climate change initiative

→ CLIMATE MODELLING USER GROUP

WP3: quality assessment of CCI products

Science highlights

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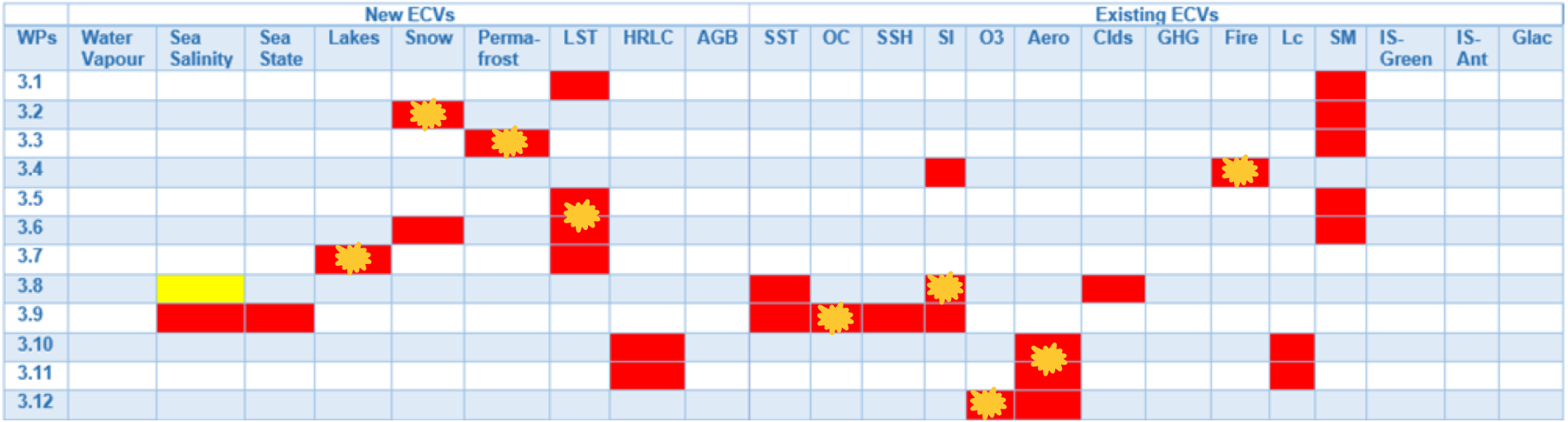
cmug cci

WP3 ECV list

	New ECVs									Existing ECVs													
WPs	Water Vapour	Sea Salinity	Sea State	Lakes	Snow	Perma-frost	LST	HRLC	AGB	SST	OC	SSH	SI	O3	Aero	Clds	GHG	Fire	Lc	SM	IS-Green	IS-Ant	Glac
3.1							■													■			
3.2					■															■			
3.3						■														■			
3.4													■					■					
3.5							■													■			
3.6					■		■													■			
3.7				■			■																
3.8		■								■			■			■							
3.9		■	■							■	■	■	■										
3.10								■							■				■				
3.11								■							■				■				
3.12														■	■								

