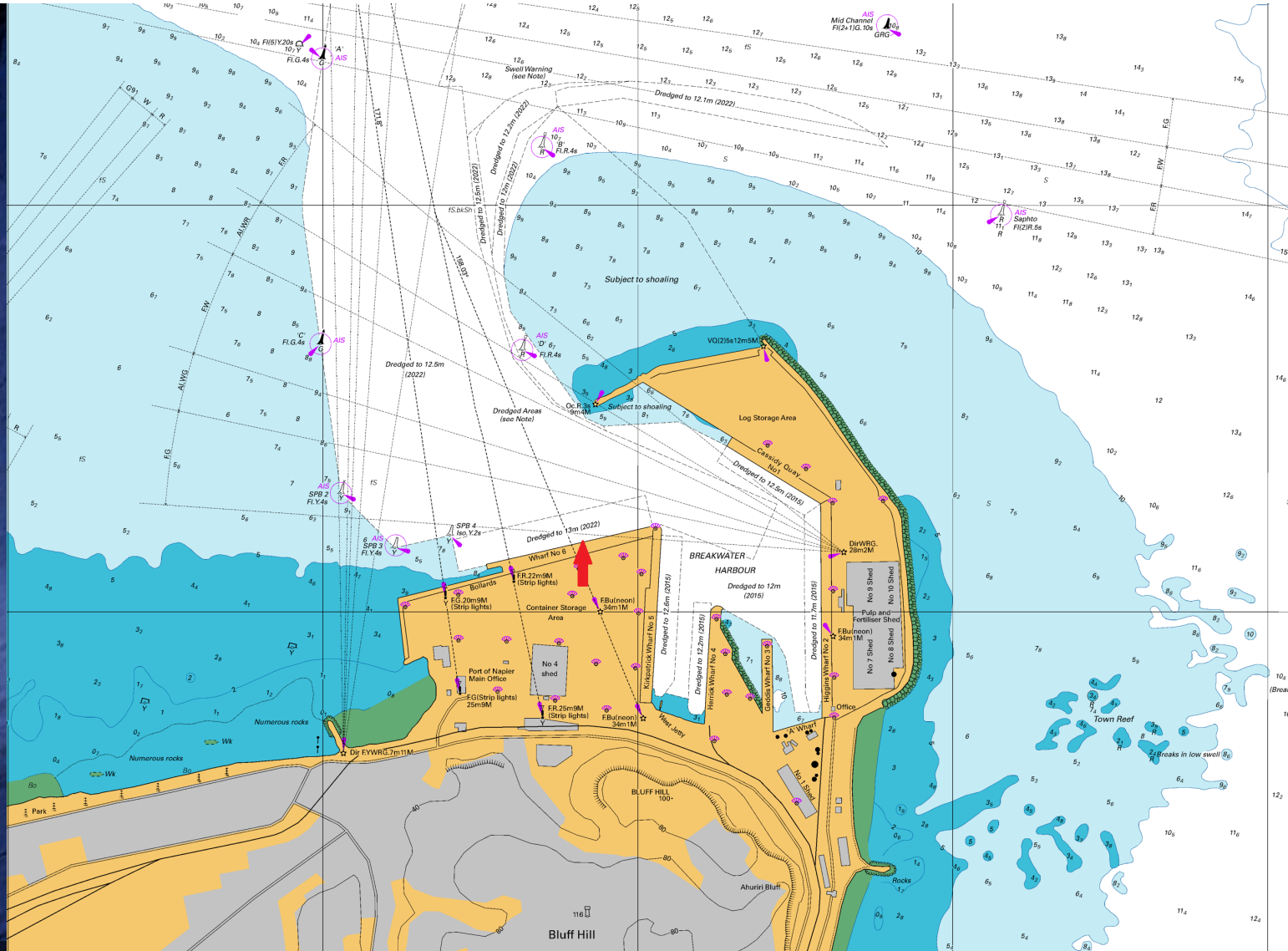
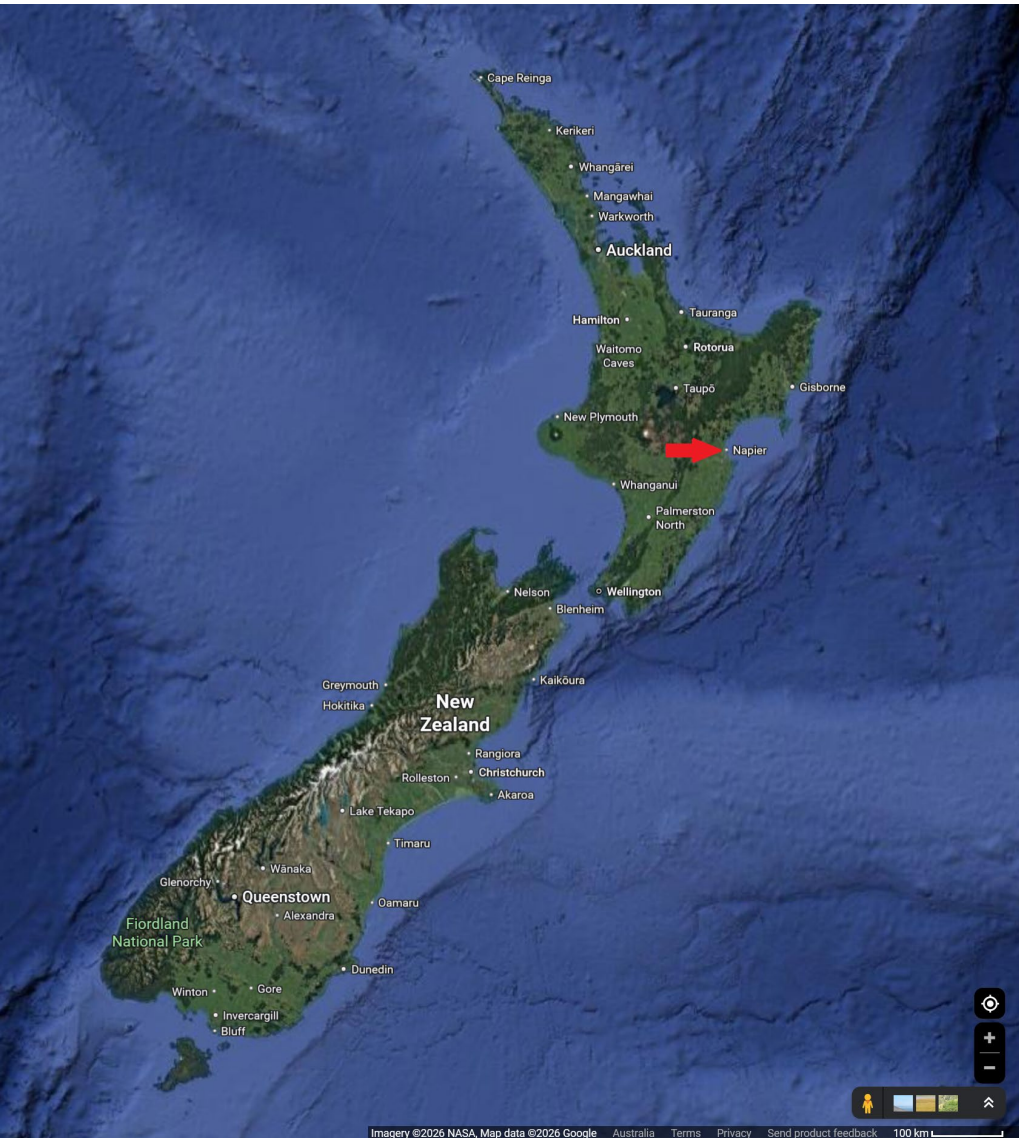
Gino Parisella, Marine Lab

