ADCP Installation in the M/N Condor

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CONICYT
Ministerio de Educación
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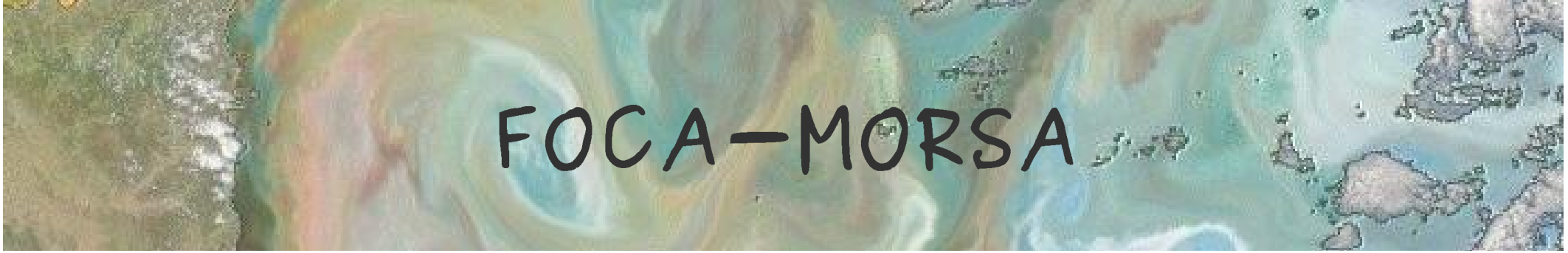
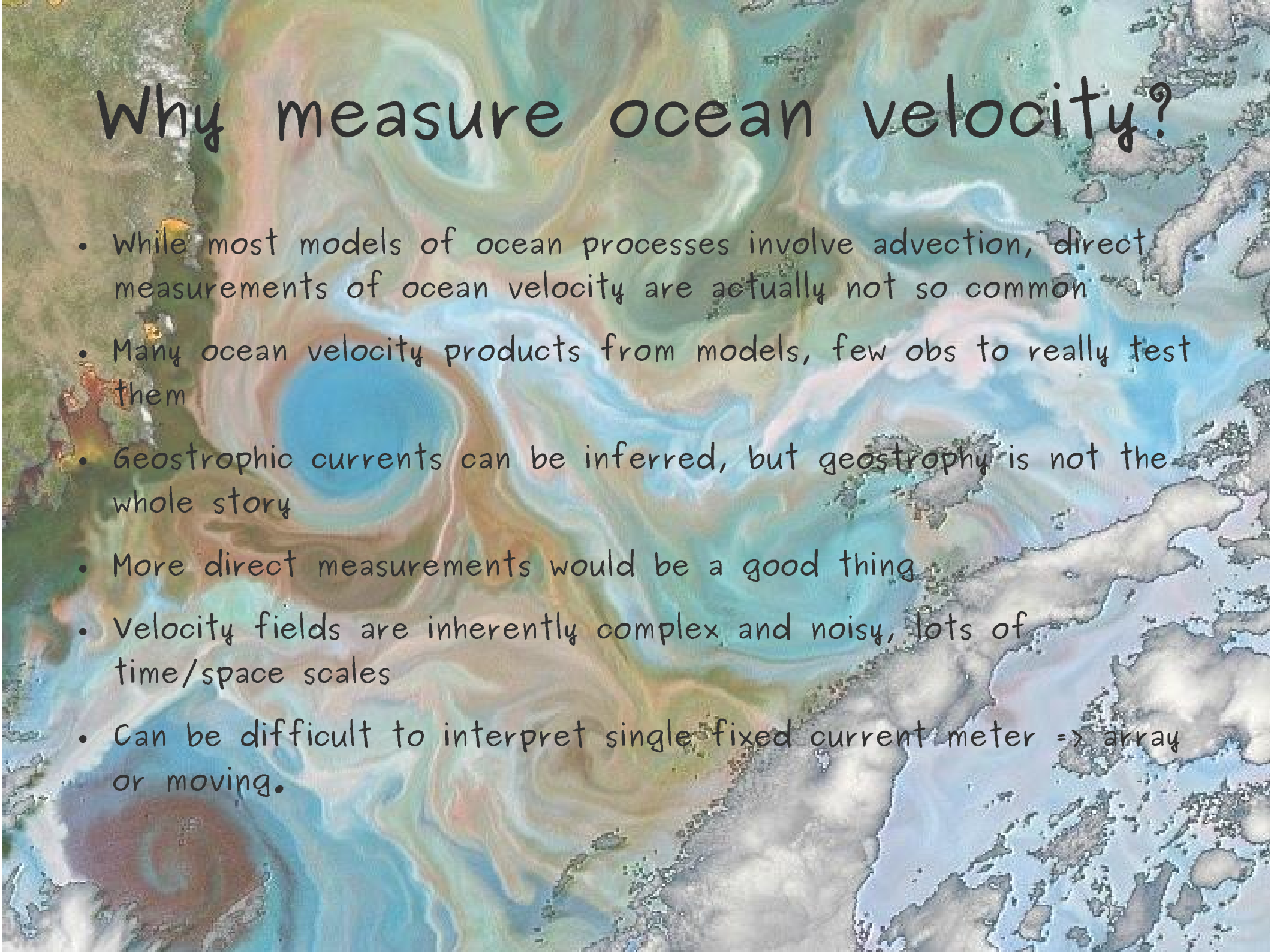


