Ocean Surface Salinity and Wind Speeds From the SMAP Sensor

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1. Background and Overview

1. The Soil Moisture Active Passion (SMAP) mission has been launched on January 29, 2015 and the instrument has been taking observations since April 2015.
2. The combination of passive and active L-band channels provides information similar that acquired by Aquarius, which suggests that it will be possible to adapt the Aquarius salinity retrieval to SMAP. With the demise of Aquarius on June 7, 2015 the ability of the SMAP sensor to measure ocean salinity has gained importance. It will allow to extend the data record of the highly successful Aquarius mission into the future.
3. This poster discusses the adaption of the Aquarius salinity retrieval algorithm to SMAP and assesses the performance of both instruments for measuring ocean surface salinity based on the current stage of the retrieval algorithm.
4. The L-band surface emission at keeps good sensitivity at high wind speeds and it is very little affected by rain. This makes SMAP an excellent sensor to measure winds in storms.

2. SMAP versus Aquarius

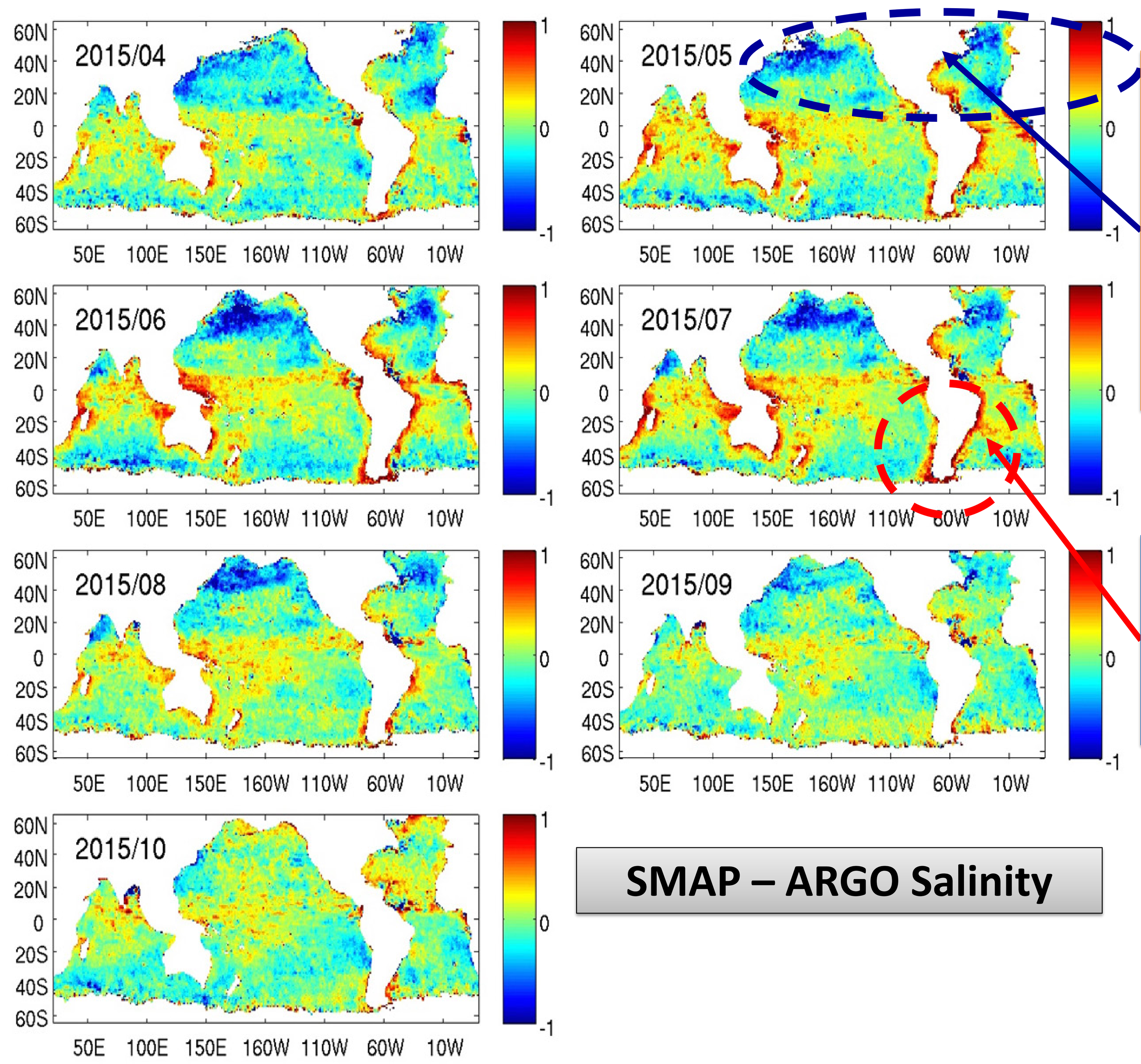
	SMAP	Aquarius
Radiometer center frequency	1.41 GHz (L-band)	
Scan geometry	Full 360° scan: Observes each Earth location fore and aft. Important diagnostic tool.	Pushbroom: 3 horns staring at fixed angles.
Sampling time for 1 footprint	17 msec	1.44 sec
Spatial resolution of half-power footprint	40 km	100 – 150 km
Noise of single footprint observation	≈ 1.2 psu	≈ 0.15 psu
Calibration accuracy requirement	1.3 K	0.1 – 0.2 K
Sun	Sun intrusion when looking left of forward. Needs to be filtered out.	Always looking away from the sun. Minimal sun intrusion.
Reflector	Slightly emissive. Needs to be corrected.	Not emissive.
Radar / surface roughness correction.	The radar failed in July 2015. Need to use ancillary wind field (WindSat, F17 SSMIS) for performing surface roughness correction.	Use radar observations, which match radiometer observation in space and time.