Robbie Jensen, Napier Port

Peter McComb, Oceanum



Napier Port and new No. 6 Wharf



Perth
Hydro

Marine Lab

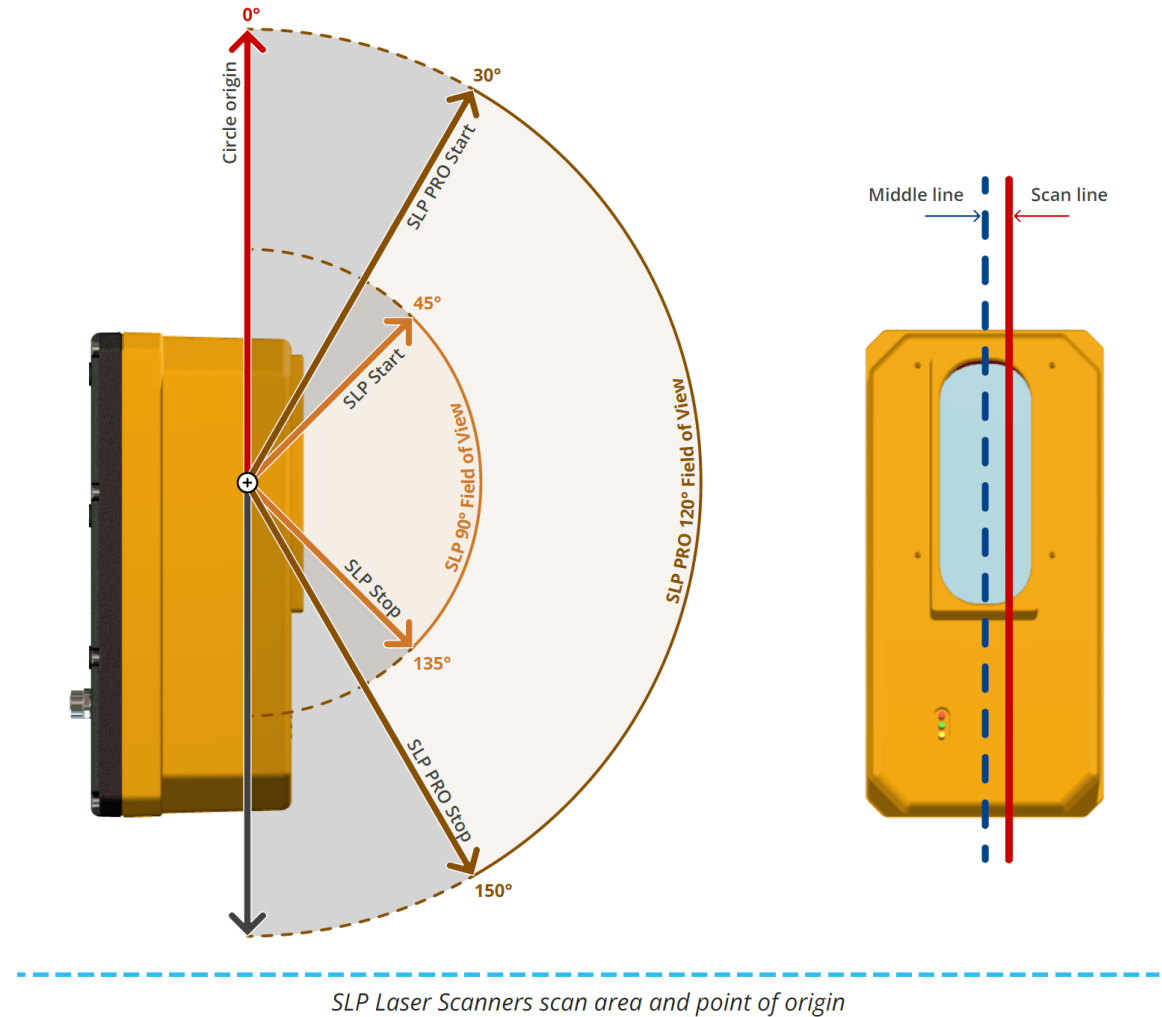
NAPIER
PORT
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PIANC APAC 2026
Connecting and Sharing - Oceania and Asia-Pacific Neighbours

What is LiDAR?