FOCA-MORSA

- Ferries Observando los Canales Australes + Mercantes Observando la Region Sud Americana
- Chile has huge EEZ, >$10 billion marine resource industry, but only 2 research vessels, $10 million fisheries research budget
- SOO make sense for Chile
- Emphasis upon cost-effectiveness, to enable a dense observing network to be run with realistic (ie low) budget, free and open access
- Funded to date through a series of individual research grants
- But target audience includes managers and industry

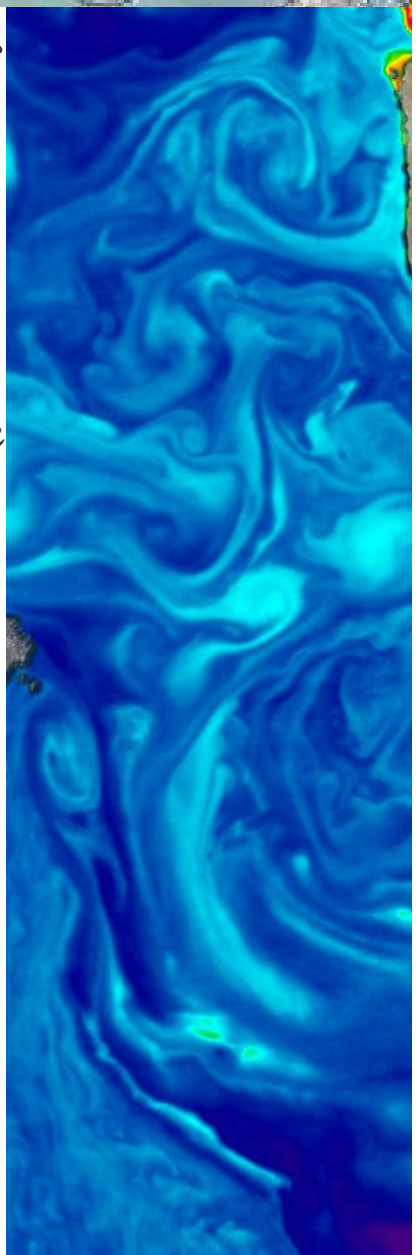


Why measure ocean velocity?