1. Temporal and/or spatial averaging of the SMAP observations is essential in order to achieve sufficient noise reduction.
2. Additional efforts in the instrument calibration need to be done beyond the mission requirements.

3. Validation of SMAP Salinities

Data Sources

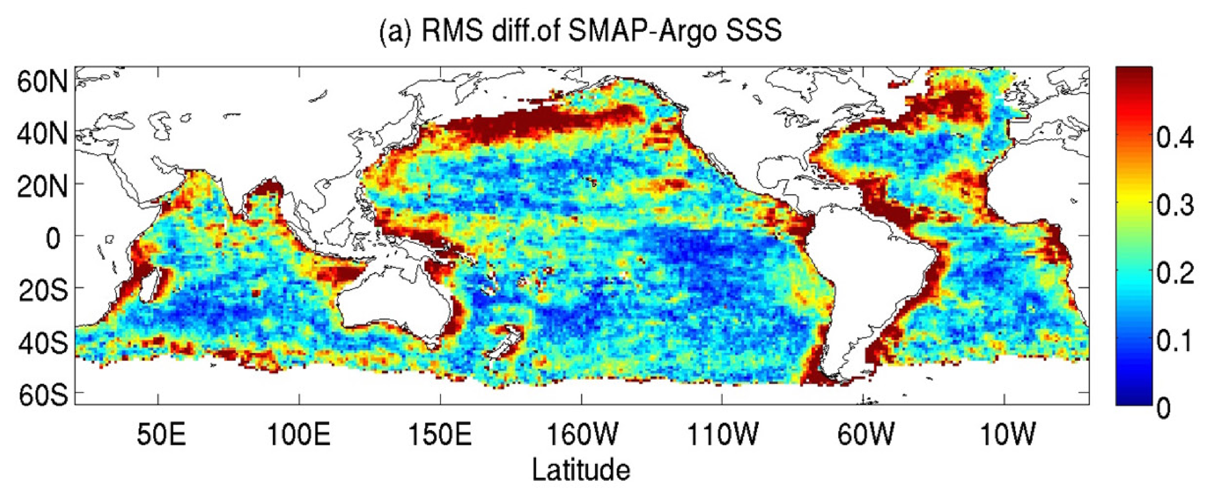
1. RSS SMAP Version 1.0 (BETA): monthly. For the validation the data were averaged into 1° x 1° lat/lon bins for the time period April – October 2015.
2. Argo-based monthly OI maps (65S-65N) from Scripps Institution of Oceanography, which covers the entire period of the SMAP SSS record.



