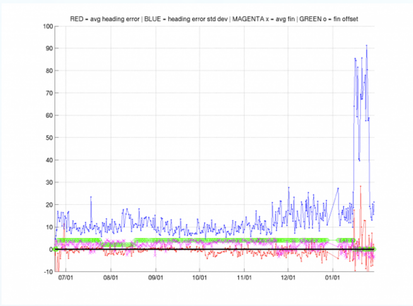
RU29 Challenger Mission

Contributors:
Cassidy Gonzalez - Physical Oceanography
Brandon Grosso - Marine Biology/Computer Science
Jessica Griffith - Chemical Oceanography
For more information, please visit http://challenger.marine.rutgers.edu/blog/ or contact the authors at Cmg348@rutgers.edu, Jmg543@rutgers.edu, and Bjg139@rutgers.edu

Issues

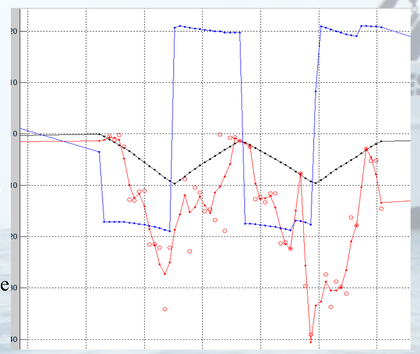


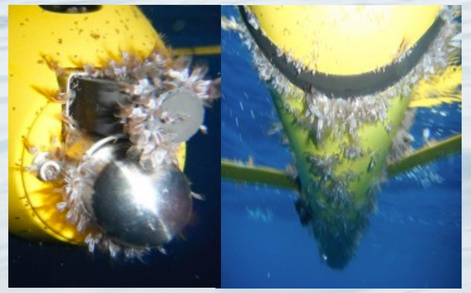
Steering Parameter Offset:

- Multiple underwater resets lead to the reset of the steering parameters, causing the glider to struggle to stabilize its steering
- This reset caused the steering to get progressively worse with time until an error in the steering parameter by an order of magnitude was finally discovered
- With the correction of this error, RU29 was once again running smoothly

Slipping Pump:

- Once the team realized there was an issue with the pump, more surface time was needed to trouble shoot the problem
- Unfortunately though, an increase in surface time allows for an increased probability of successful settlement of larval stage organisms, such as barnacles, on the hulls
- After realizing the pump was slipping as the glider was diving and climbing, it was decided to decrease the dive depth to 500m to reduce the increased power draw inadvertently caused by the slippage





Biofouling Drag: As barnacles progressively grew on RU29, again the steering parameters needed to be adjusted to account for the slight but significant drag caused by the growth. Had the biofouling grew more, there would be a possibility of completely losing steering capabilities, leading to a loss of control of RU29

Biology/Biofouling

- **Biofouling** is the accumulation of microorganisms, plants, algae, or animals on submerged equipment or ships in the ocean such as on RU29
- For a glider, biofouling can cause problems in terms of maneuverability, density increase, stability, and increased drag which decreases speed and requiring more battery to fly
- If a large amount of biofoul has accumulated, it can cause the glider to have trouble getting to its destination, and may rear it off course
- Worst case scenario, RU29 may become to heavy with the drastic accumulation of biofoul, and will lose its capability to return to the surface, inevitably leading it a loss of the glider

Brazil:

Sharks:
- Brazilian Sharpnose
- Spinner

Whales:
- Southern Right Sanctuary
- Humpback Breeding ground

Seals:
- South American Fur

Dolphins:
- Spinner
- Atlantic Spotted

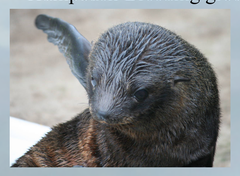
South Africa:

Sharks:
- Great Whites
- Catsharks

Whales:
- Southern Right
- Blue Whale

Seals:
- Cape Fur

Dolphins:
- Bottlenose
- Heaviside's

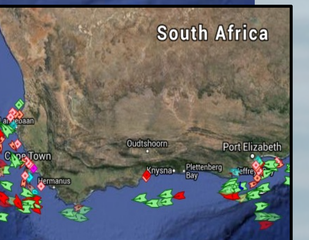


Overview

In January of 2013, Rutgers University, with a multitude of assistance, released RU 29, a Slocum Electric Glider, off the coast of Cape Town South Africa. Piloted by many different hands at Rutgers and around the world, RU29 traveled to Ascension Islands as the first stop on the South Atlantic circumnavigation crossing. RU's South Atlantic crossing is part of the Challenger Glider Mission, a two-year initiative to simultaneously pilot 16 ocean- fairing robots around the worlds ocean basins led by members of the Rutgers COOL team.

