WGClimate Climate Architecture Case Study Updates

→ Potential examples from CCI+

Pulse Connect Secure | Case studies – Climate Monitor | Not Secure | climatemonitoring.info/case-studies/

Climate Monitoring from Space

WGClimate
The joint CEOS/CGMS Working Group on Climate

CEOS CGMS

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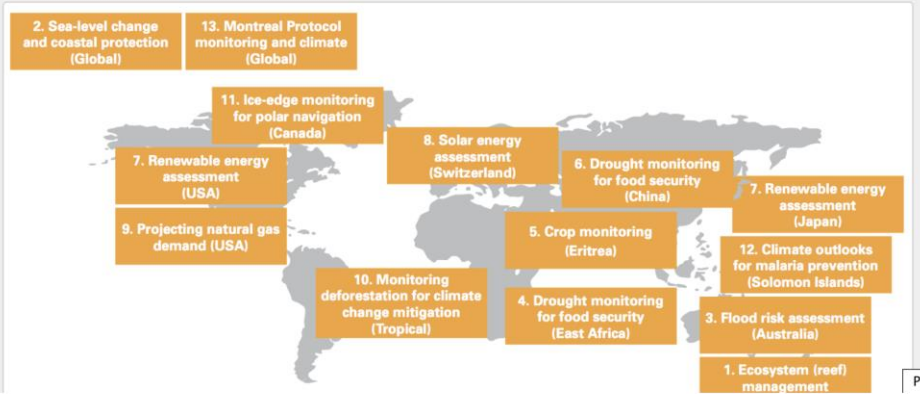
Case Studies

A series of case studies were undertaken to demonstrate the fundamental importance of satellite observations for climate monitoring. The case studies were chosen to cover a wide range of user perspectives and their need for climate services. Thirteen case studies were selected as representative examples of services that are provided at global, regional and national levels; services in developing and developed countries; and services used in research, operational and policy areas. Full details of all the case studies can be found in the report on **Satellites for Climate Services: Case Studies for Establishing an Architecture for Climate Monitoring from Space**.



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Case Studies

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Potential Case Studies

The following examples

are taken mainly from CCI project work plans, and are thus mostly work in progress.

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(i) Results will appear over the next 12-24 months

(ii) Those of a research nature may or may not be successful.

(iii) Would propose to add new case studies to the web site as they become ready, rather than waiting for all to be completed.

Potential Case Studies

Improving DVGMs & Land Surface of ESMs

- Biomass, Fire and Land Cover ECVs (also Soil Moisture, LST, LAI, Snow, ...)
- reduce systematic errors in the representation of the surface-atmosphere interactions
- e.g. impact of deforestation on climate and on regional terrestrial carbon budget in the Amazon
- e.g. cold bias over Sahel during the dry season which could be linked to a poor description of surface properties such as surface albedo or soil thermal inertia

Potential Case Studies

Improve predictions of lake response to climatic change

- Lakes ECV (Lake level, area, temp, colour, ice cover)
- e.g. High altitude lakes on the Tibetan plateau (incl Glaciers ECV) which is one of the most sensitive regions on Earth to global warming (The TP has been warming over the last 50 years at a rate of 0.36°/decade), and has important implications for local economies, as these lakes are important water resources. Plays a key role on hydrology and climate for southern and eastern Asia (hundreds of millions of people).
- e.g. Predict future evolution under climate warming and population growth – e.g. Lake Victoria, (Tanzania, Kenya, Uganda) – massive population expansion – pollution, food security, health, local rainfall and agriculture etc.

Potential Case Studies

Ice Sheet mass balance modelling

- Ice Sheets and LST ECVs
- e.g. Use LST to improve surface mass balance modelling - particularly regarding firn models for improved surface run-off – link to RetMIP (Retention Model Intercomparison Project)
- Validate models against Ice Sheets ECV and IMBIE results

Potential Case Studies

Surface Energy Balance modelling

- LST and Soil Moisture (+ snow?) ECVs
- Integration of LST and SM into a physically-based surface energy balance (SEB) model for evapotranspiration and water stress estimation for operational water stress mapping in arid semi-arid ecosystems
- Agriculture and drought

Potential Case Studies

Investigation of the 2013-2014 North Atlantic Sub-polar Gyre Cold Anomaly

- Salinity, SST, Sea Level ECV
- Potential early warning of climate-change induced AMOC collapse

Potential Case Studies

Storm Surges and Coastal Flooding

- Sea-State, Sea Level ECVs
- Major climate-related impacts of sea-level rise due to the increased likelihood of extreme sea-level events arising from the combination of high tides, storm surges and waves on top of higher sea levels. This increased frequency of extreme sea-level events, and increased impact of storm surges and waves, is already being observed, including routine flooding on spring tides at some locations. Hence it is important to understand present and future occurrence of extreme conditions, in addition to mean sea-level rise.