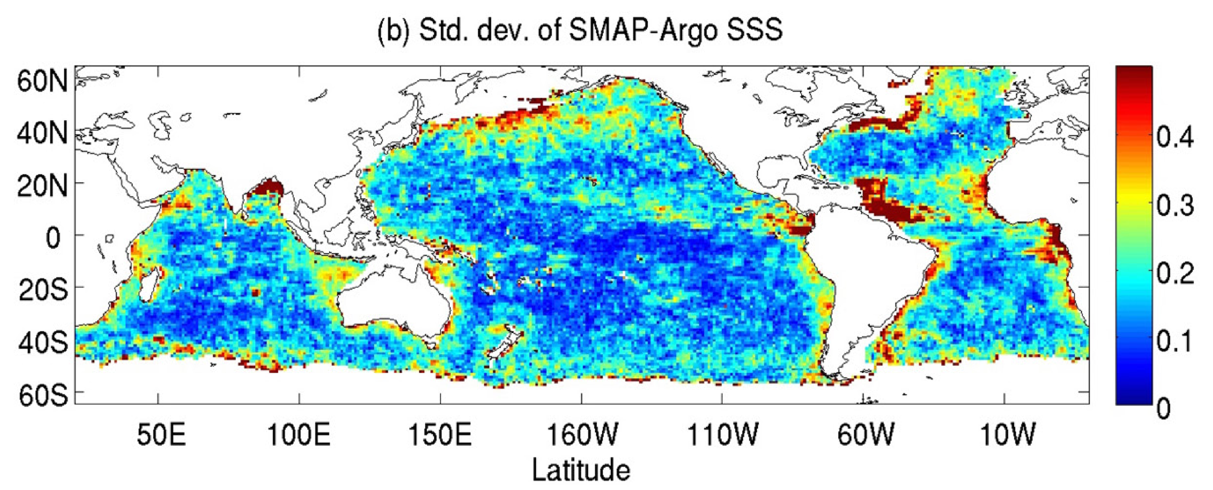
SMAP – ARGO Salinity

Fresh biases at high N latitudes during summer months and high S latitudes during winter months.
Suspect instrument calibration issue. Inaccurate thermal model that is used in correction of emissive antenna.

Salty biases of S hemisphere coasts.
Correction for land emission near cost overcorrects.

