Assessment of Remote Sensing Systems Version-7 Rain Rates

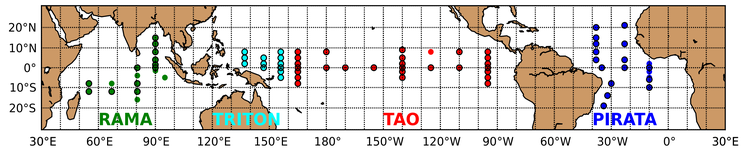
AGU Fall Meeting 2012, Poster H33C-1339

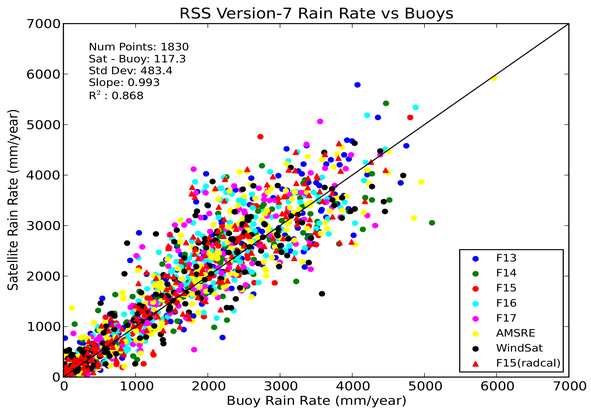
Kyle Hilburn* and Deborah K. Smith (*hilburn@remss.com)
Remote Sensing Systems, Santa Rosa, CA

Remote Sensing Systems
www.remss.com

Download this poster: http://www.remss.com/papers/hilburn/Hilburn_RSS_V7_Rain_Validation_FallAGU2012.pdf

1. Satellite vs Buoy





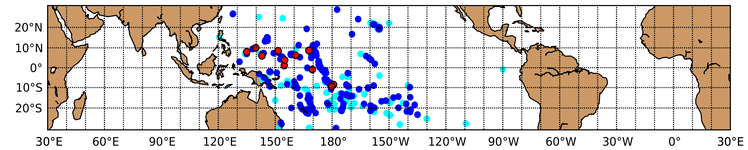
Map: Moored buoy locations cover the entire tropics. There are 78 buoys with rain measurements, and of those, the 68 buoys enclosed with black circles have long enough recording periods for inclusion in this study.

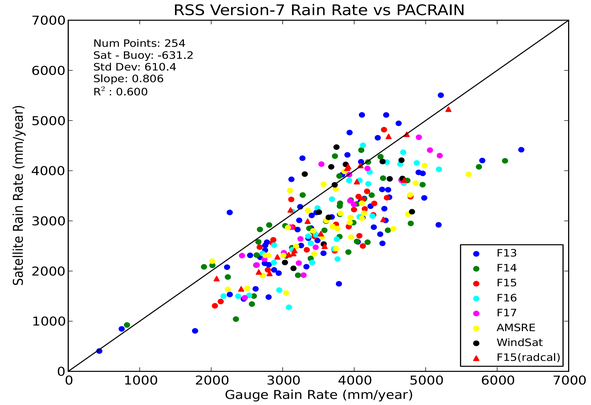
Scatterplot: Each point is a one-year average of collocated buoy and satellite data. At least 10 months of data are required. Buoy observations are averaged over a 6-hour window centered on the satellite overpass time. Satellite observations are taken from a 25 km window centered on the buoy location. This analysis covers a time period of 1998-2012.

Buoy data: Buoy data are provided by the TAO Project Office of NOAA/PMEL. The buoys are instrumented with an R.M. Young self-siphoning, capacitance-type rain gauge, at a 3.5 m height. Our analysis uses data of default quality or better, and we apply no adjustments for wind-induced undercatch. The data are provided at a time resolution of 10-minutes for the RAMA, TAO, and PIRATA arrays, and 1-hour for the TRITON array. The average buoy rain rate for all buoys, satellites, and years is 1394 mm/year.

Satellite data: Remote Sensing Systems Version-7 SSM/I (F13, F14, F15), SSMIS (F16, F17), AMSR-E, and WindSat rain rates. Each satellite provides up to two observations per day at a particular location. Satellite data are provided on a 25 km Earth grid. Before gridding, the satellite observations have footprint sizes ranging from about 10 km for AMSR-E and WindSat to 30 km for the SSM/I and SSMIS. Data from F15 are separated into two periods, before (2000-2006) and after (2007-2012) RADCAL was activated. The references provide information about the rain algorithm and RADCAL. Please note that the buoy data were not used in the calibration or in the retrieval algorithm.

2. Satellite vs PACRAIN





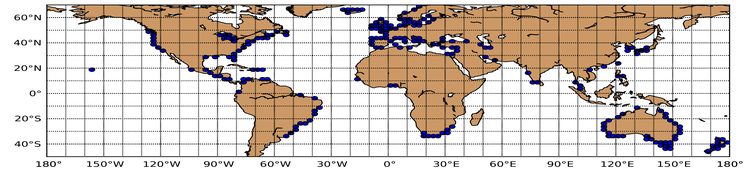
Map: Pacific island rain gauge locations. Currently there are 932 stations in the PACRAIN database (cyan), 320 of which have a coastal or atoll terrain classification, and an elevation of 100 m or less (blue). We do not use stations classified as coastal with orographic influence. Out of the 320, there are 11 stations (red) with enough data for inclusion in this study.

