

Cruise Plan: RR1720, SPURS-2 2017

October 17, 2017

A. Context

The objective of the SPURS-2 experiment is to understand the fate of freshwater deposited on the sea surface as rainfall. The study site is the region around 125°W, 10°N in the eastern tropical Pacific Ocean, within the rainy Intertropical Convergence Zone (ITCZ). The first of two SPURS-2 cruises took place in Aug-Sept 2016 aboard the R/V Revelle. Cruise activities included deploying 3 moorings and numerous autonomous assets (Seagliders, Wavegliders, Mixed-layer float, Argo floats, drifters); a CTD survey; and underway measurements with an underway CTD, towed profiler, salinity snake, and meteorological sensors.

The second SPURS-2 cruise will take place in October-November 2017 aboard the R/V Revelle. The primary cruise activities are recovering the moorings and assets deployed in 2016, making underway measurements around the study site, and conducting a drifter experiment.

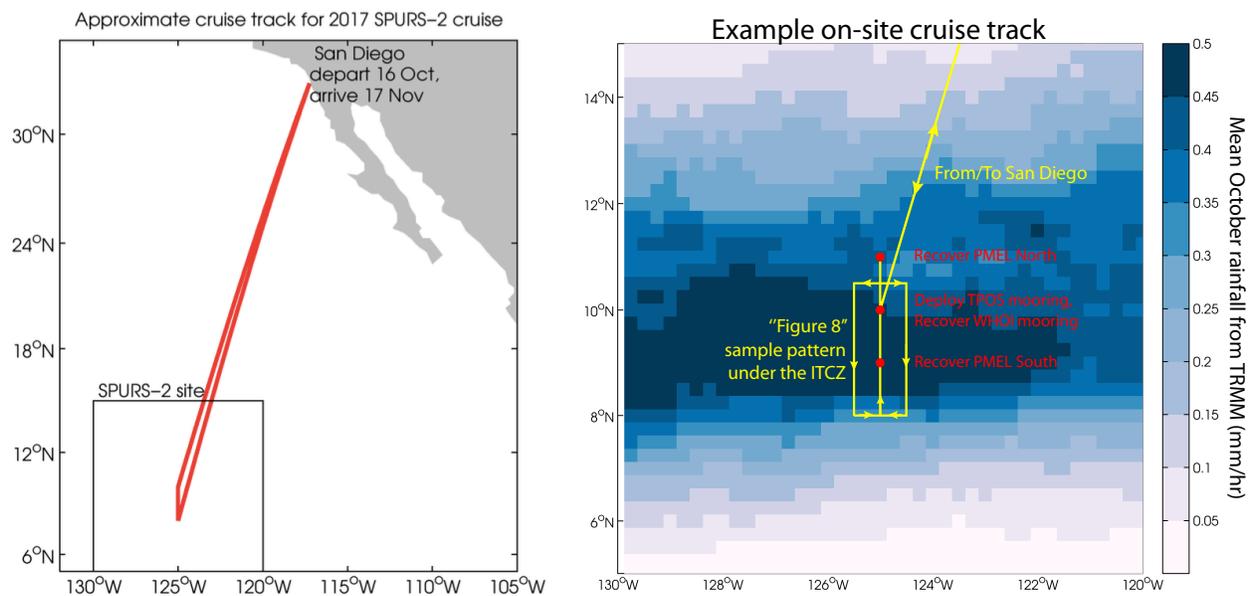


Figure 1: Left: overview of cruise track. Right: inset of the study site: shading indicates mean October rainfall (2000-2015) from TRMM. The moorings are shown in red and the proposed ship survey pattern is shown in yellow: a “figure 8” turned on its side, centered on the longitude 125°W and the latitude range of the ITCZ. The local position of the ITCZ will be determined using wind convergence observations and forecasts, and the latitude of the sampling box will be shifted accordingly throughout the survey. The Saildrones will operate along a similar course, offset longitudinally from the Revelle.

B. Cruise Activities

The main activities to take place on the 2017 SPURS-2 cruise on the R/V Revelle are:

1. Mooring recovery (3 days)

- a) WHOI mooring recovery: 12 hours (daytime)
 - Prior to recovery, at the start of the cruise, batteries for the buoy flux package will be installed (small boat op)
 - Requires small boat
 - Full-depth CTD before recovery
 - Met measurements within ~10-15km of the buoy to be made before recovery
 - Saildrones will be nearby for validation with ship
 - b) PMEL mooring recoveries (two moorings): 5 hours each (daytime)
 - Requires small boat
 - CTD cast to 500m before each recovery
- Mooring gear, including ragtop container, will be on the fantail
 - Mooring group will bring a TSE winch from WHOI
 - Require air tuggers

2. Autonomous asset recovery/deployment

- a) Seagliders (2): recover from the ship
- b) Wavegliders (2): recover both and redeploy (one with salinity rake), then recover both
- c) Argo floats: deployed during transits (6 floats from Scripps) and on site (9 floats from UW)
- d) EcoMapper AUVs (2): deployed for 4 hours and recovered
- e) SVP drifters (4, 2 of which have salinity sensors): deployed in drifter experiment (not recovered).
- f) S-ADOS drifter (buoy with 40-m instrumented line): deploy in drifter experiment and recover.
- g) Surfact floats tethered to drifters (4): deploy in drifter experiment and recover, then redeploy without recovery.
- h) Ultra-thin surface drifters (20). Deploy in drifter experiment. Not recovered.
- i) Boyle salinity "frisbee" drifter (1). Deploy in drifter experiment (not recovered).