WP3 ECV list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3.12

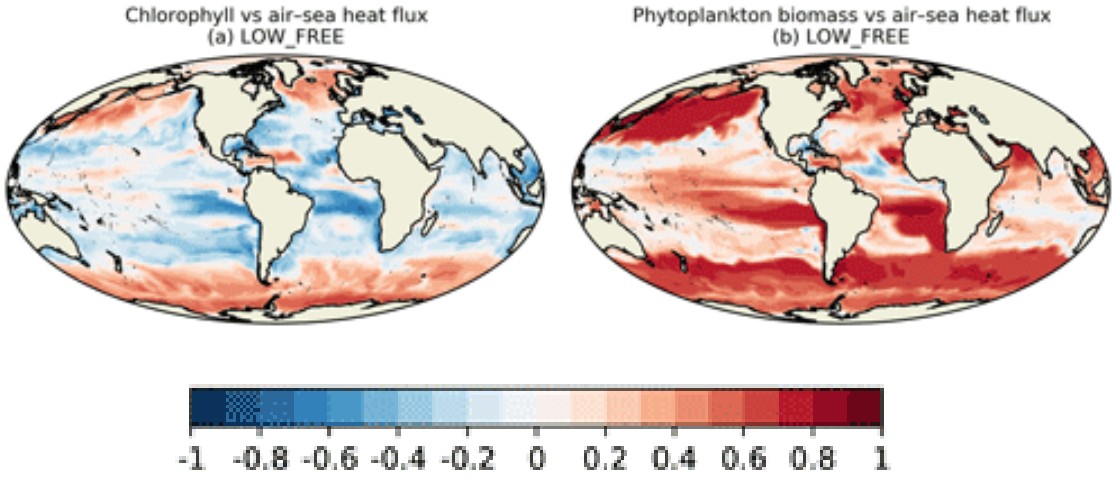
OCEAN COLOR – Met Office

- Ocean colour
  - Consistency assessment with: SST, SSS, sea level, sea ice
  - Methods: Introduce two-way physics-biogeochemistry coupling constrained by assimilating ocean colour, assess impact on other variables
  - Climate (sub)model used: NEMO-CICE-MEDUSA (UKESM1 ocean)
- Main conclusions / recommendations at this stage
  - ECVs appear to give consistent view of ocean features
  - Assimilation improves model representation of these features
- Difficulties and envisaged solutions
  - Work ongoing: full results and recommendations in D3.1 report in Jan 2022

OCEAN COLOR – Met Office

- In the model, phytoplankton chlorophyll concentration and carbon biomass correlate very differently with air-sea heat flux

- Assessment remains a work in progress, impact of two-way coupling on this to be explored very soon…

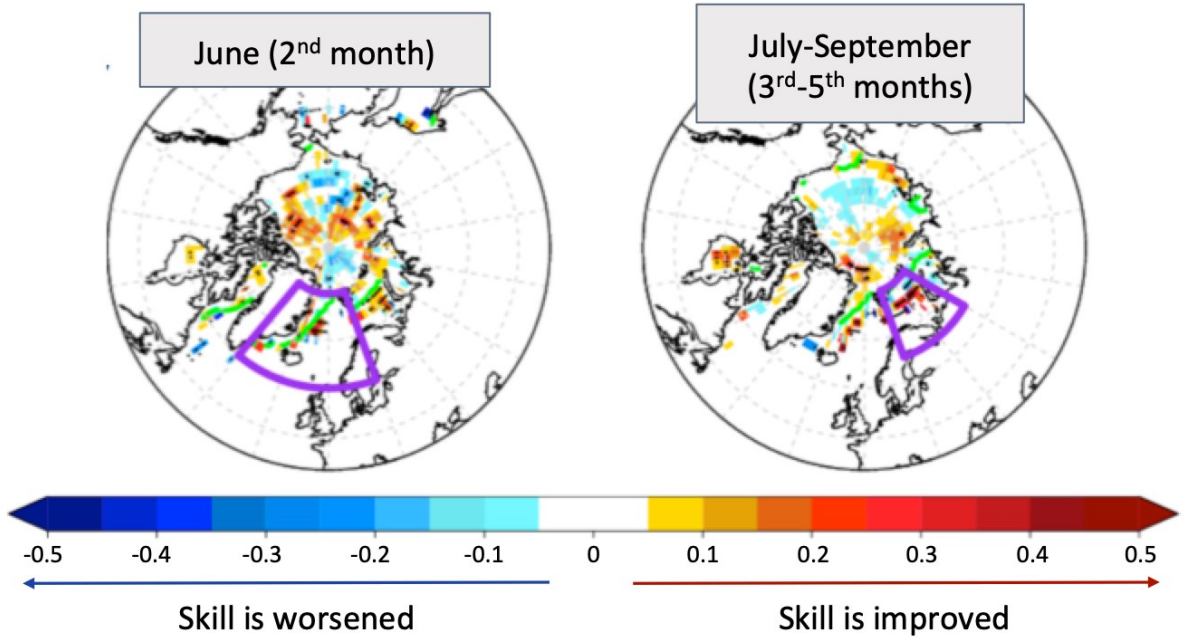


SEA ICE – BSC

- Sea Ice ECV (**Sea Ice Concentration**; **SIC**)
  - Consistency assessment with: SIC observations from **OSISAFv2**, **CERSAT** and **ORAS5**
  - Methods: **Assimilation of SIC** to assess the impact on prediction skill
  - Climate model used: **EC-Earth**
- Main conclusions / recommendations at this stage
  - Benefits of SIC assimilation are consistent regardless of dataset assimilated
  - Skill improvements are obtained in the summer/autumn seasons, including for the sea ice extent, North Atlantic SSTs and SLP
- Difficulties and envisaged solutions
  - No benefit of SIC assimilation was found for the winter/spring seasons

