

WP4 Highlights since last CMUG Integration meeting

Andreas Wernecke, Pablo Ortega, Frederique Cheruy, Rob King, Roberto Bilbao, Jaime Ruíz de Morales, Froila Palmeiro, Louis-Philippe Caron, Dirk Notz, Deborah Hemming, Zhao Yanfeng and Amen Al-Yaari



Max-Planck-Institut
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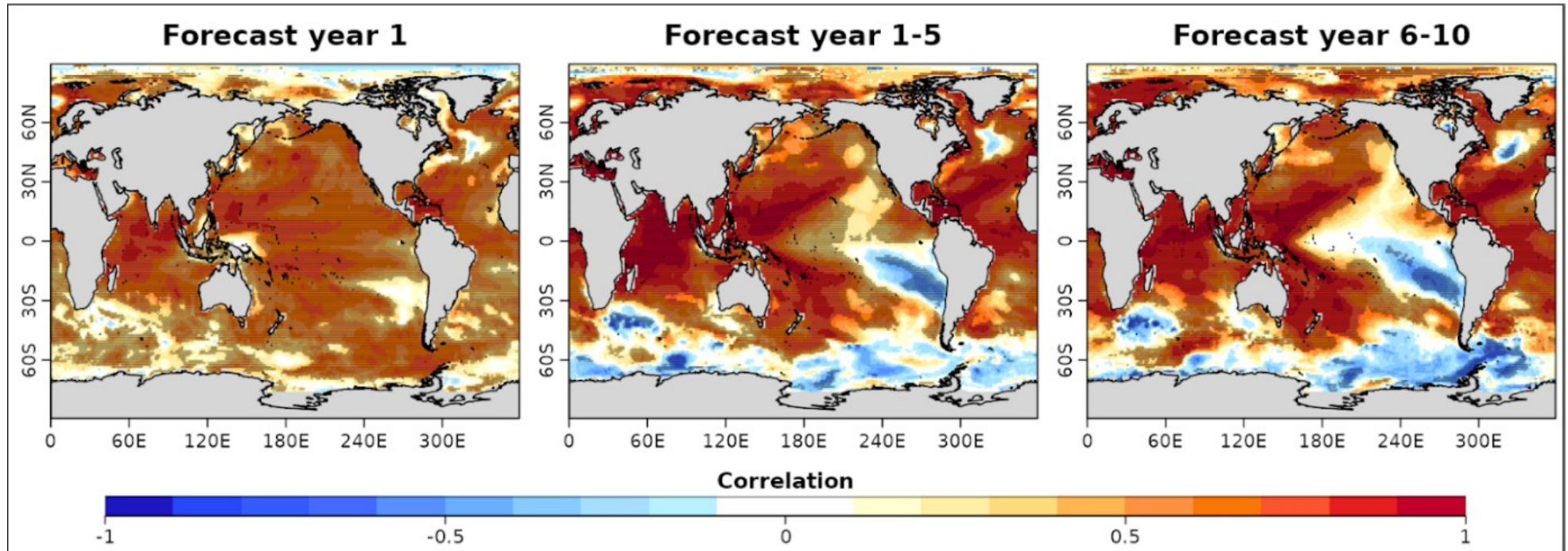


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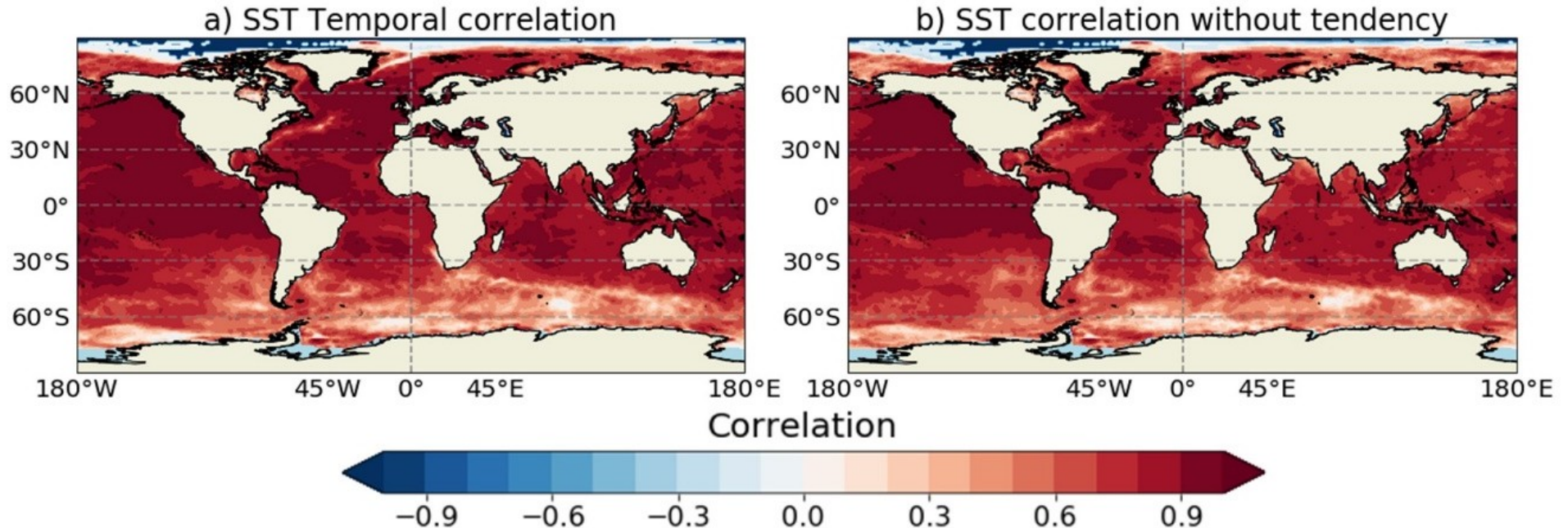
Decadal Climate Prediction Project - Skill assessment