3. Continuous underway sampling

- a) Salinity snake:
 - 42-foot boom mounted on the forward starboard 01 deck
 - hose hangs into the water and seawater is pumped back to the lab for salinity and other analysis
 - discharge 2 gal/min into sink in lab
 - fast/slow modes for sampling at 10 kts/4 kts
 - Water also used for DIC, pH and DO₂ measurements, as well as biological sampling (main lab)
- b) Met measurements:
 - sensors to be deployed on the jackstaff
 - additional sensors deployed on the A-frame
 - sea snake: 2-m boom attached to forward 01 deck, port side
 - additional rain sensors mounted around the ship.

- Prefer into the wind at <7 kts.
- Reigl wave altimeter mounted on the bow
- c) Underway Salinity Profiling System (USPS, a.k.a. OSSPRE):
 - Through-hull ports at 2- and 3-m instrumented with TSGs (to be calibrated before the cruise)
- d) ROSR:
 - Mounted to railing on forward starboard 02 deck.
- e) SEA-POL radar:
 - Radome mounted on a 20' container on forward 02 deck (inner-starboard position)
 - Power requirements: single-phase power at 208/240V or at 480V at an absolute maximum of 25 kVA
 - Gigabit Ethernet connection, ideally via a single-mode bi-directional fiber optic cable but multimode fiber or copper CAT6 cabling also possible.
- f) Underway optics and flow cytometry
 - Sensors set up in the main lab to sample the salinity snake water
 - Requires liquid nitrogen, glutaraldehyde (hazmat)
- g) WAMOS data:
 - Have coordinated with Eric Terrill's group to utilize/reprogram the WAMOS to capture rain or wave measurements

4. Periodic underway sampling (~14 days). Tentative plan is to sample along parallel ~3°-latitude meridional transects at 125°W±0.5° (see Figure 1), with the latitude of the transect centered on the ITCZ. The latitude of sampling will be adapted based on satellite observations and wind forecasts. Details to be decided.

- a) Underway CTD (uCTD):
 - Mounted at aft railing on port side quarterdeck (along with shade tent)
 - Continuous profiles to 500m every 30-40min (at 10 kts ship speed) or every hour (at 4 kts)
- b) CTD stations: in addition to the CTD stations at the mooring sites prior to recovery, periodic CTD stations during the underway sampling phase in order to validate the uCTD and make oxygen measurements (stations to be decided)
- c) Surface Salinity Profiler (SSP):
 - Launched from starboard main deck with Alaska crane
 - Towed using hydroboom and Poseidon winch: max tow speed 4 kts
 - ~10-hour deployments on a regular schedule (e.g., same time each day)
- d) Controlled Flux Technique (CFT): forward 02 deck, port side
 - CO₂ laser:
 - Requires 208V 30A 3-phase power (for laser)
 - Mounted to deck
 - Laser safety plan in place.
 - Infrared imager mounted to a rotating extendible boom:
 - During deployments, the boom is rotated outboard and secured
 - Laser and imager electronics are in a UNOLS general purpose lab van (outer port side).
 - Supplies housed in a second 20' container (inner port side)

- CFT will be carried out during SSP deployments (at 4 kts)
- e) A-sphere casts:
 - Periodic casts to 100 m (after CTD casts)
 - Uses same winch as SSP
- f) Rawinsonde launches 4 times per day
 - Helium cylinders (12) stored on aft 02 deck
- g) Salinity from bottle samples:
 - request ship's autosal

5. Drifter study (2.5 days). Plan is to deploy assets in a small region ahead of a rain event in a figure-4 pattern ~3 nm across. Will sample with the ship and spend the last 12 hrs recovering instruments. This will take place sometime during the period of underway sampling.

- a) 5 CODE drifters (deployed and recovered)
- b) 4 Surpact floats, tethered to drifters (deployed and recovered)
- c) 4 SVP drifters (deployed)
- d) 20 ultra-thin surface drifters (deployed)
- e) 1 S-ADOS drifter (deployed and recovered)
- f) 1 Boyle Frisbee drifter (deployed)
- g) Possible EcoMapper deployment

6. Model/satellite

- a) Bingham will be on board to help with data flow to/from the ship
- b) Li to send model output to guide PIs

7. Lady Amber sailboat

- Plan to have the Lady Amber at the SPURS-2 site during the cruise
- Potential Lady Amber "sail along" with the ship while towing SSP

8. Sairdrones

- Two Sairdrones to arrive on site before the Revelle for comparisons with the WHOI buoy
- Sairdrones will be on site throughout the Revelle cruise
- They will sample they will sample near the Revelle (a) when it is at the WHOI mooring for the CTD cast and the battery installation, and (b) when it is in the vicinity and travelling slowly (4 kts), in which case the Sairdrones will travel parallel to (and 100m to 1 km offset of) the ship
- Otherwise, the Sairdrones will sample around the WHOI buoy (5-30 km radius)
- Sairdrones have AIS signals and navigation lights, and pilots will be available continuously

C. Cruise Plan

Mobilization (San Diego) Oct 12, 2017; depart Oct 16, 0700.