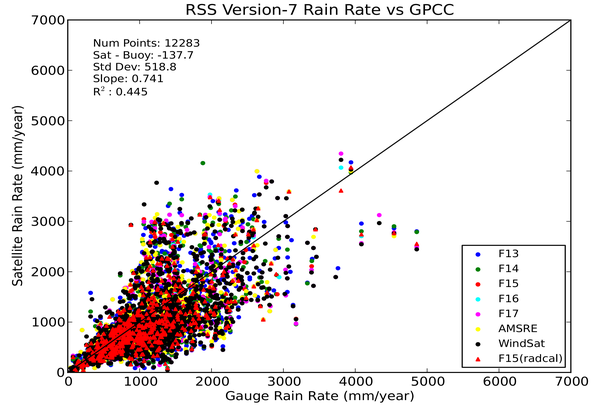
Scatterplot: Each point is a one-year average of collocated PACRAIN station and satellite data. At least 10 months of continuous data are required. PACRAIN provides 24-hour rainfall accumulation each day, and each satellite provides up to two overpasses per day. Satellite observations are taken from a 25 km window centered on the station. This analysis covers the time period 1996-2012.

PACRAIN: The Comprehensive Pacific Rainfall Database combines rainfall records from a variety of sources. The PACRAIN data we use comes from: U.S. National Climatic Data Center, New Zealand National Institute for Water and Atmospheric Research, and the Schools of the Pacific Rainfall Climate Experiment. Data flagged as including rainfall from previous days, flagged as having an estimated amount, or flagged as failing a quality assurance check were excluded. Of the 11 stations we use, 10 have elevations of 3 m or less. The one exception is Banaba Island, where the station is located at 66 m above sea level. However, with a land area of only 6 sq. km, it is safe to consider this station as representative of oceanic conditions. The average PACRAIN rain rate for all stations, satellites, and years is a remarkable 3632 mm/year.

Satellite data: Remote Sensing Systems Version-7 SSM/I (F13, F14, F15), SSMIS (F16, F17), AMSR-E, and WindSat rain rates.

3. Satellite vs GPCC





Map: Coastal rain gauge locations with nearby satellite data. The GPCC 2.5 deg gridded dataset provides 216 locations across the world from 50S to 70N. The grid cell center location is plotted.

Scatterplot: Each point is a one-year average of GPCC gauge and satellite data in a particular 2.5 deg grid cell. We use only locations with at least 10 rain gauges per 2.5 deg grid cell. GPCC provides precipitation totals for each month. We construct monthly average satellite rain rates on the same 2.5 deg grid as GPCC, requiring at least 10 satellite observations per day. The GPCC and satellite one-year averages are calculated from the monthly averages, requiring data for all 12 months to be present. We apply no adjustments for systematic gauge measurement errors. This analysis covers the time period 1996-2010.

GPCC: This assessment uses the Global Precipitation Climatology Centre (GPCC) Full Data Reanalysis Version 6, which provides data through 2010. GPCC recommends this product for hydrometeorological model verification and water cycle studies because it has the best spatial coverage and highest accuracy. This product uses near real-time data from surface synoptic reports (SYNOP) and monthly climatological totals (CLIMAT). It also uses non real-time data from historical data collections and international scientific projects. GPCC combines data from more than 85,000 stations, receiving data from 190 countries. GPCC is a component of the World Climate Research Programme (WCRP) and the Global Climate Observing System (GCOS). The average GPCC rain rate over all grid cells, satellites, and years is 1135 mm/year.

Satellite data: Remote Sensing Systems Version-7 SSM/I (F13, F14, F15), SSMIS (F16, F17), AMSR-E, and WindSat rain rates.

This work was made possible thanks to support from:

NASA Earth System Data Records Uncertainty Analysis Program
NASA Earth Science MEaSUREs (SSM/I, SSMIS)
NASA AMSR-E Science Team (AMSR-E)
NASA Earth Science Physical Oceanography Program (WindSat)

References:

Hilburn, K. A., and F. J. Wentz (2008), Intercalibrated passive microwave rain products from the unified microwave ocean retrieval algorithm, *Journal of Applied Meteorology and Climatology, 47*, 778-795.
Hilburn, K. A., and F. J. Wentz (2008), Mitigating the impact of RADCAL beacon contamination of F15 SSM/I ocean retrievals, *Geophysical Research Letters, 35*, L18806, doi:10.1029/2008GL034914.

Download the data:

Satellite: SSM/I, SSMIS, AMSR-E, and WindSat: **www.remss.com**
Buoy: TAO, TRITON, PIRATA, and RAMA: **http://www.pmel.noaa.gov**
PACRAIN database: **http://pacrain.evac.ou.edu**
GPCC: **http://gpcc.dwd.de**