Roberto Bilbao, Jaume Ruíz de Morales, Froila Palmeiro, Pablo Ortega and Louis-Philippe Caron (BSC)



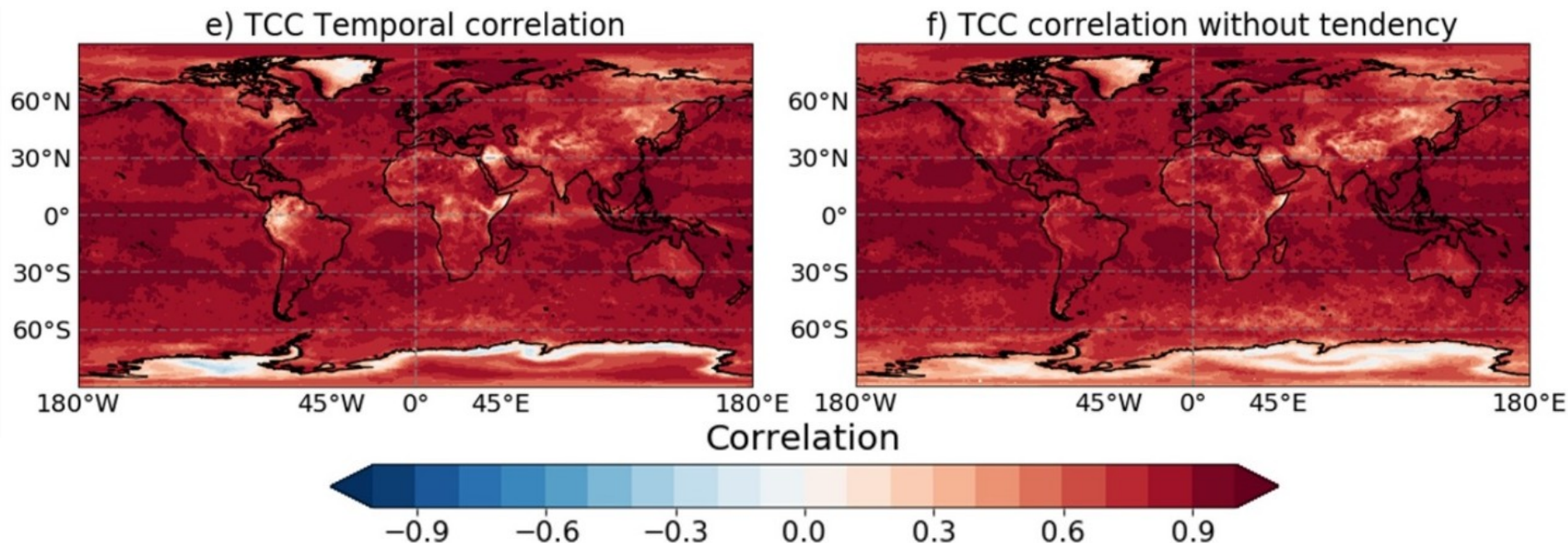
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