SEA ICE – BSC

Clear **improvements in prediction skill** for **summer ice concentrations,** especially around the sea ice edge



Model: **EC-Earth**
Start month: **May**
Period: **1992-2018**

Acosta-Navarro et al (in prep)

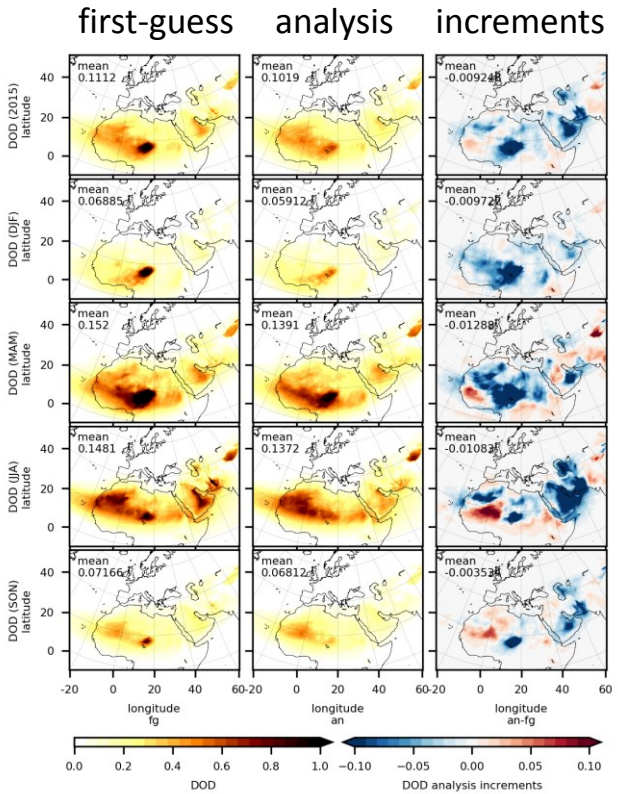
AEROSOLS (dust) – BSC

- Aerosol (dust) ECV
  - data assimilation
  - MONARCH atmospheric model and LETFK data assimilation
- Main conclusions at this stage
  - A pilot IASI dust reanalysis has been produced for a regional domain
  - Assimilating IASI thermal infrared retrievals (using pixel-level uncertainties) is beneficial, with some issues over emission areas
  - IASI-based analyses compare well with a MODIS-based dust reanalysis. The latter is better correlated with independent observations
- Difficulties and envisaged solutions
  - IASI obs not sensitive to sfc dust layers, less accurate retrievals in winter
  - Improvements in the assimilation strategy would be needed

AEROSOLS (dust) – BSC

Some of the main features of the dust seasonal cycle are well represented by the IASI pilot reanalysis for 2015

Dust concentrations in the winter months are particularly low when assimilating IASI dust retrievals

