Cloud Property Retrievals using Ship-based Spectral Transmissivity Measurements

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1. Goals
- Ship-based measurements of spectral cloud transmissivity to retrieve cloud optical thickness and effective radius
- Apply improved and accelerated spectral retrieval algorithm
- Evaluate cloud radiative impact energy budget

2. Instrumentation

Fig. 1: Sketch of the OCEANET-Container

Fig. 3: Optical inlets of CORAS

Fig. 2: Located Container on the Helicopter deck of RV Polarstern

Tab. 1: Overview of optical inlets from CORAS (Compact Radiation measurement System)

<table>
<thead>
<tr>
<th>Measured Quantity</th>
<th>Spectral Range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downward Irradiance</td>
<td>290-2200 nm</td>
<td>2.3 (VIS)/1.5 (NIR) nm</td>
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<td>290-2200 nm</td>
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</tr>
</tbody>
</table>

3. Examples

Fig. 7: Cruise track from ANT-XVIII/S

Fig. 9: Corresponding cloud situation for Fig. 10 from full sky imager

Fig. 10: Spectrum of measured downward radiance from (a) 15:00-15:03 UTC and (b) 15:00-15:03 UTC on 24th April, 2012 aboard RV Polarstern

4. Methodology

Fig. 11: Sketch of zooming retrieval technique; red cross marks the observation

Fig. 4: Modeled spectral transmissivity (PP-RTM) for a liquid water cloud at SZA=30° in dependence on optical thickness and effective radius

Fig. 5: Normalized transmissivity at SZA=30° for optical thickness of 25 and effective radius of 5 µm (solid line) and 25 µm (dashed line)

5. Outlook

Fig. 6: Look up table for spectral cloud retrieval using modeled transmissivity (PP-RTM) and spectral slope fit through normalized transmissivity at SZA=30°:

- Information on optical thickness and effective radius
- Normalization removes effect of spectrally correlated errors [1]
- Less sensitivity to effective radius for optical thickness lower than 5

References:

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