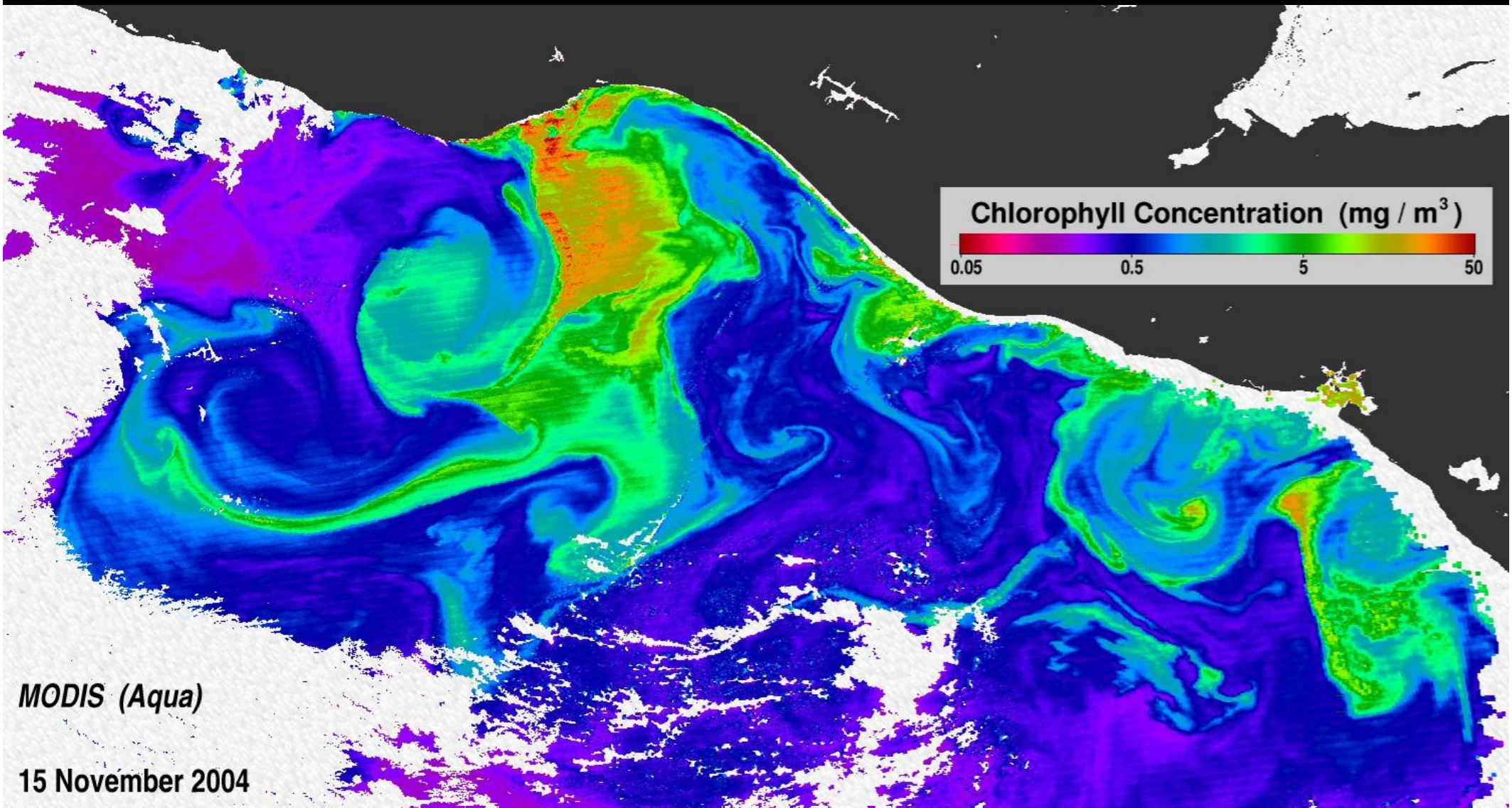
- While most models of ocean processes involve advection, direct measurements of ocean velocity are actually not so common
- Many ocean velocity products from models, few obs to really test them
- Geostrophic currents can be inferred, but geostrophy is not the whole story
- More direct measurements would be a good thing
- Velocity fields are inherently complex and noisy, lots of time/space scales
- Can be difficult to interpret single fixed current meter => array or moving.

