Saildrone is an unmanned surface vehicle currently being tested by NOAA PMEL. With a speed over ground of up to 8 kts, a range of more than 16,000 nautical miles, and endurance of up to 12 months, they potentially could contribute in important ways to the Tropical Pacific Observing System. In this study, we highlight some of the abrupt fronts observed by the Saildrones as they crossed the equatorial cold tongue front.

Science questions:
- How sharp are these fronts?
- Are they associated with daytime solar warming? Or oceanographic processes (e.g. meridional convergence)?
- How do gridded products capture these fronts?

RESULTS

Front #1

This front at 6°N had a 0.6°C drop in less than 15 km and an overall 1.5°C drop in 60 km. Winds were strong enough to mix solar warming. Large meridional convergence.

Front #2

This front had a 0.9°C drop in less than 30 m and an overall 1.1°C drop in 1 km! This was at dusk, when winds were weak. Very large meridional convergence in the upper 15 m, but divergence below.

Front #3

The sharp front at 4.9°N had an increase of 0.4°C in 10 m and a 0.7°C increase in less than 1 km. This was at dusk and so solar warming and nighttime mixing could not contribute to this warming.

Front #4

This front had an increase of 0.8°C in 50 m and a 1.1°C increase in 125 m. This was at dawn and it is unlikely that solar warming is contributing to this warming.

CONCLUSION

Saildrones are excellent vehicles for observing fronts. Extremely abrupt fronts were observed as the vehicles crossed the northern edge of the equatorial cold tongue. In some cases, these fronts were less than 1 km wide, providing challenges for satellite and numerical model gridded products. Care must be made thought to distinguish fronts from diurnal warming and cooling along the vehicle trajectory. We confirm that several of these abrupt temperature changes were sharp fronts associated with oceanic processes, including surface meridional convergence.

Support from NOAA Ocean Observing and Monitoring Division is gratefully acknowledged.