climate change initiative

CLIMATE MODELLING USER GROUP

CCI+ CMUG Phase 2 Proposals
ESMValTool development

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ESMValTool
Earth System Model Evaluation Tool

ESA UNCLASSIFIED - For Official Use

ESMValTool development

Motivation

- Innovative and comprehensive **model evaluation and analysis** approaches are needed to assess the performance of the increasingly complex and high-resolution models
- The community tool **ESMValTool** makes use of observational datasets such as ESA CCI and develops and applies new evaluation and analysis methods.
- This is an important contribution to improve our **understanding** of present-day climate, reduce **uncertainties** in future climate projections and support **model development**

ESMValTool development

Aim

- Exploit ESA CCI and CCI+ data in the context of **Earth system model (ESM) evaluation** with ESMValTool
- **Enhance the ESMValTool** with additional diagnostics and metrics enabling analysis of models with ESA CCI and CCI+ data
- Implementation of **new CCI datasets and corresponding diagnostics** into the ESMValTool and **updating existing datasets** where needed
- Explore possibilities to **take advantage of the uncertainty information** provided with the CCI datasets for model evaluation

ESMValTool development

Proposed work packages

WP1: Implementation of CCIs SNOW and PERMAFROST into ESMValTool and update of existing datasets

WP2: Implementation of uncertainty estimates into ESMValTool

WP3 (optional): Implementation of CCI BIOMASS and diagnostic for evaluation of the role of vegetation on hydrometeorological processes

WP4 (optional): Extension of ESMValTool to process output from IFS (ECMWF) and MONARCH system (BSC)

WP1 Implementation/update of CCI datasets

aerosol cci	**update** to Swansea ATSR (v4.33) and SLSTR / 3A (v1.12) OR ensemble (ATSR v3.0 and SLSTR / 3A v2.2) v6.1
biomass cci	**implement** L4-AGB-MERGED-100m-2018-fv3.0
cloud cci	v3.0 AVHRR AM+PM **add** L3U data (daily)
land cover cci	**update** to v2.0.7/v2.1.1
land surface temperature cci	v3.00, MODIS EOS Aqua **add** daily values
permafrost cci	**implement** MODISLST_CRYOGRID-AREA4_PP-fv03.0
snow cci	**implement** multi-sensor.multi-platform.MERGED.2-0.r1
soil moisture cci	**update** to version v7.1
sst cci	**add** daily values **update** v3.0 once available
water vapour cci	v3.1 TCWV-global (COMBI) **add** daily values

Implementation of CCI datasets

SNOW, PERMAFROST

- Implementation of diagnostic for deriving permafrost (temperature at the depth of zero annual amplitude < 0°C) in the CMIP models (e.g. Burke et al., 2020)
- Implementation of diagnostic for effective snow depth (mean snow depth weighted by duration) (Slater et al., 2017)
- Application to CMIP6 model ensemble

BIOMASS (optional)

- AGB for evaluation of the role of vegetation on hydrometeorological processes in CMIP6 models

Update of CCI datasets

CLOUD, LANDCOVER, LAND SURFACE TEMPERATURE, SOIL MOISTURE, SST, WATER VAPOUR

- Update to recent version
- Adding daily values
- Enhancing observational products for climate model evaluation with machine learning (process-oriented model evaluation based on cloud classes)
- Causal model evaluation for cloud regimes and land cover types

AEROSOL (optional)

- Evaluation of dust aerosol and clouds (Aerosol/Cloud Reanalysis)

Uncertainty estimates

- Available **uncertainty information** will be implemented into the ESMValTool alongside already existing ECVs from ESA CCI datasets
- In order to make **scientific use** of this uncertainty information, possibilities to propagate uncertainty information to the spatial and temporal scales used by the models will be investigated.
- As a **starting point**, work done on implementing uncertainty information for the CCI LAND SURFACE TEMPERATURE will be used and extended on a case-by-case study for selected other ECVs.

Extension ESMValTool data processing

Optional

- Extension of ESMValTool to process output from IFS (ECMWF) and MONARCH system (BSC)
- Evaluation of dust aerosol and clouds (Aerosol/Cloud Reanalysis)