- **L**ight **D**etection **A**nd **R**anging
- **T**riple-In units used at Napier
- **1000** points per scan
- **30** scans per second
- **C**ontinuous operation 24/7
- **5** mm accuracy
- **Range 0.8 – 150 m (SLP 100)**
- **Range 2.7 – 500 m (SLP PRO)**



Moored ship dynamic motions

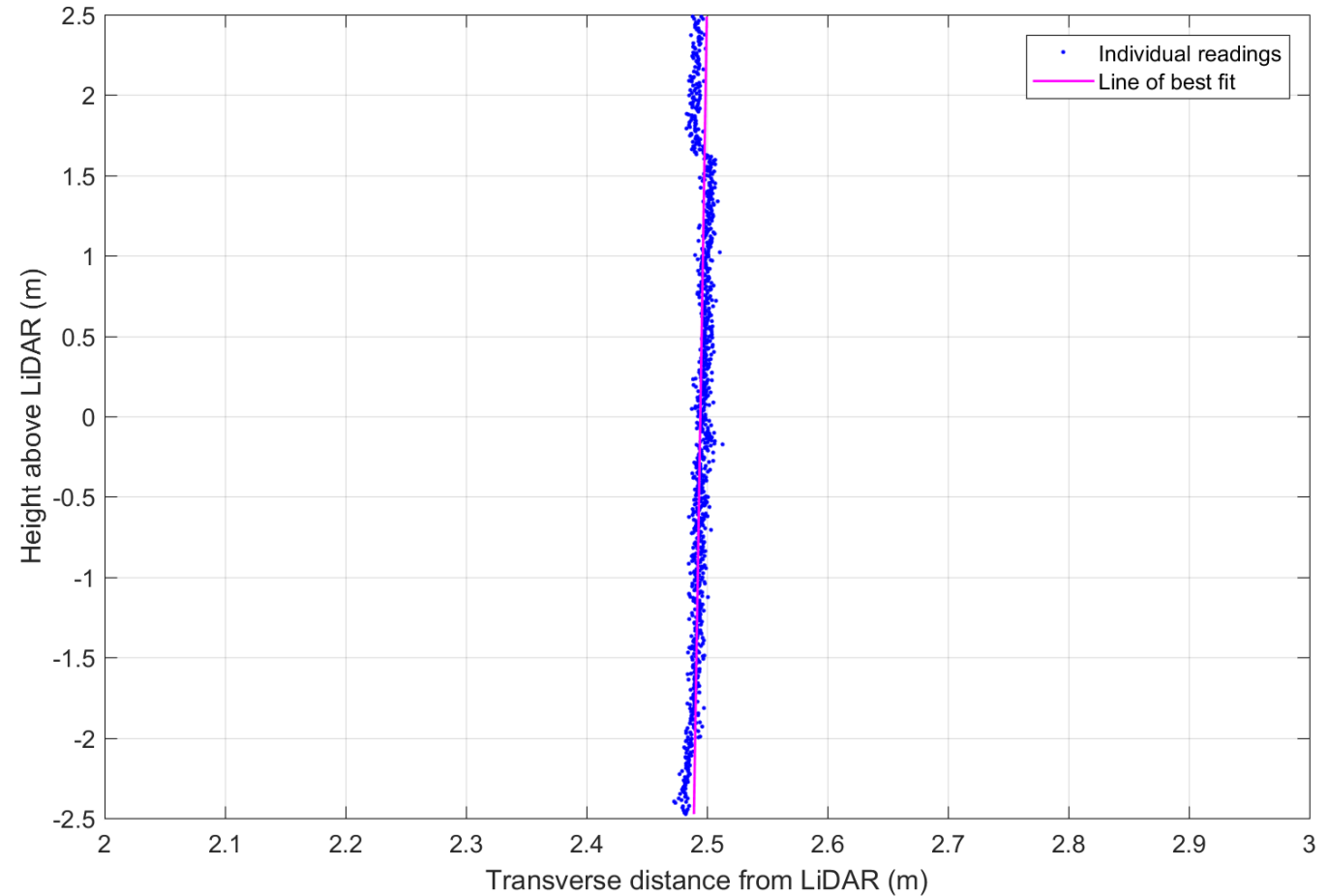


SLP 100 for flat side

- One unit at forward end of flat side
- One unit at aft end of flat side
- Sway, yaw and roll at 1 Hz