Currents in Chile

- Advection is key to the extremely high productivity of the SE Pacific:
- At lowest order upwelling is determined by the off-shore transport of surface waters, but the distribution of upwelled nutrients in the euphotic zone becomes finely structured due to the energetic and rapidly evolving eddy field
- Larval transport likewise
- Hence velocity structure v important for understanding marine ecosystem functioning
- Funding for ADCP to investigate marine reserves
- Many other good reasons for Chile to invest in more velocity obs...



Eddy formation in EBUS

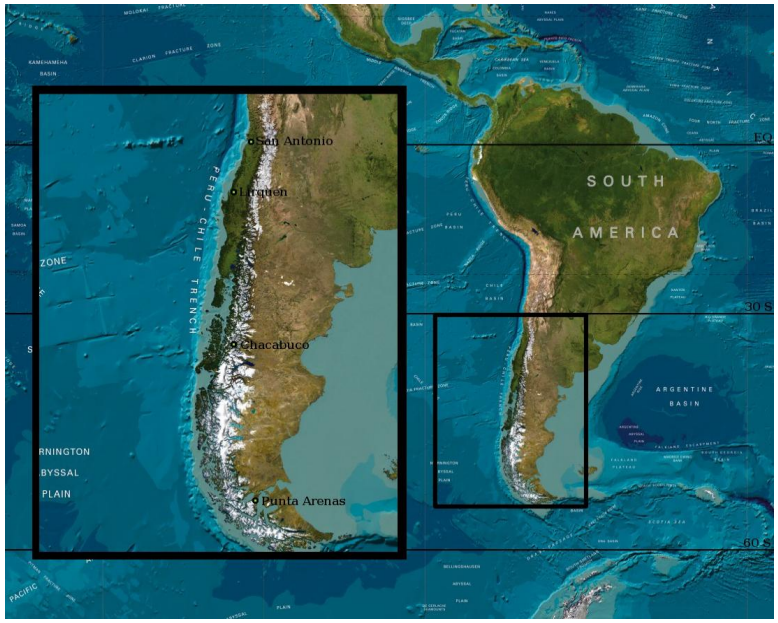


SADCP 101

- Uses high frequency sonar to infer water column motion via Doppler shift of reflected "pings"
- Relies on presence of passive reflectors in the water (usually plankton)
- Can be deployed from ships, over the side on a pole or installed directly in the hull
- Things become complicated on a moving platform - the ship's velocity (~10 m/s) must be known to better precision than the currents to be measured (~10 cm/s)
- ADCP can estimate ship motion in shallow water, but off the shelf need accurate "attitudinal" GPS
- Heading error must be < 0.1°, often not met by ship's gyro

M/N Condor

- Container ship covering section of Chilean coast from 33S to 53S
- Traverses the ultra-productive *Lengua de Vaca* upelling zone and all the fjords region (salmon country)
- (fairly) regular 15 day return journey, bought especially for this route
- home port nearby
- friendly crew, supportive owners

