Validation of IASI Surface Temperature Under Dusty Conditions:
Application to the West Africa Region

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Abstract

Determination of the atmospheric state (T, H2O) from the simultaneous retrieval of aerosol properties (AOD; altitude) and surface temperatures using multi-satellite and surface emissivity databases described in Capelle et al., 2012. ECMWF forecasts are used as reference to assess satellite performances. In a previous study, IASI ST have been validated for a low AOD case with a 2K product. A near equal ST is observed for both IASI and AATSR, a difference of 1K in the Sahel. This study is focused on IASI ST determination under dusty conditions.

Overview of IASI dust and ST inversion methodology

• Method based on pre-computed Look Up Table (LUTs)

• Spatial up-scaling and temporal interpolation

• In order to avoid to compare ST at different retrieval times, ECMWF forecast STs were used as reference for the comparison of IASI, MODIS, AATSR and SEVIRI ST.

• The comparisons are based on the estimation of the monthly ST bias and SDV versus the reference ST (ECMWF forecast).

Results and discussion

Daytime statistics

1. Data description

Table 1. Data spatial and temporal resolution

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Resolution</th>
<th>Time interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>IASI</td>
<td>12 km</td>
<td>15 minutes</td>
</tr>
<tr>
<td>AATSR</td>
<td>1 km</td>
<td>10 minutes</td>
</tr>
<tr>
<td>MODIS</td>
<td>1 km</td>
<td>10 minutes</td>
</tr>
<tr>
<td>SEVIRI</td>
<td>1 km</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

2. Data pre-processing

- Spatial up-scaling and temporal interpolation

- All available data have been up-scaled and set at 12:00 GMT.

- A temporal interpolation has been performed to ECMWF forecast in order to have a new temporal resolution of 1 hour (i.e. 00:00, 03:00, 06:00, 09:00, 12:00, 15:00, 18:00, 21:00).

- IASI, SEVIRI, MODIS and AATSR data have been temporally interpolated by a nearest neighbor technique before instead of using the exact acquisition time.

3. Experiment details

- In order to avoid to compare ST at different retrieval times, ECMWF forecast STs were used as reference for the comparison of IASI, MODIS, AATSR and SEVIRI ST.

- The best SDV is obtained for AATSR with slightly larger biases than IASI. AATSR has similar biases as in the low AOD case. A near equal SDV is observed for AATSR and AQUA which seems more correlated to the AOD variability than ECMWF forecast. A near equal SDV is observed for AATSR and AQUA which seems more correlated to the AOD variability than ECMWF forecast. For AATSR, AQUA and TERRA, biases are almost constant value of 1K for the whole study period.

- The best SDV is obtained for AATSR with almost constant value of 1K for the whole study period. In Sahel, AATSR present a decreasing bias against ECMWF, due to the considered area (<0.1)

Nighttime statistics

- The AOD is almost constant (<1) until July and increases to 4K from August to December.

- AOD bias is almost constant and close to 1K, good agreement with AATSR and MODIS bias and ST.

- For AATSR, SEVIRI and TERRA, biases are almost constant and close to 1K, good agreement with AATSR for ST and AATSR for AOD.

- The AOD is almost constant (<1) until July and increases to 4K from August to December. For AATSR, AOD bias are almost constant and close to 1K, good agreement with AATSR and MODIS bias and ST.

- For AATSR, SEVIRI and TERRA, biases are almost constant and close to 1K, good agreement with AATSR for ST and AATSR for AOD.