SMAP Salinity Effects Associated with the Presence of Rain

Maria Jacob[1], Andrea Santos-Garcia[2], and Linwood Jones[2]

[1] *Comisión Nacional de Actividades Espaciales, Argentina*

[2] *Central Florida Remote Sensing Lab., University of Central Florida, Orlando, FL*

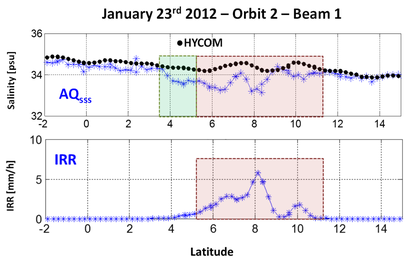
ABSTRACT

The Soil Moisture Active Passive (SMAP) satellite carries an L-band radiometer, which measures sea surface salinity (SSS) over a swath of 1000 km @ 40 km resolution. Previous studies [see references] have demonstrated significant differences between satellite and in-situ salinity measurements during rain. In the presence of precipitation, salinity stratification exists near the sea surface, which nullifies the presumption of a well-mixed salinity. In general, these salinity gradients last only a few hours and the upper layer becomes slightly fresher in salinity.

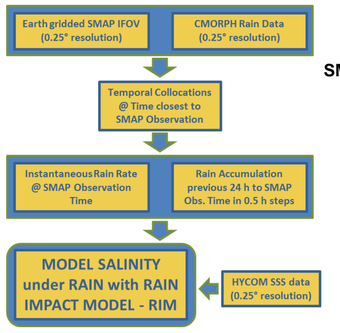
This poster describes the Rain Impact Model (RIM) that simulates the effects of rain accumulation on SSS [Santos-Garcia et al, 2014] applied to SMAP. This model incorporates rainfall information for the previous 24 hours to the measurement sample and uses as initialization the Hybrid Coordinate Ocean Model (HYCOM) data. Given the better resolution of SMAP, the goal of this paper is to continue the analysis previously done with AQ to better understand the effects of the instantaneous and accumulated rain on the salinity measurements.

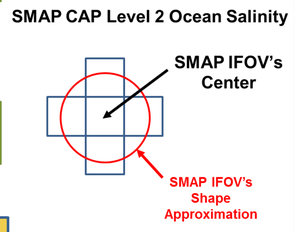
INTRODUCTION

- SSS differences (ΔSSS = AQ – HYCOM) have been observed during simultaneous rain events
  - Significant reductions in the satellite measured SSS



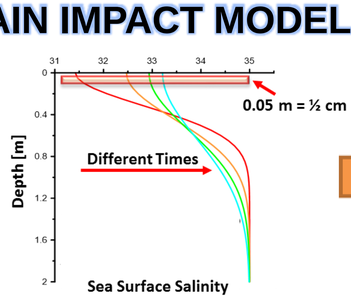
APPROACH

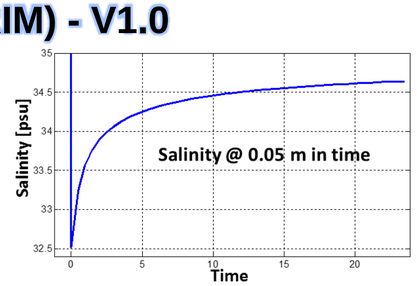




RAIN IMPACT MODEL (RIM) - V1.0

Stratification - single Rain Event (Based on In-Situ Measurements)

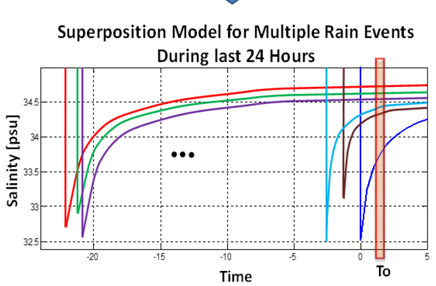




$$S(z,t) = S_0 d_0 * \left(d_0 + \frac{R}{\sqrt{K_z * t}} e^{(-z^2/4K_z t)} \right)^{-1}$$ z = 0.5 cm

$$RIM_{SSS} = S_0 \left[\left(\prod_{i=1}^{n} \left[1 + \frac{R_1 i}{\sqrt{K_z * t_i}} e^{(-z^2/4K_z t_i)} \right] \right) * \left[1 + \frac{R_2}{\sqrt{K_z * t}} e^{(-z^2/4K_z t)} \right] \right]^{-1}$$

HYCOM; Vertical Diffusivity; Rain Impulse Functions; Depth = 0.5 cm



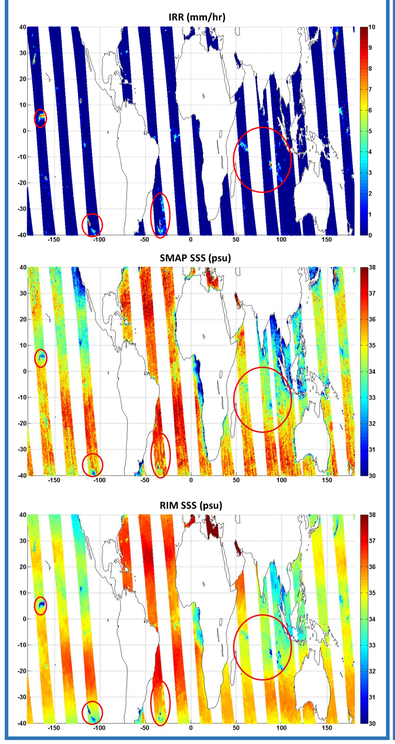
- Uses HYCOM as initialization (From SMAP CAP L2)
- Uses CMORPH to build the Rain History (CMORPH_V1.0)