The objective of the South Atlantic Challenger Mission was to complete a total of three legs: South Africa to Ascension Islands to Brazil and back to South Africa. RU 29 left Cape Town, South Africa January of 2013. The glider was recovered in November 2013, after 290 days of travel to the Ascension Islands, an isolated volcanic island located in the south central Atlantic Ocean. After being recovered at Ascension Island, RU 29 was released again and began its voyage to Ubatuba, Brazil. RU29 was recovered in Ubatuba, Brazil on May 18, 2014 after its 189-day voyage. The first two legs of the South Atlantic Challenger Glider Mission covered 10,387 km. RU 29 began its third and final leg of the Challenger Mission in June, 2015. The glider was deployed from Ubatuba, Brazil and recovered in Cape Town, South Africa on March 31, 2016.

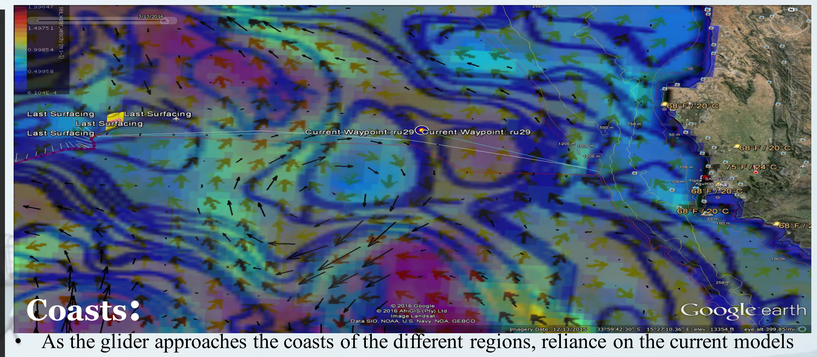
After RU29's successful South Atlantic Ocean Challenger Glider Mission, there are plans to send her very soon to the Indian Ocean to complete another circumnavigation of an ocean. Everyone here at RU and our partners are excited to see what she accomplishes next.



Shipping Lanes and Traffic

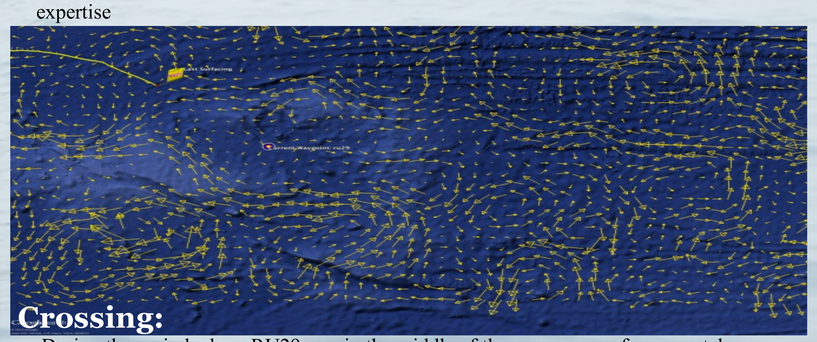
- Both the Brazilian coast and the South African coast have very busy shipping lanes, so it was important to keep this in mind during each of the deploys and recoveries
- A problem encountered during the South African recovery, was when RU29, the recovery crew on the Algoa, and another large ship were all headed to the same point at the same time
- In response, the recovery crew needed to radio into the other ship and ask to change course, to avoid potentially running over and destroying RU29

Currents



Coasts:

- As the glider approaches the coasts of the different regions, reliance on the current models became less and less reliable
- After a period of unforgiving dependence on each of the models, it became clear that no single prediction was correct
- This meant the Challenger team had to use their expertise to find optimal tracks for the glider to follow in order to finish the mission without a hitch
- This included accounting for a delayed current model, averaging currents and eddies in an area from different models, and even ignoring the models and relying on their own expertise



Crossing:

- During the period where RU29 was in the middle of the ocean, away from coastal influence on currents, the Challenger team was able to accurately use current models to fly RU29
- Models used include: Copernicus, Marcoos, RTOFS, and Oscar
- While piloting the glider through the rough waters, there were times where the team were able to hitch a ride on the storms passing by, which increased speed dramatically
- There were also times where the team needed to pilot the glider away form certain areas simply because the intensity would sweep RU29 away

Bathymetry

- With RU29's altimeters, she was able to map the depth of the ocean floor in shallower waters
- RU 29 occasionally had turned on the altimeter, which allows the team to adjust its depth relative to the surrounding region's bathymetry, but it was mainly turned off to avoid drastic power consumption
- This slocum glider used for the mission can travel up to 1000m down into the ocean
- By changing its depth, the team was able to avoid RU29 colliding with ridges or any other dangerous features present near the ocean floor