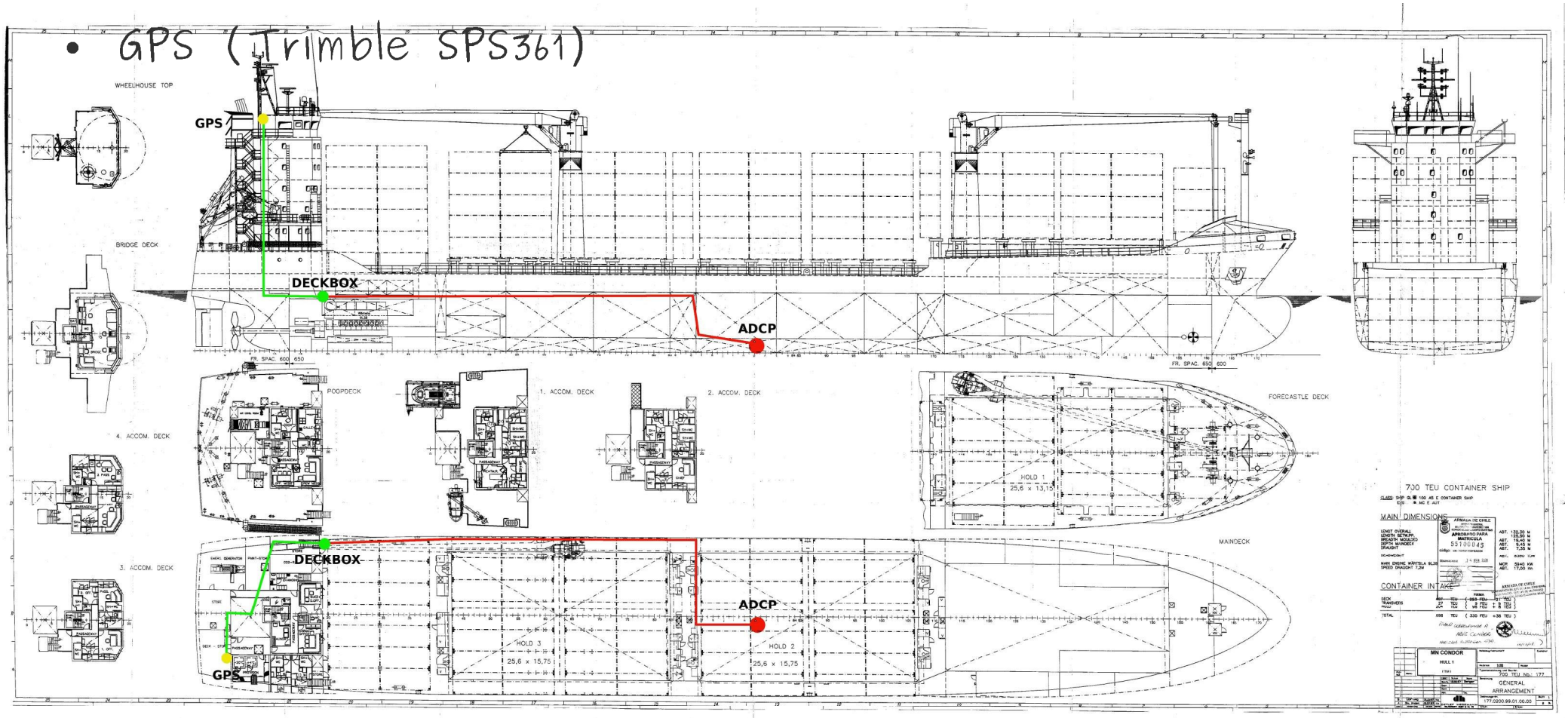


Approval process

- "All in the way you ask"
- Approval from owners much easier than expected
- For them a new hole in the hull is not such a big deal
- "Environmental dividend" at company level, but more important is the human factor
- Effort to explain and engage at all levels, harness good will
- Approval by classification agency GL