Example SLP 100 point cloud

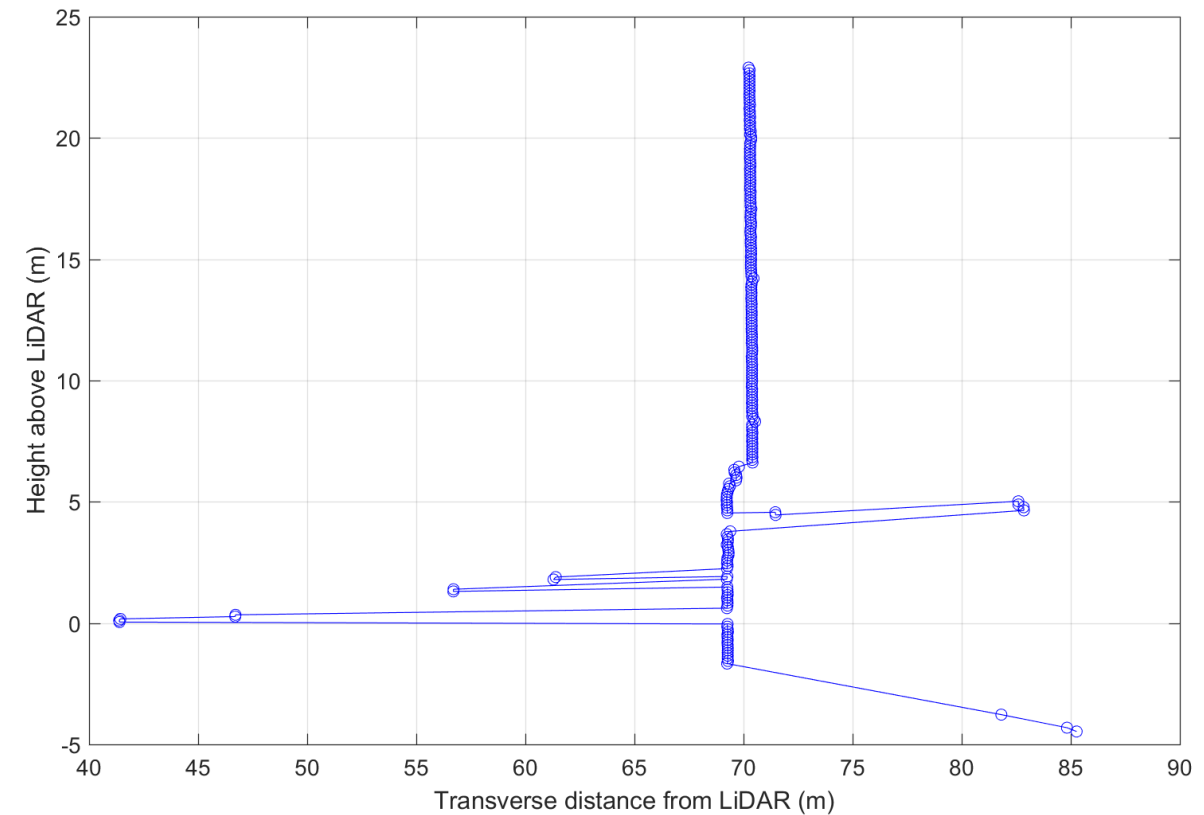


SLP PRO for transom

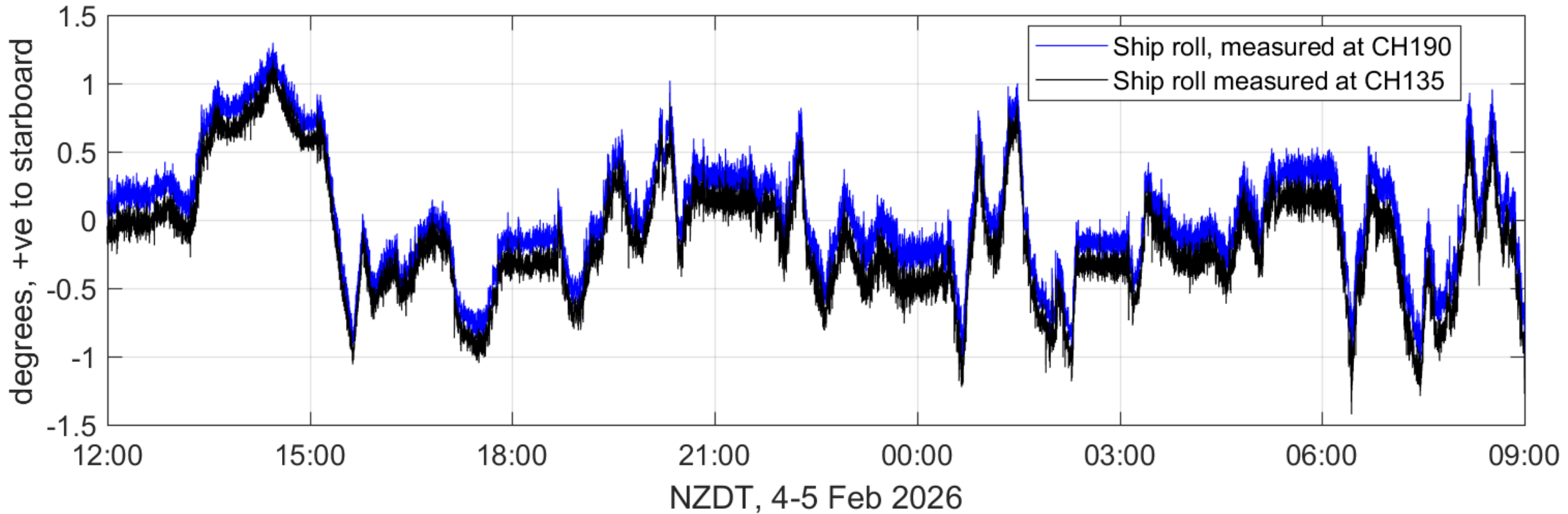
- One unit at east end of berth
- One unit at west end of berth
- Allows for port or starboard tie-up
- Scans transom
- Can be fixed or swivelling
- Gives ship surge at 1 Hz



Example SLP PRO point cloud



LiDAR roll measurements, BF Giant



PIANC motion limits for container ships

Operability criteria for container loading			
<i>Parameter</i>	<i>Limit</i>		
	<i>95% efficiency</i>	<i>90% efficiency</i>	<i>85% efficiency</i>
Ship surge SSA	0.3 m	0.6 m	0.8 m
Ship sway SSA at aftmost top container stack	0.5 m	0.8 m	1.0 m
Ship sway SSA at forwardmost top container stack	0.5 m	0.8 m	1.0 m
Ship roll SSA	1.0°	1.5°	2.0°

- PIANC (2023) “Criteria for acceptable movement of ships at berths”, WG 212 report.
- SSA (single significant amplitude) is 2.0 x RMS
- Average of 1/3 highest motion amplitudes.