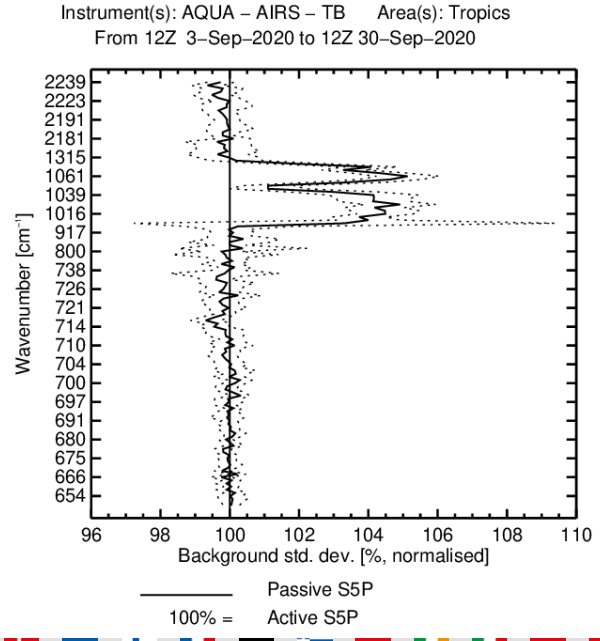


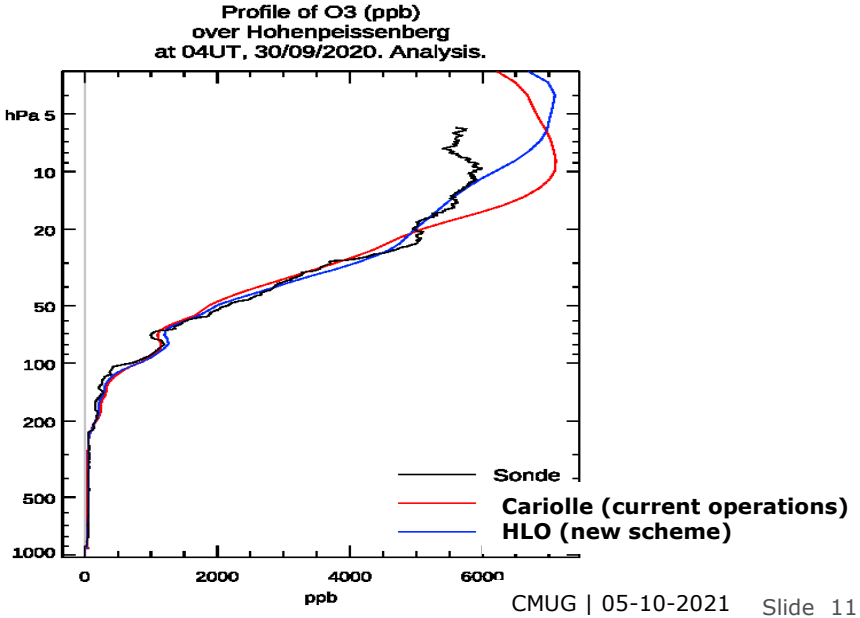
O3 (Total column) – ECMWF

- Total column O3
  - 4D-Var assimilation
  - ECMWF's Integrated Forecast System
- Main conclusions / recommendations at this stage
  - Assimilation of S5P TROPOMI TO3 data tested in NWP configuration (three months of data)
  - Verification with standard ECMWF tools to understand impact on NWP showed (small) positive impact of the TROPOMI data on the forecast
  - Improvements in ozone analysis were also seen in better agreement with IR radiances
  - Comparisons of online (NRT) vs offline (CCI+) TO3 products – preliminary results indicate a slightly better performance of online NRT product
  - Datasets are mature for analysis/reanalysis applications and for model parameterization assessment
- Difficulties and envisaged solutions
  - Data volume dealt with super-obbing (observation averaging to coarser resolution)

O3 (Total column) – ECMWF

- Smooth observations processing thanks to work done by Antje Inness & Roberto Ribas in CAMS
- High-res S5P observations are averaged to 40km (CAMS resolution) and assimilated
- Small but positive impact on observation fit to IR observations in the Tropics
- Observations were used to choose the new ozone scheme to be used in operations and next reanalysis