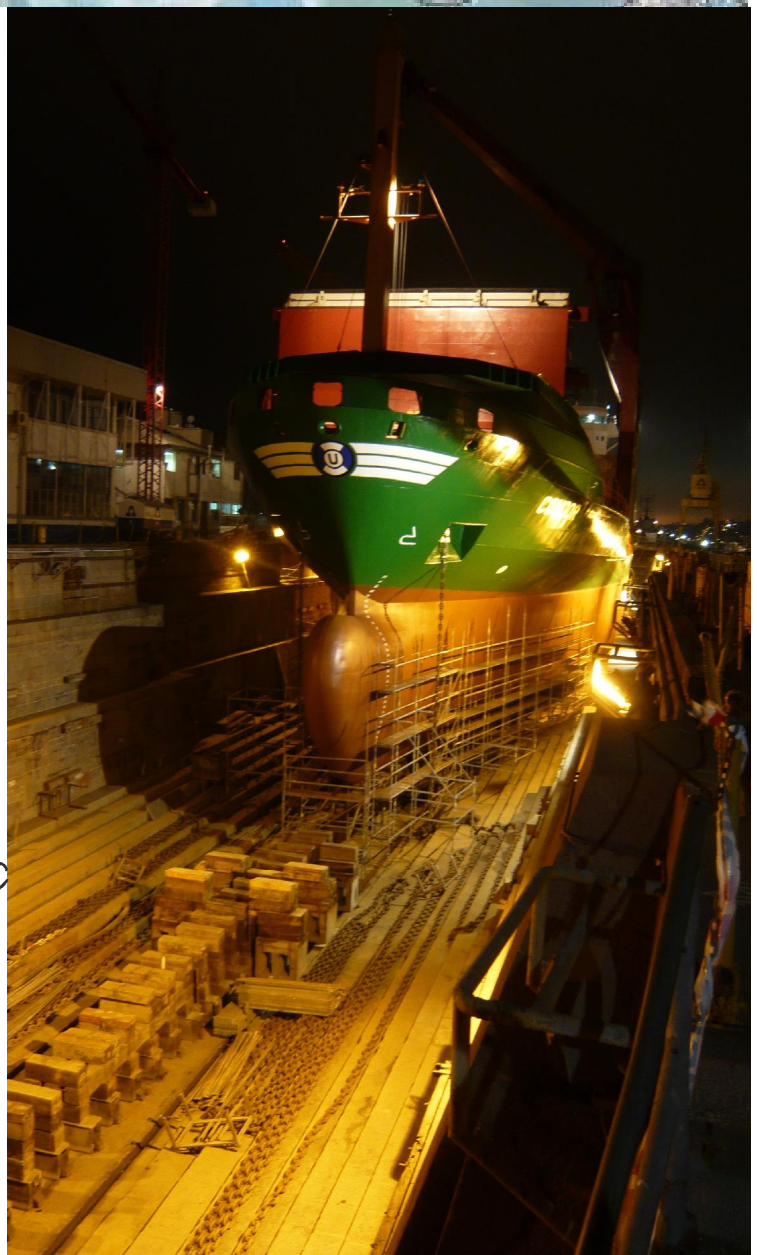
ADCP system

- ADCP (TRDI 300kHz workhorse mariner)
- Deckbox + DAS
- GPS (Trimble SPS361)



Installation

- All work done in ASMAR – the Chilean Navy's dry dock in Talcahuano – on two occasions (one unscheduled)
- Sea chest installed in May 2011, ADCP and cabling in August 2012, GPS in March 2013 in port
- Sea chest located midships in the "tunnel", next to fore–aft centerline
- The tunnel is dry, usually, but hermetic
- Deckbox in the engine control room together with data logging laptop
- GPS on bridge



Sea chest

- Designed to fit between *camisas*; coffer dam not welded to hull; small fairing to accept external lid; air vent, valve and conduit
- Some "surgery" needed to get it into tunnel and weld to hull
- Sailed with outer lid in place, waiting for ADCP
- Did not leak!
- Subsequent grounding was not our fault

In goes the ADCP

- Deliberately left the ADCP for last, made for nervous final moments in dry dock
- Installation finished at 4am, just hours before the dock flooded!
- Pressure test required to confirm no leaks

AGPS

- Trimble SPS361
- Two antenna soln, 1/3 price of the recommended Ashtech
- Claimed heading accuracy of up to 0.02°
- Antenna located port–starboard on the *pulpito* handrail, 10 m separation
- Data looks ok, some heading drop-outs, jury still out