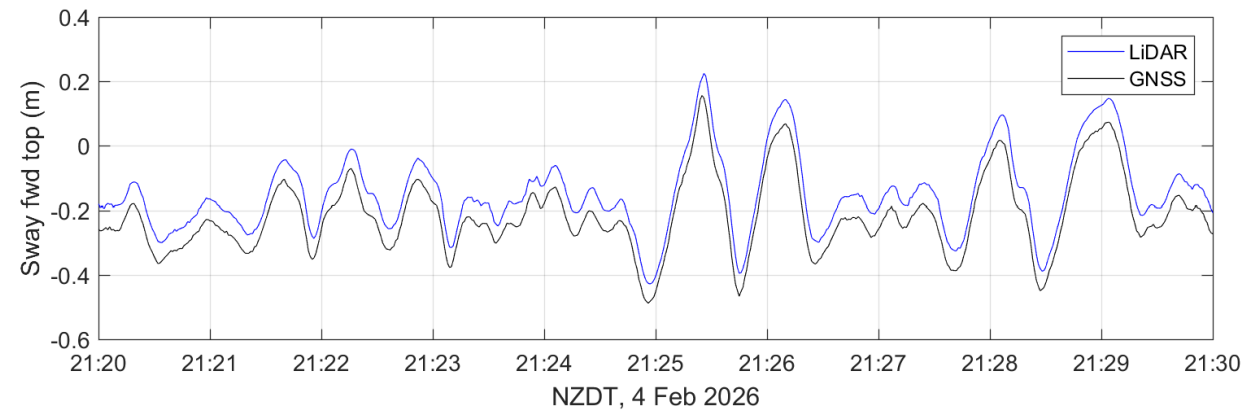
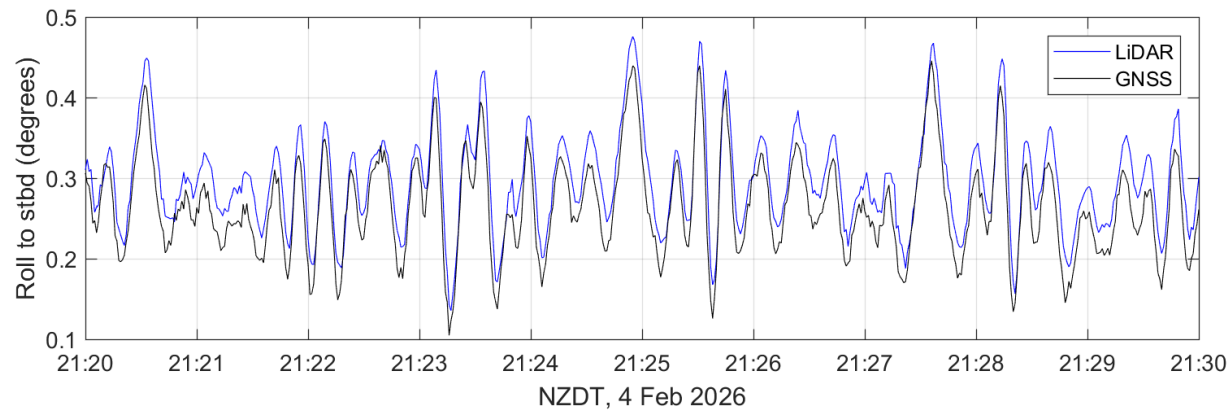
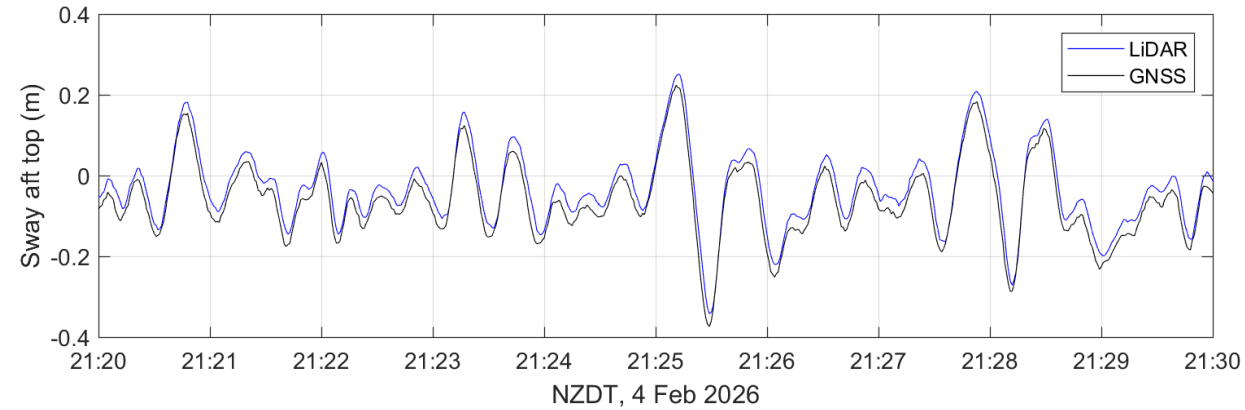
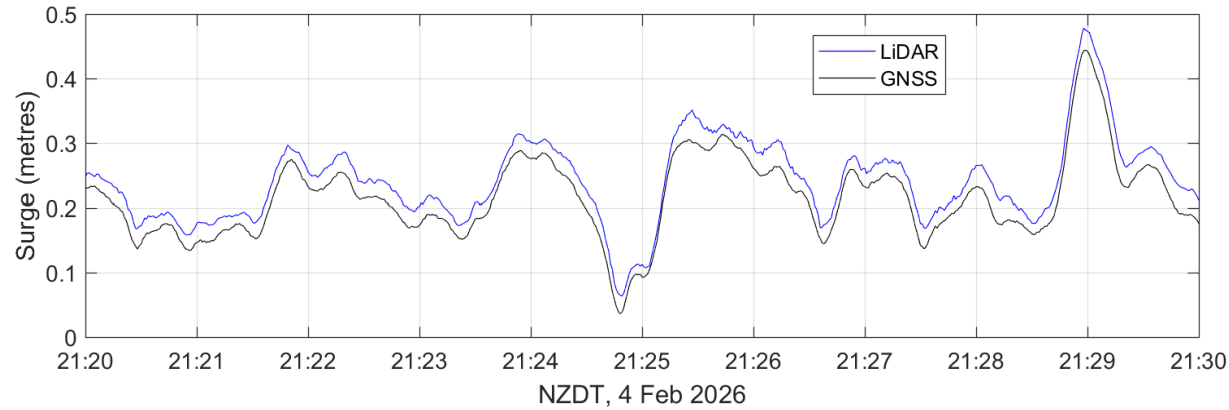
GNSS measurements for validation