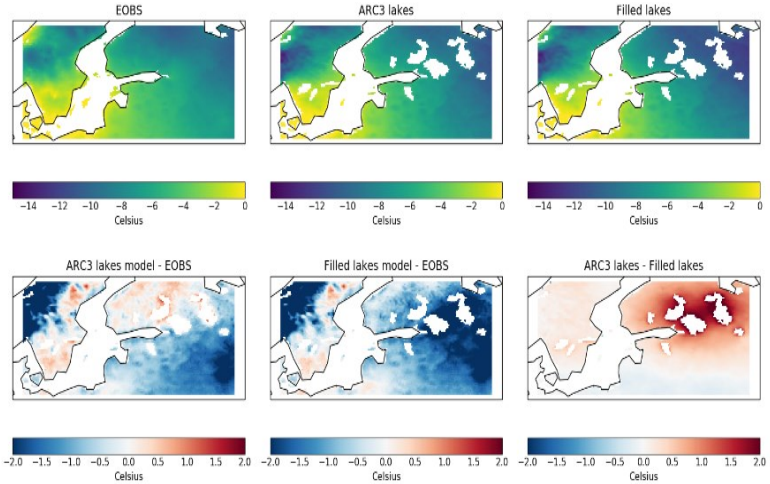


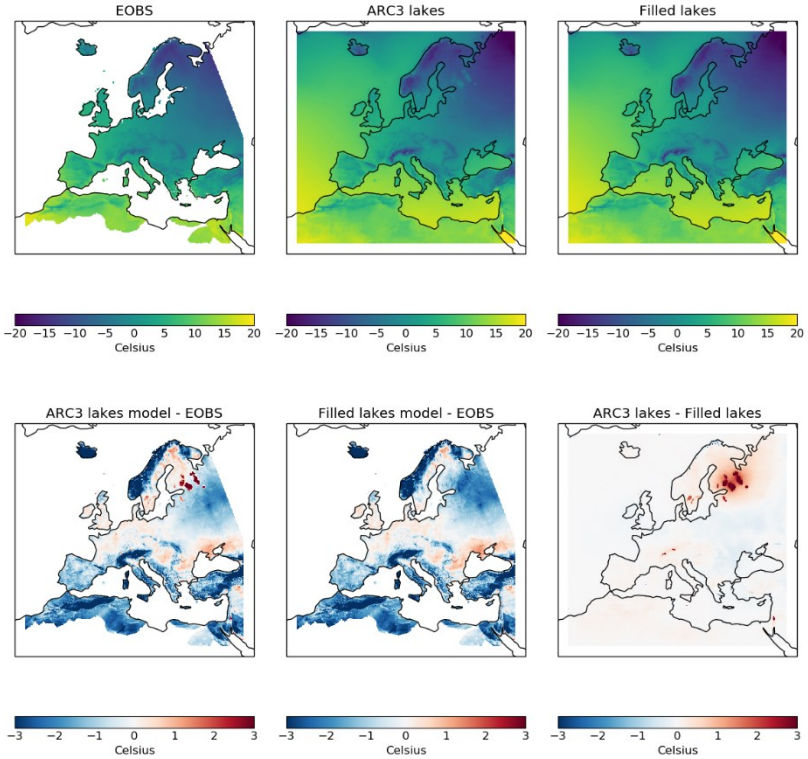
LAKE temperature and ice – Met Office

- Lake Surface Water Temperature (LWST) and Lake Ice Cover (LIC)
  - Sensitivity of regional climate models to the use of observed LSWT and LIC
  - Current dataset not suitable for purpose, daily frequency required
  - ARC3 dataset, daily temperature of lake centres, 1995-2011 (MacCallum and Merchant, 2011), LIC diagnosed for LWST
  - Reanalysis driven RCM runs (with and without prescribed lakes)
- Main results
  - Corrected bias on mean winter temperature around big lakes.
  - Smaller local effects in summer for mean temperature and precipitation
- Recommendation
  - Reconstruction of LWST and LIC as in MacCallum and Merchant including new data

LAKE temperature and ice – Met Office

- Temperature (DJF)





Clear effect on local climate from prescribed lake temperature around Scandinavia/N Russia

Improved comparison with obs

FIRE (burnt areas) – BSC

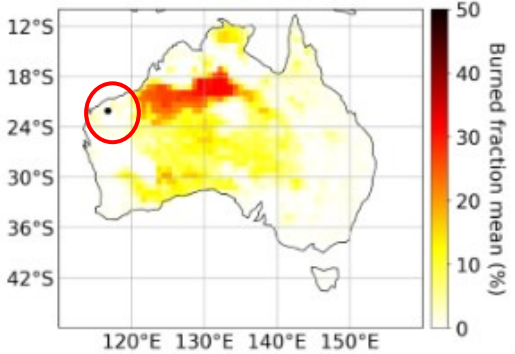
- Fire ECV (Burned area)
  - Consistency assessment with:

  ESA CCI version 5.1, from 01/2001 to 12/2018, 0.25º regular spatial resolution, monthly temporal resolution
  - Methods: **Validation of a historical simulation**
  - Climate (sub)model used: **EC-Earth**
- Main conclusions / recommendations at this stage
  - EC-Earth is unable to produce a realistic mean state that is compatible with the observational uncertainty in our selected study region (Australia)
- Difficulties and envisaged solutions
  - EC-Earth is not fit-for-purpose for wild fire predictions on the area