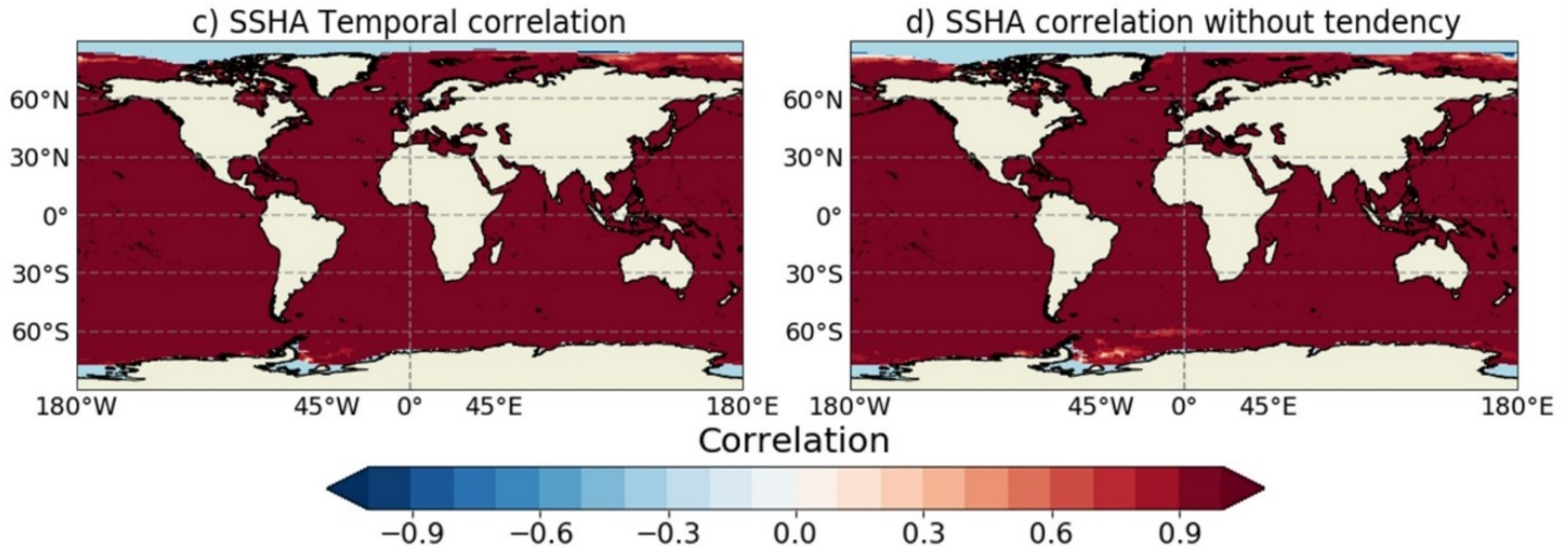
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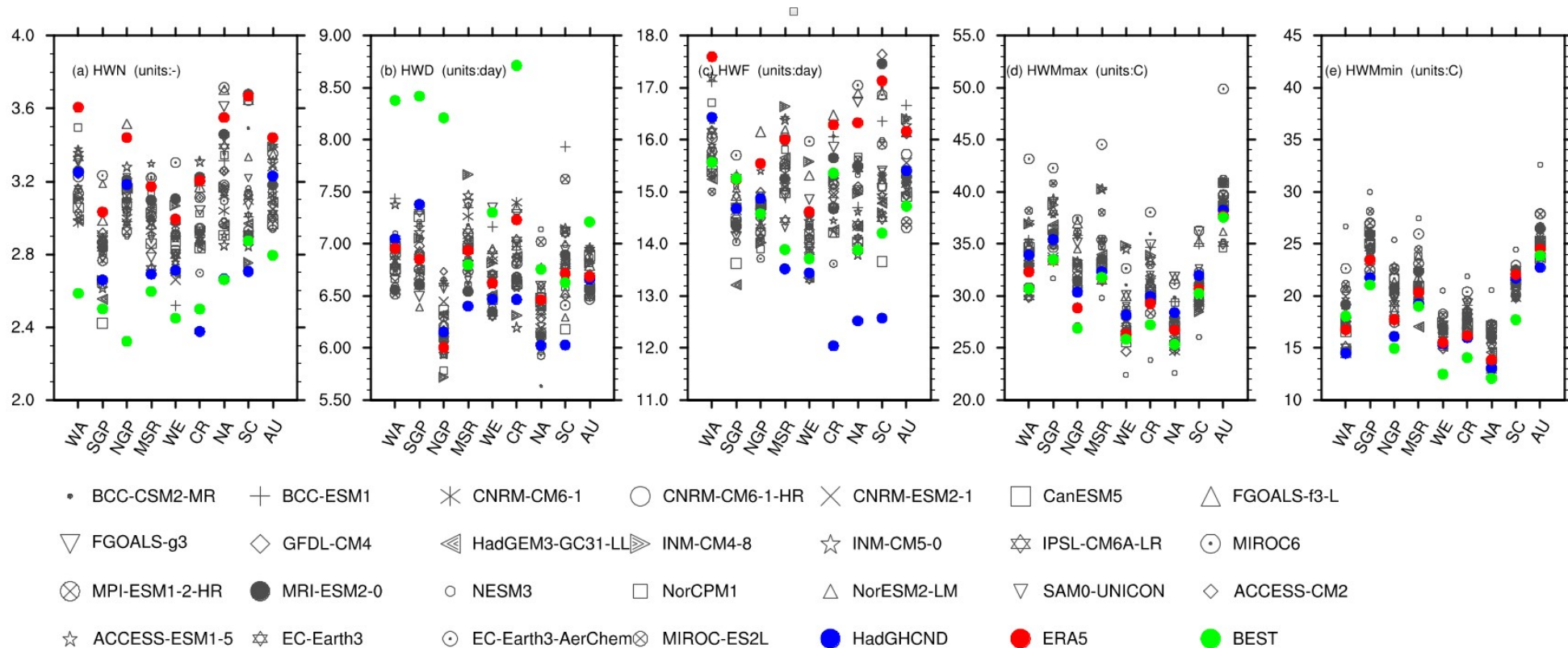