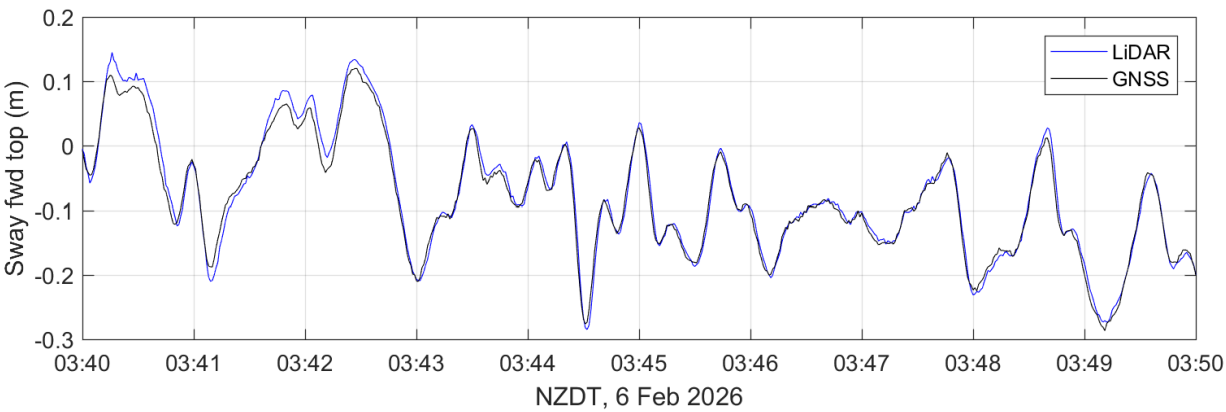
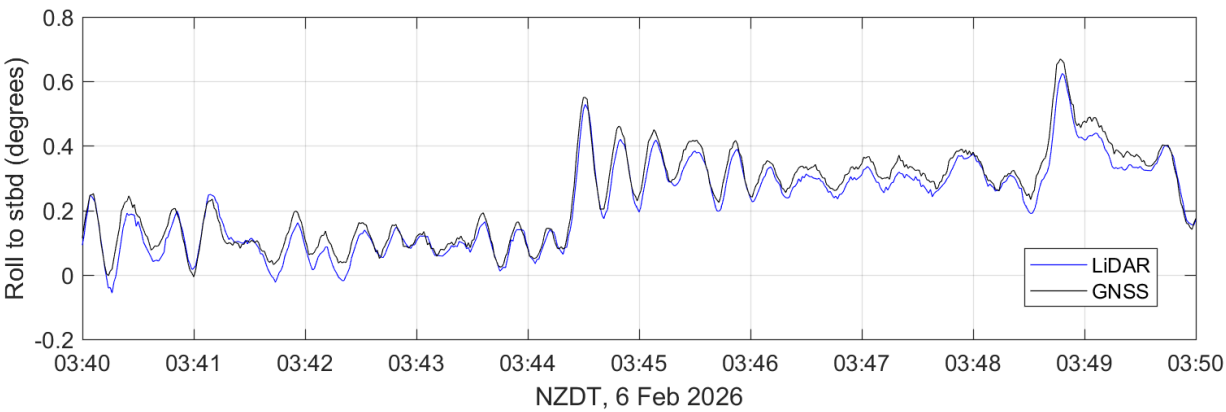
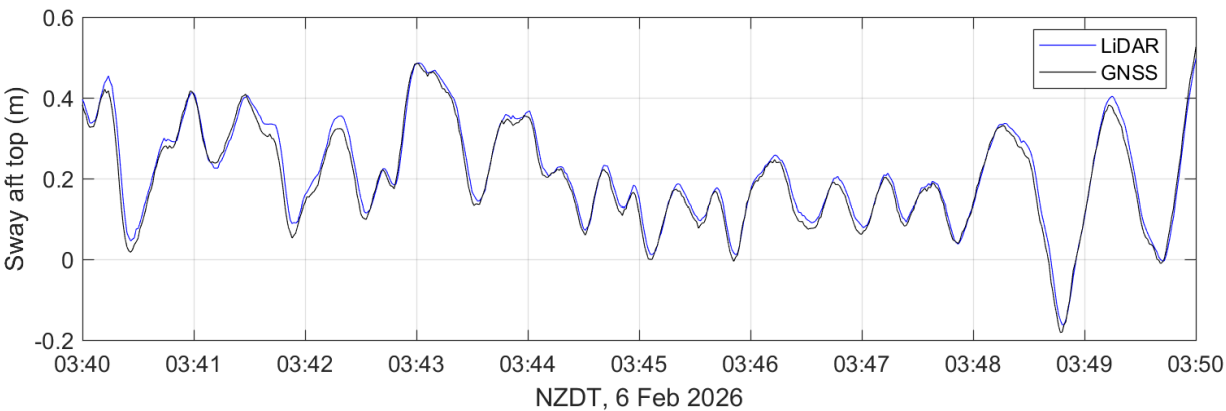
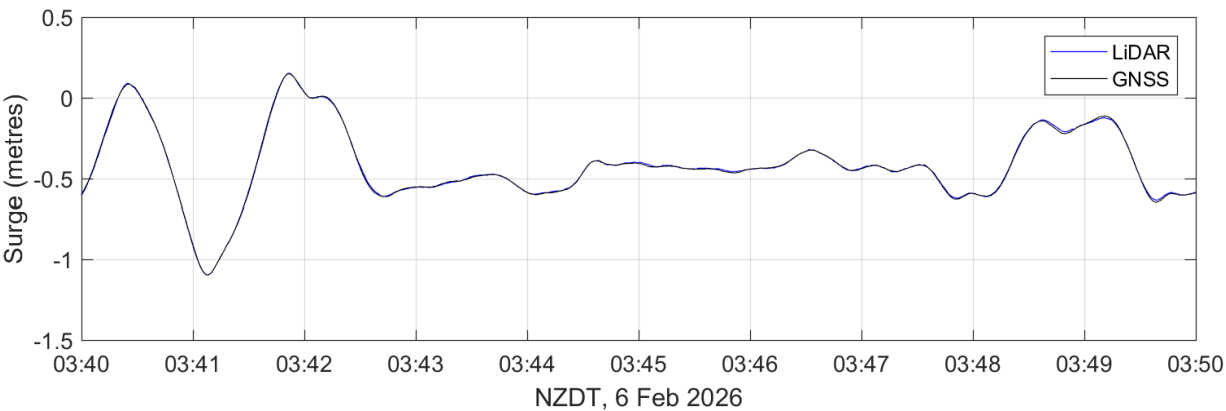
- Three survey-grade GNSS receivers
- Shore base station
- Set up on inbound transit
- Record through tie-up and while alongside
- 6-DoF ship motions at 1 Hz, RMS error cutoff 15 mm