SUMMARY

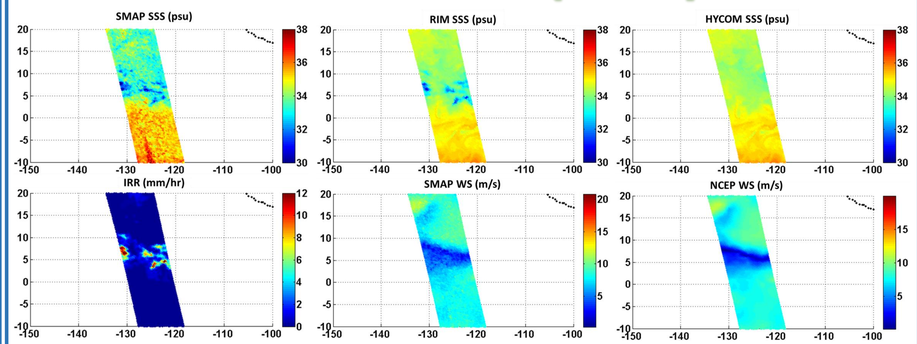
- RIM, previously tuned and validated with Aquarius and SMOS, exhibits an equivalent performance using SMAP data
- RIM provides positive identification of the existence of a transient salinity stratification due to rain accumulation
- Very good performance of RIM predicting sea surface salinity provides a robust quality flag for identification of salinity stratification
- Further improvements can be achieve using RIM V2.0 (rain and wind speed effects)

DATA ANALYSIS

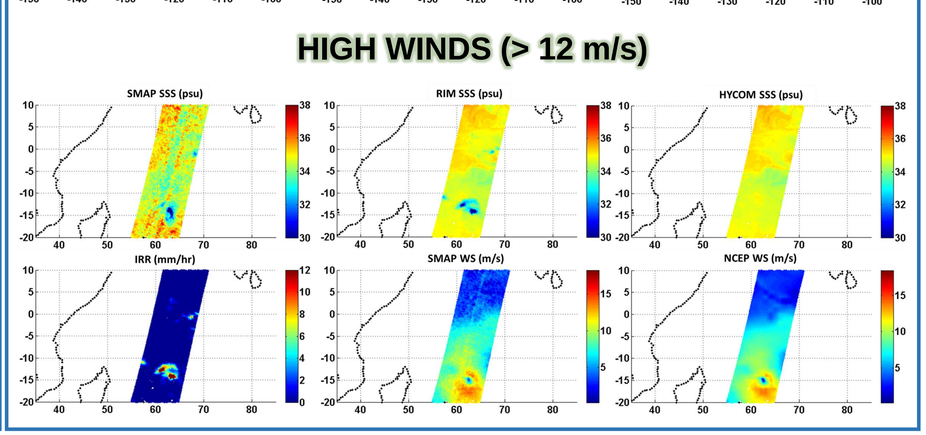
CONCATENATED RESULTS



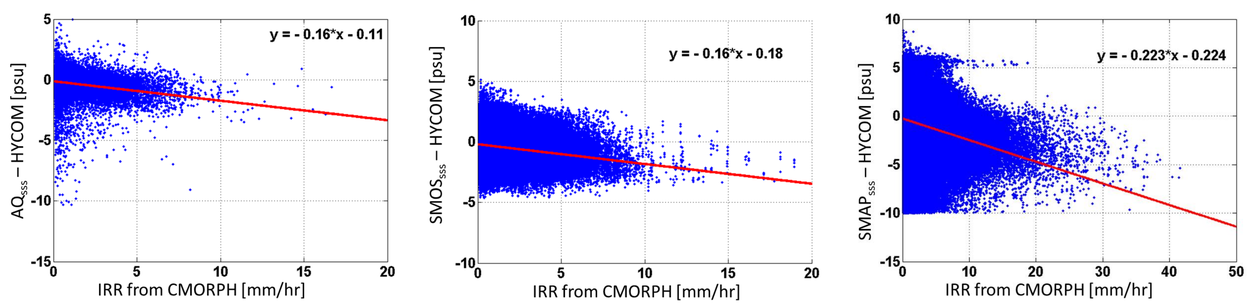
MODERATE WINDS (< 10 m/s)



HIGH WINDS (> 12 m/s)



AQUARIUS, SMOS & SMAP COMPARISONS



IRR > 0.1 mm/hr
All wind speeds

-60 ≤ LATITUDE ≤ 60

Restriction given by the CMORPH coverage