Land Surface Characterization for GPM-Era Algorithms

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1. Introduction

One of our focus areas during the past year was to complete an emissivity intercomparison study under the auspices of the Land Surface Characterization Working Group (LSWG) which supports the activities of several algorithm teams. Accurate emissivity estimates are needed to advance the current state of precipitation retrievals over land.

2. Emissivity (ε) Intercomparison – Study Parameters

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Targets</th>
<th>Dates</th>
<th>Channels</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMSR-E</td>
<td>All</td>
<td>07/04 - 06/07</td>
<td>All</td>
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<tr>
<td>AMSR-E</td>
<td>All</td>
<td>08/05 - 06/07</td>
<td>All</td>
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<tr>
<td>SSMI</td>
<td>All</td>
<td>07/04 – 06/07</td>
<td>All</td>
</tr>
<tr>
<td>TMI</td>
<td>All</td>
<td>07/06 - 06/07</td>
<td>All</td>
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<tr>
<td>Meteo-France</td>
<td>AMSU-A</td>
<td>07/06 - 06/07</td>
<td>23.8; 31.4; 50.3; 89 GHz</td>
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<tr>
<td>NOAA-MIRS</td>
<td>All</td>
<td>07/06 - 06/07</td>
<td>All</td>
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<tr>
<td>NASA-GSFC</td>
<td>AMSU-B/MHS</td>
<td>12/05 - 02/07</td>
<td>All</td>
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<tr>
<td>NRL/JPL</td>
<td>WindSat</td>
<td>07/04 - 06/07</td>
<td>All</td>
</tr>
<tr>
<td>CNRS</td>
<td>SSMI</td>
<td>07/04 – 06/07</td>
<td>All</td>
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</tbody>
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Objective: Compare a variety of ε retrieval techniques (denoted by different colors in tables to the left) using (as best as possible) common input data sets (7/04 – 6/07) over a diverse set of surfaces (see map below).

Questions: How similar or different are the ε estimates? For which frequencies and surfaces? For which type of retrieval?

Focus Targets: HMT-SE, SGP and C3VP sites; results only shown in this poster for SGP (most homogeneous) and C3VP (most diverse)

3. Results – SGP (35 N, 97 W)

Agricultural region of pastures and wheat fields; experiences seasonal changes in vegetation. Subjected to prolonged periods of dry weather in the summer. Strong convective rains in the springtime and occasionally heavy snowfall in the winter. Homogeneous, mostly flat terrain.

Monthly mean values of ε x Ts; clear sky conditions

4. Results – C3VP (44N, 80W)

Complex site in terms of geography and weather: It’s on the northwest side of Lake Ontario and is a mixture of land, water, forests, woodlands and grasslands. Pronounced winter season with extended snow cover; a certain challenge for GPM!

5. Summary and Next Steps

Although we are still analyzing the results, we can provide some general conclusions based on this initial study:

- Better agreement is found at the more homogeneous sites (SGP), during vegetated conditions, and at lower frequencies.
  - This offers promise in using the emissivity directly in retrieval algorithms under these “known” conditions
  - The rain/no-rain distinction is likely still to be problematic given the spread seen amongst the different estimates

- Worse agreement is found at the more complex sites (C3VP), during cold seasons, and for higher frequencies.

- The uncertainty amongst the estimates is further compounded by potential uncertainties due to (and in order of importance):
  - Insufficient precipitation screening
  - Land surface temperature
  - Sample sizes during cloudy conditions
  - Number of layers used in atmospheric contribution calculation

- There is some indication that the retrieval type (direct, inversion, physical) also is a factor in the results.

Next steps?
- Re-examine the data to remove “outliers” (and to understand their causes)
- Look at the other sites, including deserts and rain forests
- Examine further the impact due to actively precipitating conditions
- Can we quantify the errors in precipitation rate as a function of surface and atmospheric conditions?

References