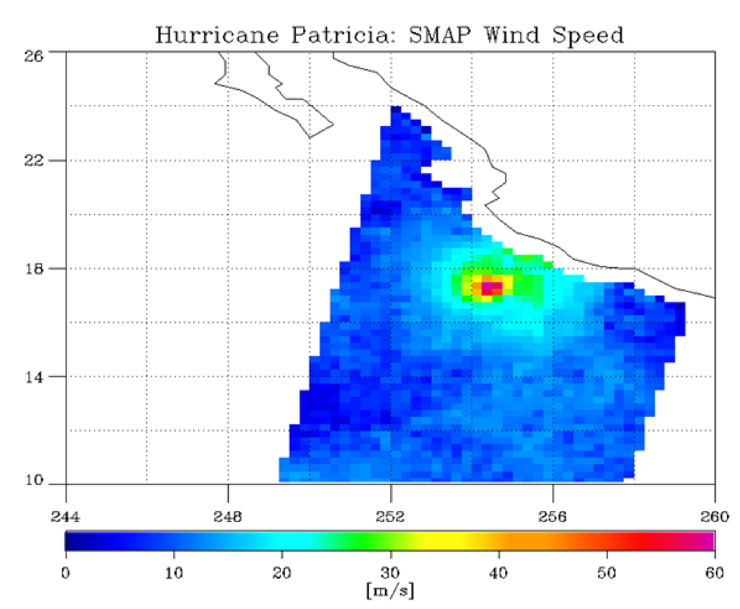


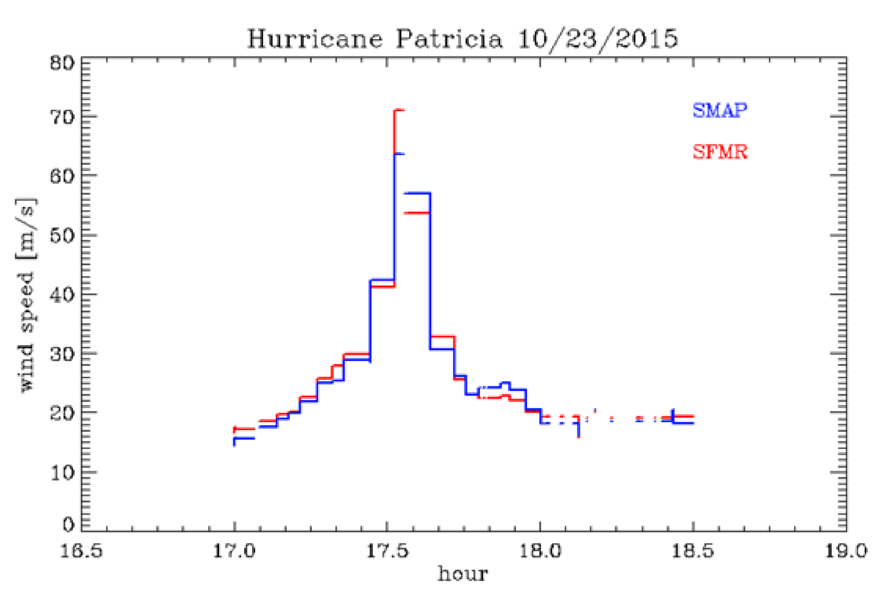
Global average **RMS** difference **SMAP - Argo** maps: **0.26 psu** (comparing to 0.22 psu for Aquarius V4 - Argo). This includes time-mean difference and temporal variations.



Global average **std. dev. SMAP - Argo** maps: **0.20 psu** (comparing to 0.16 psu for Aquarius V4 - Argo). This is for temporal variations.

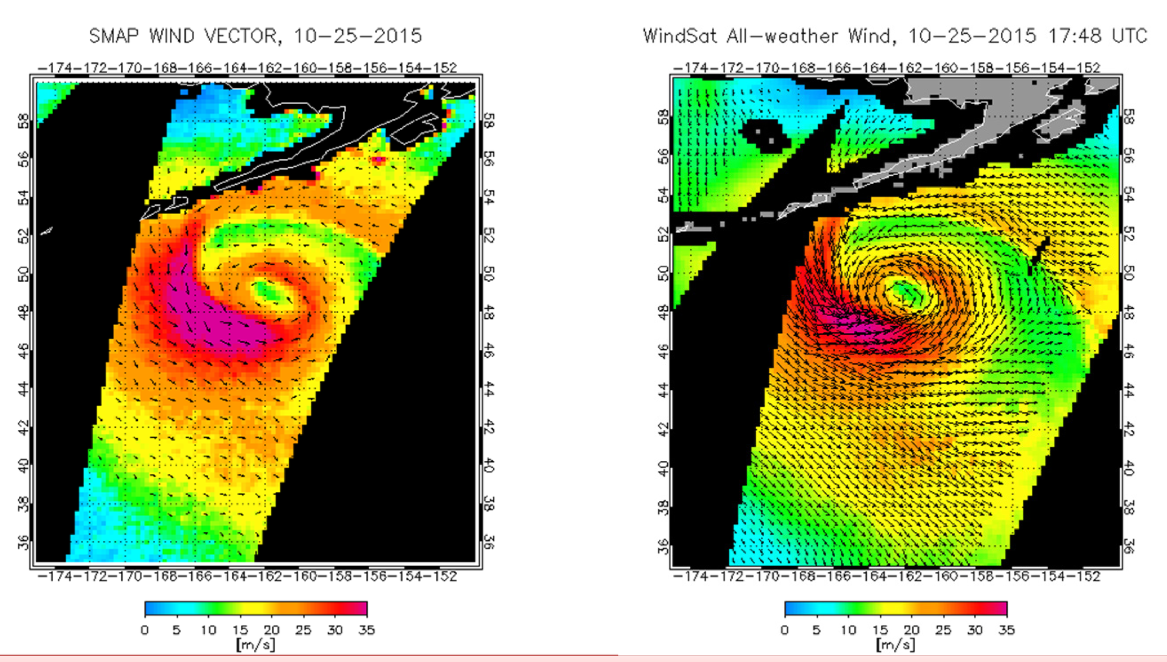
4. SMAP Wind Vector Capability in Storms





wind speeds in Hurricane Patricia: **SMAP** versus **SFMR**

use HYCOM SSS as ancillary input



wind vectors in extratropical cyclone: **SMAP** versus **WindSat**

5. Data Availability

RSS SMAP Ocean Surface Salinity
http://www.remss.com/missions/smap

Version 1.0 (BETA Release):
Level 3: 0.25° x 0.25° maps. 40 km resolution.

1. 8-day running average maps centered on each day.
2. Monthly maps.

Batch processing once every month.

Validated data release (Version 2.0) planned for spring 2016.