Potential Case Studies

Snow Cover trend analysis

- Snow, LST, SM, LC ECV
- Verification of ~50% reduction in late springtime NH snow coverage since 1980 observed in NOAA IMS data, and intercomparison of observed SWE with CMIP-6 models (SnowMIP). Investigation of the roles of surface temperature and precipitation in driving snow cover and SWE trends.
- Greening of NH vegeatation as response to earlier spring melt

Potential Case Studies

Water Vapour feedback

- LST, SST, Water Vapour ECV
- Comparison of observed water vapour trend as function of surface temp with theoretical expectation from Clausius Clapeyron, and validation of CMIP model predictions.
- Could also talk about other radiative feedbacks, e.g. cloud / sea-ice, ice albedo, etc

Potential Case Studies

Dust Reanalysis

- Aerosol, SM and LC ECVs
- Aerosol (and dust) reanalyses provide valuable information to a range of different users, information which is also fed into aerosol-related climate services.
- Air quality, health, aviation, agriculture, solar energy.

Potential Case Studies

Decadal Prediction skill assessment

- 30yr+ ECVs: Sea Level, SST, Clouds, ...
- an extensive model skill assessment of the decadal hindcasts done within DCPP and thus contributing to CMIP6 initiative
- The combined analysis of several state-of-the-art decadal climate prediction systems will help to constrain which climate variables and regions have robust skill, covering timescales from seasons to decades, and thus provide robust valuable climate information for the development of climate services

Potential Case Studies

Assess the land-surface interaction related biases in AMIP simulations

- ECVs: LST, Snow, SM, ...
- Biases in present-day simulations cast doubts on the reliability of the future climate projections, and question the use of near-surface variables produced by numerical climate models for climate change impact studies.
- Explore the potential of multiple satellite derived products to try to relate existing and identified biases (surface state and surface fluxes) to missing or incorrectly represented processes, thus offering solutions for model improvement by revisiting the process representation

Potential Case Studies

Evaluation of CMIP-6 models

- Use of multiple ECVs with ESMValTool

Potential Case Studies

Sea Level Budget Closure

- ECVs: Sea Level, Ice Sheets and Glaciers ECVs (also SM?)
- Reconcile sea level rise with observed ice sheet and glacier melting, ocean heat content, and land surface moisture reservoir.

Potential Case Studies

Growth of Megacities and urban heat islands

- ECVs: LST, HRLC, SM
- Health, wellbeing, infrastructure, economic deleopment, extreme weather

Potential Case Studies

Quantification of the European Carbon Sink, etc

- CO_2 and CH_4 ECVs - see CMUG Ph.2 D2.1 (Sci. Impact Rpt)
- e.g. "We show that the satellite-derived European terrestrial carbon sink is indeed much larger (1.02 +/- 0.30 GtC/year in 2010) than previously expected"
- e.g. use CO_2 and CH_4 to obtain information on wildfire emissions.
- e.g. Schneising et al. (2014b) analysed SCIAMACHY XCH_4 retrievals over major US “fracking” regions and quantified methane emissions and leakage rates, showing emission estimates correspond to leakages of 10.1%±7.3% and 9.1%±6.2% in terms of energy content, calling immediate climate benefit into question and indicating that current inventories likely underestimate the fugitive emissions from Bakken and Eagle Ford.

Potential Case Studies

1. Improving DVGMs & Land Surface of ESMs
2. Improve predictions of lake response to climatic change
3. Ice Sheet mass balance modelling
4. Surface Energy Balance modelling
5. Investigation of the 2013-2014 North Atlantic Sub-polar Gyre Cold Anomaly
6. Storm Surges and Coastal Flooding
7. Snow Cover trend analysis
8. Water Vapour feedback
9. Dust Reanalysis
10. Decadal Prediction skill assessment
11. Assess the land-surface interaction related biases in AMIP simulations
12. Evaluation of CMIP-6 models
13. Sea Level Budget Closure
14. Growth of Megacities and urban heat islands
15. Quantification of the European Carbon Sink, etc