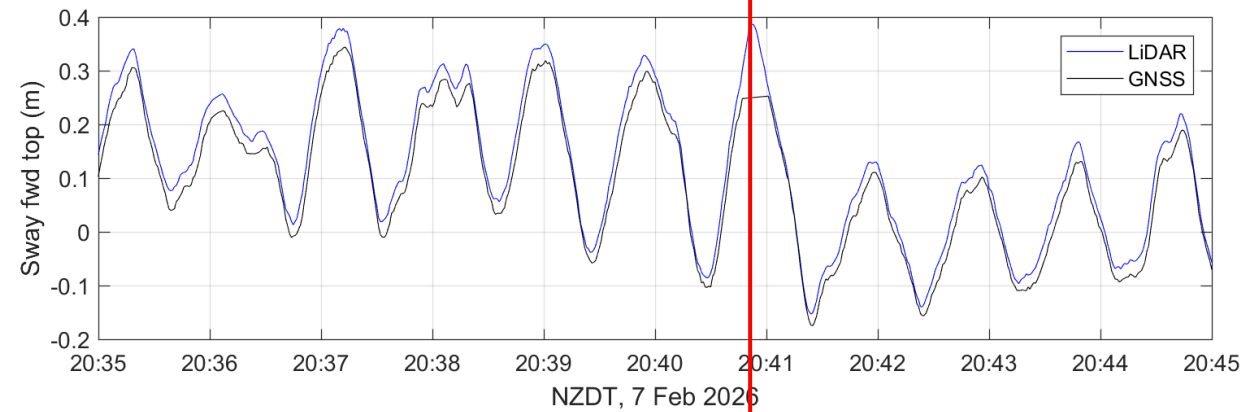
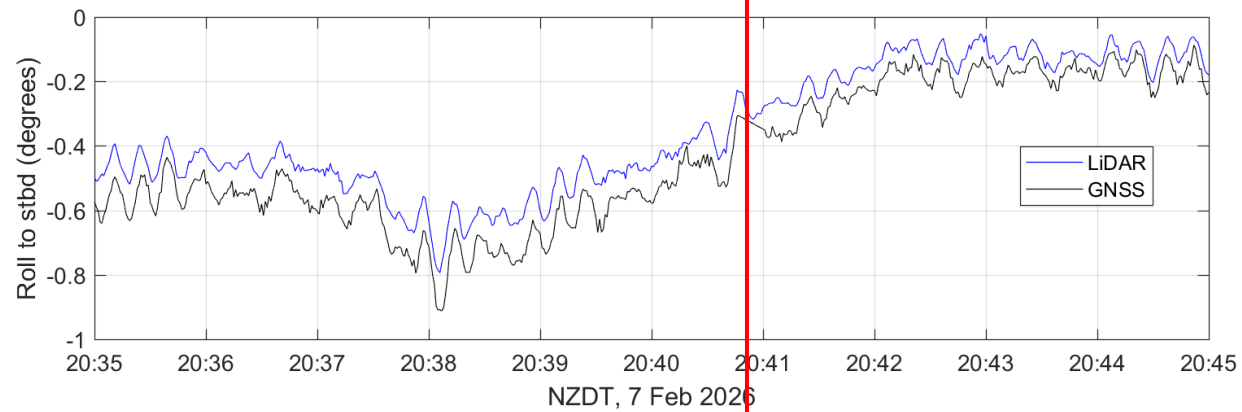
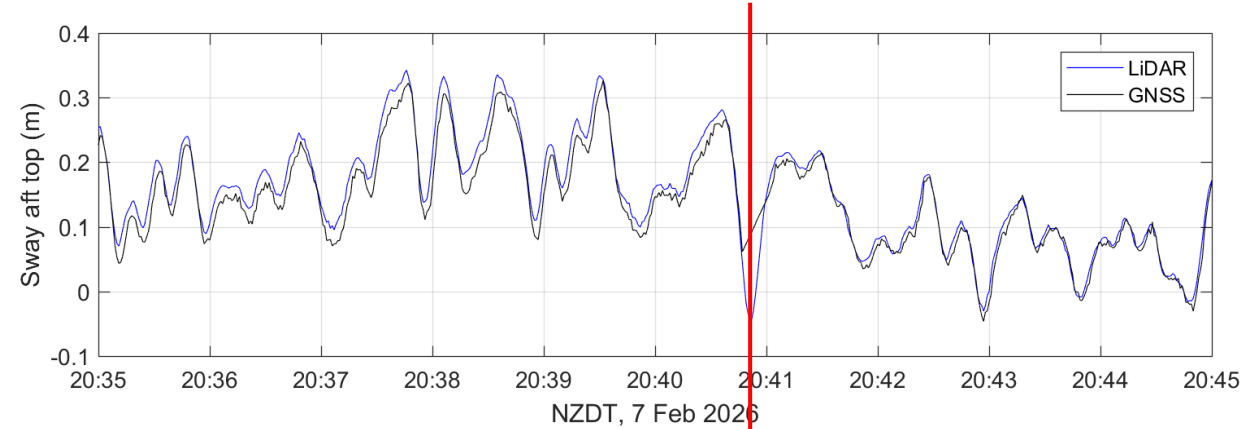
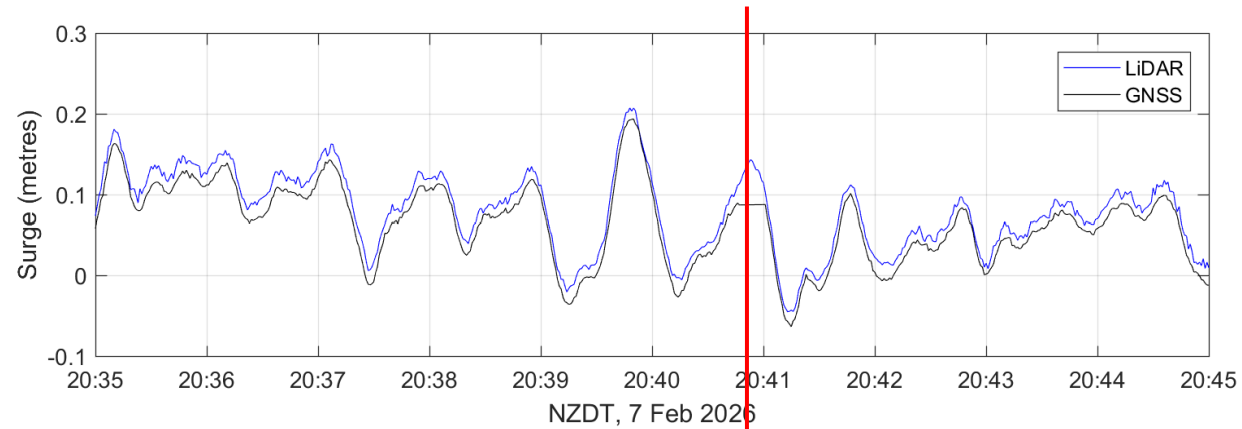
10-minute snapshot, BF Giant at No. 5 Wharf