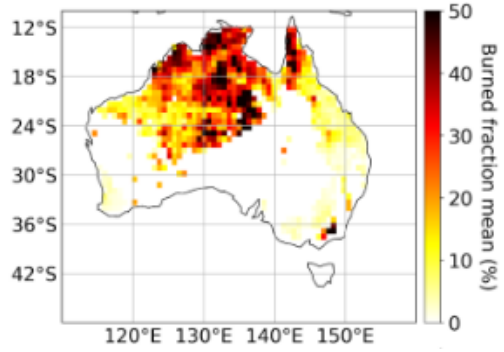
FIRE (burnt areas) – BSC

After propagating observational errors into the model scales, we have seen that **the climatology of burned area in our model is incompatible with the CCI data**

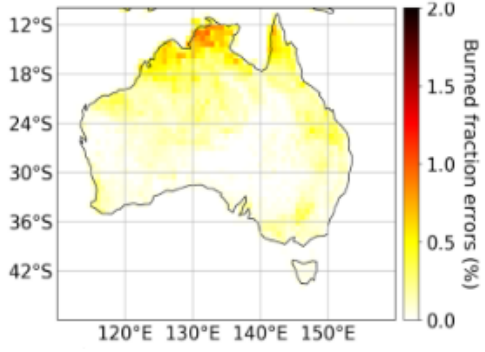
Burned fraction Model Mean



Burned fraction CCI Mean



Burned fraction CCI Uncertainties



For **only one 1 grid point** of the model the model climatology was included within the observational

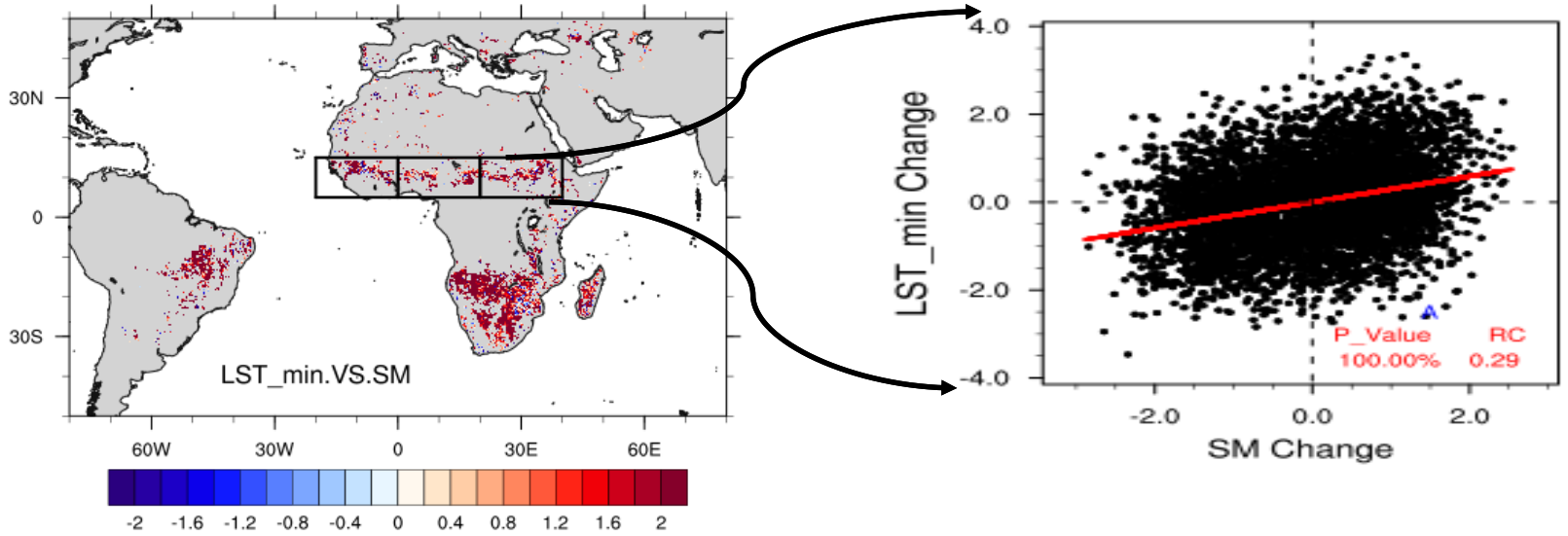
LST (Land surface temperature) – IPSL-LMD