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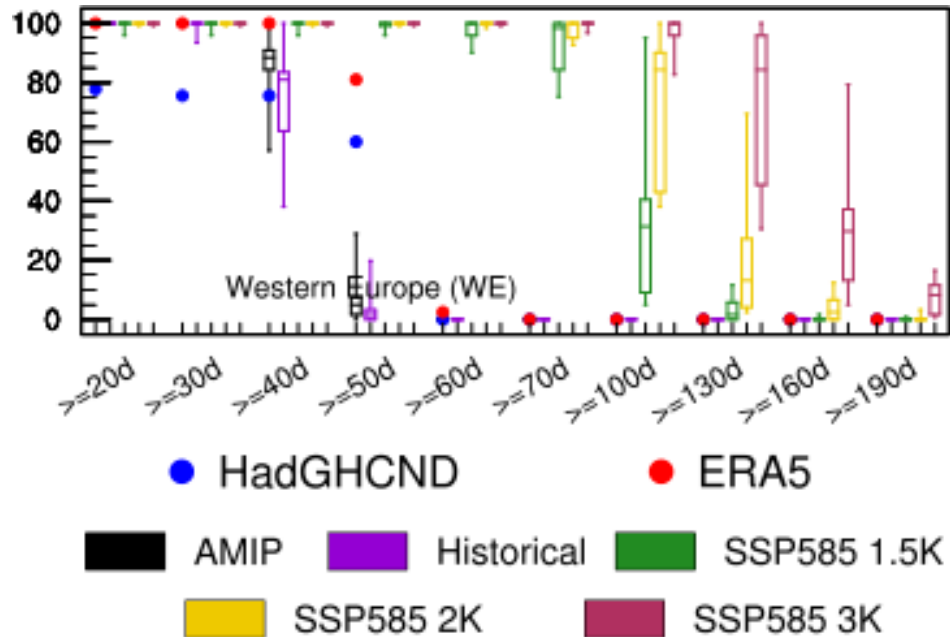
Assess the land-surface interaction related biases in AMIP simulations with CCI and other products

