Validation of Daily Satellite Rainfall Estimates over Africa and S. America

Tufa Dinku
tufa@iri.columbia.edu

International Research Institute for Climate and Society
The Earth Institute at Columbia University
I. Motivation

II. The Satellite Rainfall Estimation Problem

III. Validation over Different countries/regions
Motivation
Motivation

The IRI Data Library: Making Data Accessible for Climate Applications

Over 300 datasets providing a thorough image of Earth’s past, present, and near-future climate

- Air-Sea Interface
- Topographic and Land Characteristics
- Atmosphere
- Radiation Budget
- Oceanography
- Seasonal Forecasts
- Historical Model Simulations
- Hydrology
- Atmospheric Indices
- Hydrology
- Oceanography
IRI/LDEO Climate Data Library

The IRI/LDEO Climate Data Library contains over 300 datasets from a variety of earth science disciplines and climate-related topics. It is a powerful tool that offers the following capabilities at no cost to the user:

- access any number of datasets;
- create analyses of data ranging from simple averaging to more advanced EOF analyses;
- monitor present climate conditions with maps and analyses in the Map Room;
- create visual representations of data, including animations;
- download data in a variety of commonly used formats, including GIS-compatible formats.

Are you new to the world of climate data? Check out our Introduction to Climate Data page.

What’s New

Mar 08 - Shapes for climate zones in Sri Lanka have been added as a new Features data set.

Mar 08 - A new ‘International Federation’ Map Room has been added to the IRI Map Rooms and is accessible from the Map Room front page. It contains a forecast precipitation map tool developed in collaboration with the International Federation of Red Cross and Red Crescent Societies that features analyses to provide context for global forecastreconciliations.

Mar 08 - A new ‘linked pdf’ image option has been added to the Figure Viewer pages of the Data Library. Clicking on the “linked pdf” button will produce a clickable PDF version of the image you are viewing that links back to the Figure Viewer page for the image in the Data Library. The following link provides an example: February 2008 SSTSA.

Feb 08 - A k-means cluster analysis named k-meanst36 has been added to the Data Library as a new function.

Finding Data

- Datasets by Category
- Datasets by Source
- Dataset Search
- Browse/Search Datasets
- Browse/Search Maproom

Help Resources

- Introductory Tutorial
- Statistical Analysis Tutorial
- Image Function Documentation
- Questions and Answers

Monitoring Global Climate

Map Room
A collection of maps and analyses used to monitor climate conditions. Click on any of the maps to modify the figures or access the source data.

Climate Information Digest
A monthly publication covering global climate events, their impacts and the seasonal forecast.

ENSO Watch
Information about El Niño-Southern Oscillation.

Climate Highlights
Assessing the qualities of rainfall data sets

• There are many rainfall products in IRI data library

• IRI uses these products for different projects over different parts of the world, and also helps partners in developing countries to use the data

• But these data sets come from different sources and have different quality/accuracy

• We want to have a better understanding of the qualities/accuracies of these data sets
The Satellite Rainfall Estimation Problem
What sensors “see”

- **IR & VV**

- **MW** (high frequency - scattering by ice)

- **MW** (low frequency - emission by rain)

- **Radar (PR)** - Affected by attenuation

- **ICE**
  - -20

- **Mixed**
  - 0

- **Liquid**
<table>
<thead>
<tr>
<th>Sensor</th>
<th>Strength</th>
<th>Weakness</th>
</tr>
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</table>
| IR     | Hi temporal resolution and wide spatial coverage | • Weak relation to rainfall  
 |        |                                              | • Cirrus contamination                                |
| VV     | Hi temporal resolution and wide spatial coverage | • Weak relation to rainfall  
 |        |                                              | • Bright clouds no rain  
 |        |                                              | • Not available during night                          |
| MW     | Strong relation to rainfall                  | • Low frequency  
 |        |                                              | • Narrow spatial coverage  
 |        |                                              | • Partial beam filing                                 |
| Radar  | Most accurate                                | • Limited coverage  
 |        |                                              | • Attenuation                                         |

Most of the current algorithms combine good *space/time resolution* of IR estimates with the better *accuracy* of MW estimates.
Merging IR, MW and Gauge: an example
### Satellite rainfall products evaluated

<table>
<thead>
<tr>
<th>Product</th>
<th>Time Res</th>
<th>Space Res</th>
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<th>MW</th>
<th>Gauge</th>
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</table>
Validation sites

Current validation regions

1. Ethiopia: Validation at spatial and temporal, scales
2. Desert locust recession regions: Validation at daily time scale and spatial resolution of 0.25-deg.
3. Zimbabwe: validation at of 0.25-deg
4. Madagascar: Validation different temporal and spatial scales
5. Columbia: Validation at different temporal and spatial scales
Gridding Raingauge Data

Gauge data gridded using Anomaly Interpolation

- Kriging for interpolating of means (climatology)
- Angular-Distance Weighting for ratios
- Minimum one gauge per 0.25° grid box
Validation over Ethiopia

Rainfall threshold used: 1mm
## Validation over Ethiopia

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Rainfall threshold used: 1mm
Validation over Zimbabwe
## Validation over Zimbabwe

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Validation over Colombia
## Caribbean

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Elv LE 500, North
Mean = 6.7
### Pacific

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Elv LE 500, Pacific
## Highland

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</table>
Validation over Desert Locust Regions

- Data obtained from FAO-DLIS
- Over 20,000 qualitative reports (2003-2006) used
- About 7,000 used after quality control
Validation over Desert Locust Regions

Rainfall threshold used: 0.5 mm
All about satellite rainfall estimation

http://www.isac.cnr.it/~ipwg/

IPWG
International Precipitation Working Group

The International Precipitation Working Group (IPWG) was established as a permanent Working Group of the Coordination Group for Meteorological Satellites (CGMS) on 20-22 June 2001 in Ft. Collins, CO. The IPWG is co-sponsored by CGMS and the World Meteorological Organization (WMO) and focuses the scientific community on operational and research satellite based quantitative precipitation measurement issues and challenges.

It provides a forum for operational and research users of satellite precipitation measurements to exchange information on methods for measuring precipitation and the impact of space borne precipitation measurements in numerical weather and hydrometeorological prediction and climate studies.

PURPOSE

In the area of quantitative precipitation estimation, the IPWG intends to build upon the expertise of scientists who are currently involved in precipitation measurements from satellites with emphasis on derivation of products. The IPWG is established to foster the:

- development of better measurements, and improvement of their utilization;
- Improvement of scientific understanding;
- Development of international partnerships.

OBJECTIVES

The objectives of the IPWG are:
Publications


- Dinku et al., 2008: Validation of high-resolution satellite rainfall products over complex terrain in Africa. *IJRS*, 29 (14), 4097-4110.

THANK YOU