10-minute snapshot, CMA CGM Perth at No. 5 Wharf

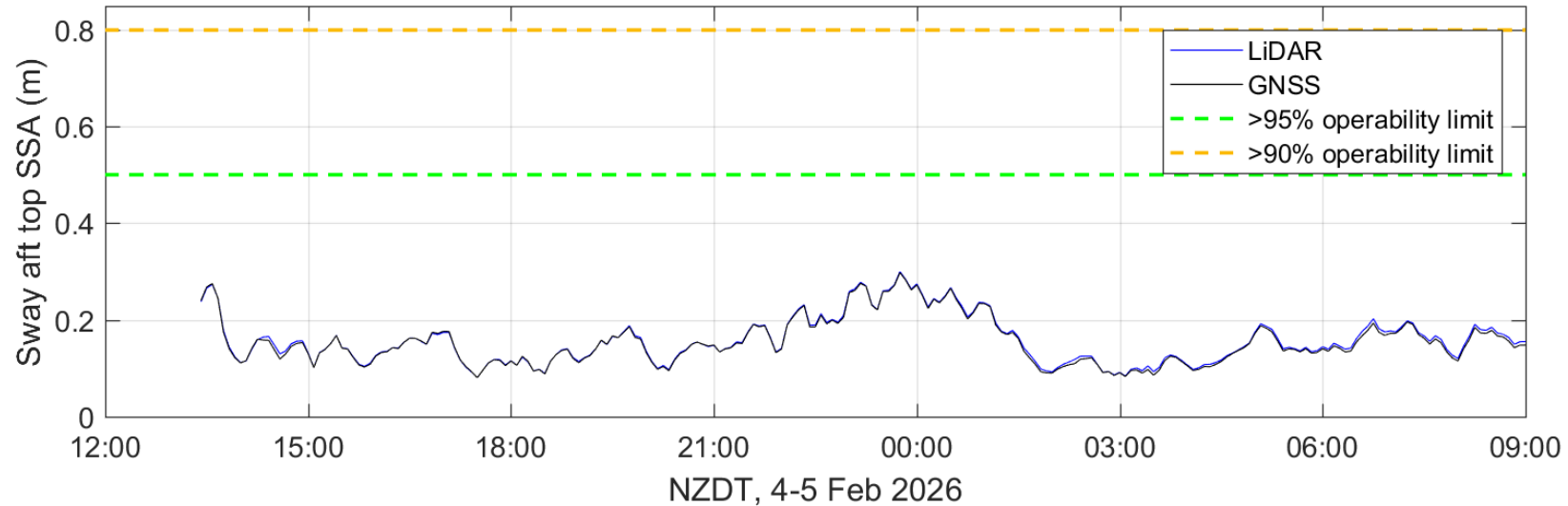


10-minute snapshot, MSC Lucia III at No. 5 Wharf



GNSS dropout

Motion statistics comparison



RMS error between LiDAR and GNSS			
	<i>BF Giant</i>	<i>CMA CGM Perth</i>	<i>MSC Lucia III</i>
Surge	0.003 m	0.002 m	0.002 m
Sway aft top	0.004 m	0.007 m	0.003 m
Sway forward top	0.007 m	0.011 m	0.006 m
Roll	0.003°	0.014°	0.009°

Installation on No. 6 Wharf



- 2 x SLP 100
- 2 x SLP PRO
- Near-real-time motion display in Datamesh, together with measured and forecast wave data



New ShoreTension units on No. 6 Wharf



Q & A