A positive feedback between soil moisture and night-time surface temperature as evidenced by space-based observations

- Land surface temperature (LST)
  - Consistency assessment with: ESA CCI Soil Moisture (SM)
  - Methods: (Linear regression, correlations, dry spells)
  - Climate (sub)model used:
- Main conclusions / recommendations at this stage
  - We use the ESA's CCI SM and TRMM products to detect the contribution of soil thermal inertia (TI) to daily variations in minimum LST (LST_min) during dry spells.
  - Over the Sahel region, a positive linear regression coefficient between changes of LST_min and SM was found: a damping effect of TI on the nocturnal cooling.
- Difficulties and envisaged solutions
  - Different horizontal spatial resolutions between LST and SM

LST (Land surface temperature) – IPSL-LMD

A positive feedback between soil moisture and night-time surface temperature as evidenced by space-based observations



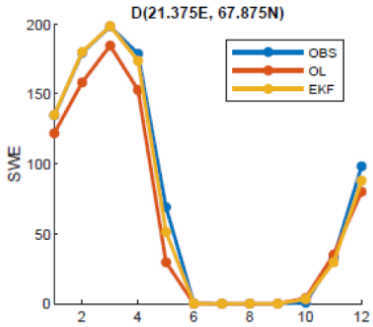
Linear regression coefficient between changes of SM and LST_min

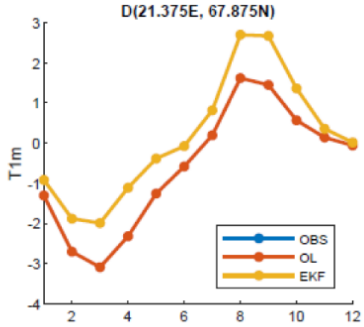
SNOW & PERMAFROST – Meteo-France

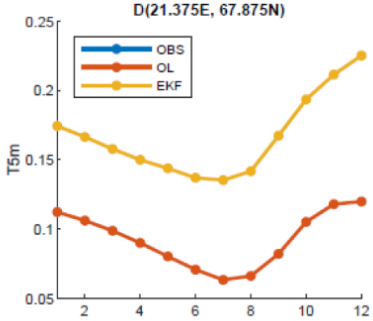
- Snow (snow water equivalent), Permafrost (soil temperature)
  - Consistency assessment with: SM (CCI)
  - Methods: assimilation of SWE
  - Climate (sub)model used: ISBA-CTRIP LSM
- Main conclusions / recommendations at this stage
  - Assimilating SWE improves river discharge simulations
  - Slightly improves SM in Scandinavia
  - Reduces the model cold bias w.r.t. the Permafrost ground T product
- Difficulties and envisaged solutions
  - Permafrost ground T has no annual cycle (mean annual value)
  - On-going comparison with in situ observations

SNOW & PERMAFROST – Meteo-France

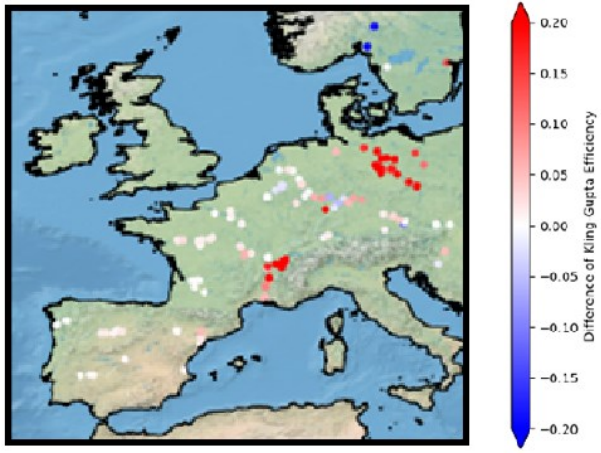
- Impact of assimilating SWE over a model grid cell located at the East of Kiruna







- Impact of assimilating SWE on the KGE score of river discharge



WP3 – Quality assessment

Thank you for your attention