Arrive (San Diego) Nov 17, 1600. Demobilization Nov 18.

Oct 16-21:

Depart San Diego, steam to 11N,125W		5.5 days
Test deployment of uCTD, SSP, etc. during transit		8 hrs

Oct 22:

CTD to 500m	11N,125W	2 hrs
Recover North PMEL mooring	11N,125W	12 hrs
Transit to WHOI mooring	10N,125W	6 hrs
Recover “yellow” Waveglider (while transiting south)	~10.5N, 125.2W	2 hrs

Oct 23:

Service WHOI mooring	10N,125W	6 hrs
Met measurements on station (with Saildrones)	10N,125W	6 hrs
Full-depth CTD (if timing works)	10N,125W	4 hrs

Oct 24-Nov 11:

Underway survey in sideways figure-8 pattern with uCTD and SSP; periodic CTD stations and A-sphere casts; continuous underway measurements. 10 hrs/day at 4 kts, 14 hrs/day at 10 kts. Adjust latitude of survey in order to stay in the ITCZ.	124.5- 125.5W, 8-10N	15 days
Recover/redeploy “green” Waveglider and redeploy “yellow” Waveglider with stinger	~9.5N,125W	4 hrs
Recover South PMEL mooring (with CTD to 500m beforehand) (around Nov 1)	9N,125W	5 hrs
Drifter experiment	Tbd	2.5 days
EcoMapper experiment	Tbd	8 hrs
Recover Seagliders and Wavegliders	Tbd	1 day
Recover WHOI mooring (around Nov 3)	10N,125W	12 hrs
Deploy assets to be left out (drifters, floats, etc.)	Tbd	

Nov 12-17:

Transit to San Diego (reach port Nov 17)

5.5 days

D. PIs

Asher	SSP/CFT	asherwe@apl.washington.edu
Bingham	Data management	bigkahuna@fredbingham.com
Centurioni	CODE drifters	lcenturioni@ucsd.edu
Clayson	Meteorology/fluxes	cclayson@whoi.edu
Clayton	Underway optics and flow cytometry	sclayton@uw.edu
Cronin	Saildrones	meghan.f.cronin@noaa.gov
Drushka	SSP/CFT	kdrushka@apl.uw.edu
Edson	Meteorology/fluxes	james.edson@uconn.edu
Farrar	Mooring recovery (WHOI)	jfarrar@whoi.edu
Gaube	RUMP	pgaube@apl.washington.edu
Ho	pCO ₂ , DIC, pH and DO ₂	ho@hawaii.edu
Hodges	Wavegliders and EcoMappers	bhodges@whoi.edu
Kessler	Mooring recovery (PMEL)	william.s.kessler@noaa.gov
Li	Modeling	zhijin@jpl.nasa.gov
Morey	Ultra-thin surface drifters	smorey@fsu.edu
Rainville	Seagliders and Lady Amber	rainville@apl.washington.edu
Reverdin	Surpact floats	gilles.reverdin@locean-ipsl.upmc.fr
Reynolds	ROSR	michael@rmrco.com
Riser	Argo floats	riser@ocean.washington.edu
Rutledge	SEA-POL radar	rutledge@atmos.colostate.edu
Schanze	Salinity snake	jschanze@esr.org
Shcherbina	Mixed-layer float	ashcherbina@apl.washington.edu
Sprintall	uCTD	jsprintall@ucsd.edu
Volkov	Dual-sensor SVP drifters	dlvolkov@gmail.com

E. Cruise Science Party

Last name	First name	Group
Ash	James	uCTD
Asher	Bill	SSP/CFT
Bingham	Fred	Data
Brothers	Matthew	Radar
Clayton	Sophie	Biology
Cole	Drew	Res tech
Dahn	Marah	Res tech
Drushka	Kyla	SSP/CFT
Fuchs	Brody	Radar
George	Jim	Radar
Graham	Raymond	WHOI mooring
Greenwood	Benjamin	Meteorology
Hacker	Peter	uCTD
Ho	David	Chemistry
Hoang	Clifford	uCTD
Hodges	Ben	Wave glider
Huey	Mary	Computer tech
Junyent	Francesc	Radar
Kawamoto	Spencer	uCTD
Lindstrom	Eric	NASA
Litchendorf	Trina	SSP/CFT
Pietro	Ben	WHOI mooring
Rivera	David	PMEL mooring
Rutledge	Steve	Radar
Schanze	Julian	Salinity snake
Sprintall	Janet	uCTD
Supply	Alexandre	Drifters
Thompson	Elizabeth	SSP/CFT

F. Deck Layout

