Cloud_cci Achievements
ESA Cloud_cci Phase 2

- Multi-decadal coherent global data sets for GCOS cloud property ECVs including uncertainty estimates based on inter-calibrated radiances from:
  - AVHRR, MODIS, AATSR observations (CC4CL)
  - Combined AATSR+MERIS measurements (FAME-C)
L1c AVHRR, MODIS, A(A)TSR + auxiliary data

AVHRR heritage channels
- 0.67 µm
- 0.87 µm
- 1.6 µm
- 3.7 µm
- 11 µm
- 12 µm

Pre-processing
- \( C_f \)
- \( \text{phase}_c \)

Retrieved products
- \( \tau_c \)
- \( r_{\text{eff}} \)
- \( \rho_c \)
- \( T_{\text{surf}} \)

Derived products
- \( h_c \)
- \( T_c \)
- LWP, IWP
- \( \rho_{\text{DHR}}^{1,2} \)

L2toL3
- L3U
- L3C
- L3S

Community Optimal Estimation Cloud Retrieval for Climate = CC4CL
Major achievements

- Improving cloud mask (CC4CL)
- Improving phase discrimination (CC4CL)
- Introducing cloud albedo
- Introducing new 1D-histograms
- Producing feedback loop 3 data
- Carrying out comprehensive evaluations
- Processing chains tested and optimized
31 y Cloud_cci AVHRR time series (afternoon primes)
Correlation of AVHRR cloud fraction anomaly with ENSO index

Sources: Climate Prediction Center-NCEP, NOAA

Correlation of Cloud cci AVHRR cloud fraction anomaly with ENSO index (1982-2012)


CCI 6th Collocation Meeting, ESRIN, 30 September 2015
Satellite cloud data for climate model evaluation

- What is a „satellite simulator“?
- Why is it needed for clouds?
- How does it work?
- COSP ESA Cloud_cci module for EC-Earth & COSMO (Option 8)

Example: COSP schematic.

Bodas-Salcedo et al., BAMS, 2011
Simplified cloud simulator for ERA-Interim evaluation

- In ERA-Interim clouds are modelled quantities
  - LWC, IWC, CC, geopotential height, temperature, pressure level
- Simulation of Cloud_ccci L3 properties:
  - COT, LWP, IWP, CC, CTH, CTT, CTP, CPH

ERA-Interim <cloud cover> ~ 0.53

Pseudo-satellite <cloud cover> ~ 0.5

L3 Cloud_ccci <cloud cover> ~ 0.63
## ECV Cloud – Options

<table>
<thead>
<tr>
<th>Option #</th>
<th>Name</th>
<th>Main target area of option</th>
<th>Involved partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option 1</td>
<td>The relation between total column water vapour trends and cloud properties</td>
<td>Performing more extensive climate impact assessments</td>
<td>DWD</td>
</tr>
<tr>
<td>Option 4</td>
<td>Calculate the contribution of cloud to the radiation budget</td>
<td>Performing more extensive climate impact assessments</td>
<td>DWD, FUB, UO</td>
</tr>
<tr>
<td>Option 8</td>
<td>Couple cloud simulator (COSP) to COSMO model</td>
<td>Performing more extensive climate impact assessments</td>
<td>DWD, ETH</td>
</tr>
<tr>
<td>Option 9</td>
<td>Enabling Cloud_cci based climate analyses through national GFCS activities</td>
<td>Performing more extensive climate impact assessments</td>
<td>DWD, MS</td>
</tr>
<tr>
<td>Option 13</td>
<td>Development of an advanced multi-layer cloud retrieval scheme</td>
<td>Developing additional algorithms</td>
<td>DWD, RAL, UO</td>
</tr>
</tbody>
</table>
Summary and Conclusions

- **Multi-decadal coherent global data sets** for GCOS cloud property ECVs including uncertainty estimates (CC4CL, FAME-C)

- **Optimal estimation technique** employed improving homogeneity and stability of time series

- **Benefit for user community** – added value of ESA Cloud_cci products
  - Spectral consistency of derived products
  - Uncertainty characterization
  - Increased temporal resolution by including multiple sensors
  - Comprehensive assessment and documentation of algorithms and products

- **Final processing** of full time series (late autumn 2015 – spring 2016)

- Extensive **validation** and **inter-comparison** studies (2016)

- **New ECV Cloud_cci Options** (climate impact assessments and alg. dev.)
THANK YOU!