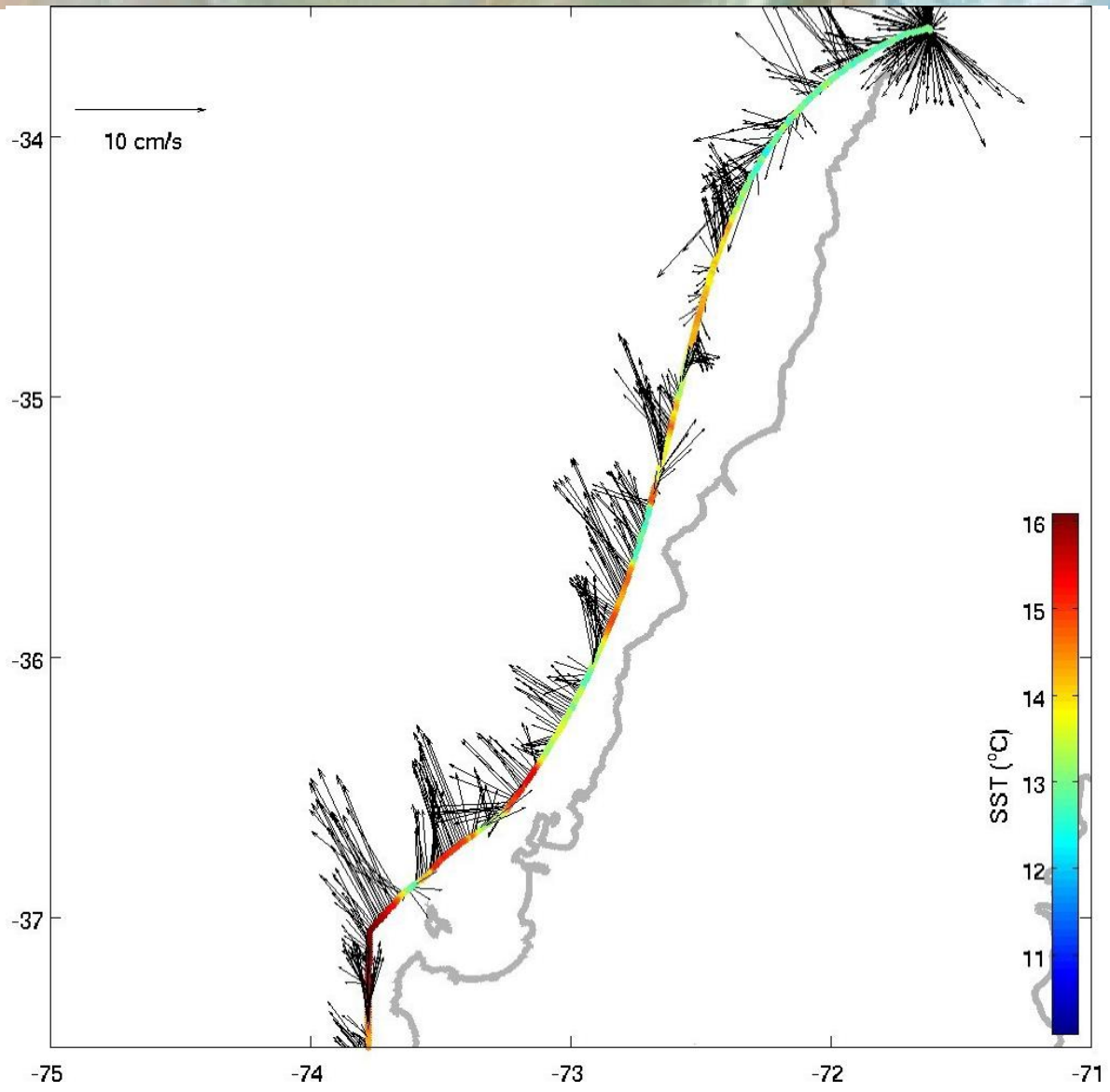
Cables

- Interference has been common source of data loss
- 80 m ADCP power/comms cable from ADCP to deckbox in engine control room
- Comms are RS422 at 9600 baud
- Cat 7 ethernet cable from engine to bridge
- Antenna cables from bridge to *pulpito*
- Share cable runs but within own conduit

DAS

- Very simple, no frills, home-grown, robust data acquisition system based on shell script
- We ping as fast as possible and record all raw data to a PC (there is a LOT)
- Gunnas: combine all data streams, configure GSM telemetry, real time surface velocity display on bridge

Preliminary results



Summary + future

- ADCP system installed and operational in cargo ship
- Results look promising, database will be unique and valuable (so we hope)
- New grant will assimilate ADCP data to investigate optimal observing system
- This grant will fund installation of second ADCP (to north or to west?) as well as maintaining/augmenting our existing FT systems
- Thanks to Tom Rossby, Charlie Flagg and Eric Firing