Frederique Cheruy (IPSL)



Assess the land-surface interaction related biases in AMIP simulations with CCI and other products

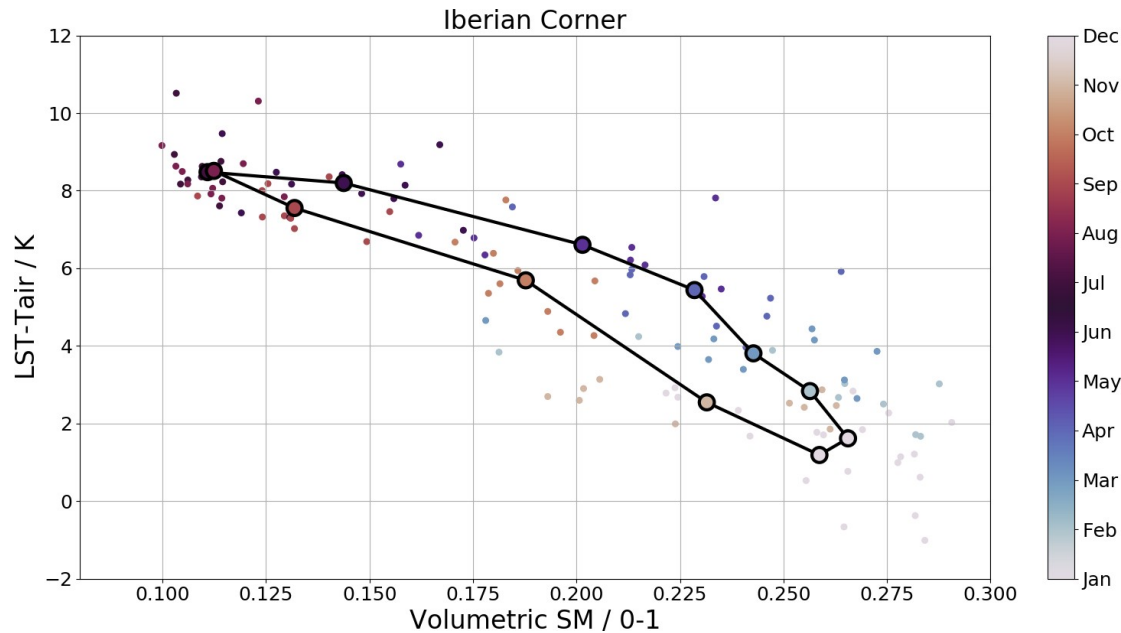
Frederique Cheruy (IPSL)



- Percentage of pixels in Europe with Heat Wave (HW) days above threshold
- HadGHCND has less spatial coverage but longer HWs than historical
- Limiting warming to 1.5K instead of 3K reduces HW days by about 60 per year

Use LST products to develop and test simple models relating the LST versus air temperature (near surface) difference to vegetation moisture stress

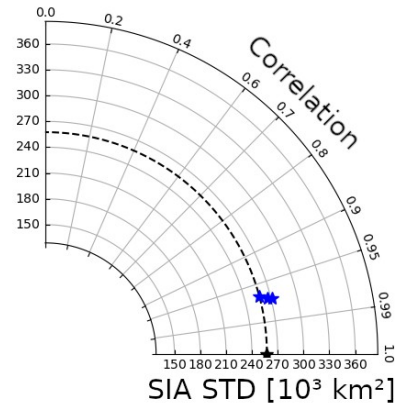
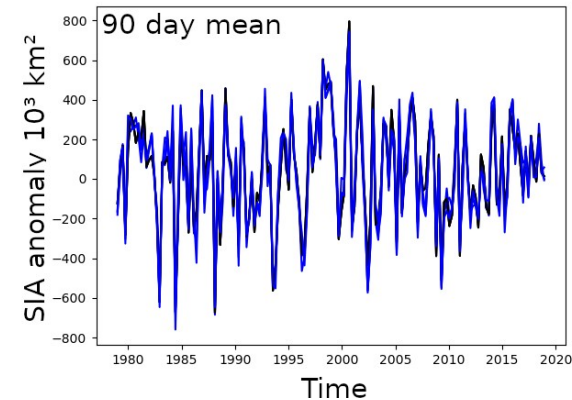
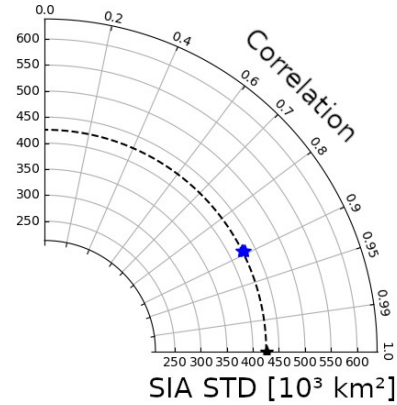
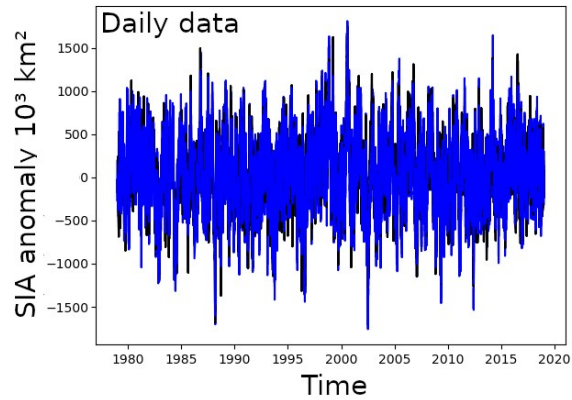
Rob King, Deborah Hemming
(Met Office)



- Relationship between LST and air Temperature and near surface soil Moisture
- Changes in leaf transpiration likely reason (vary across bioms)
- Quantify on satellite scale for model evaluation

D4-4.4 Optimal spatial and temporal scales for model evaluation

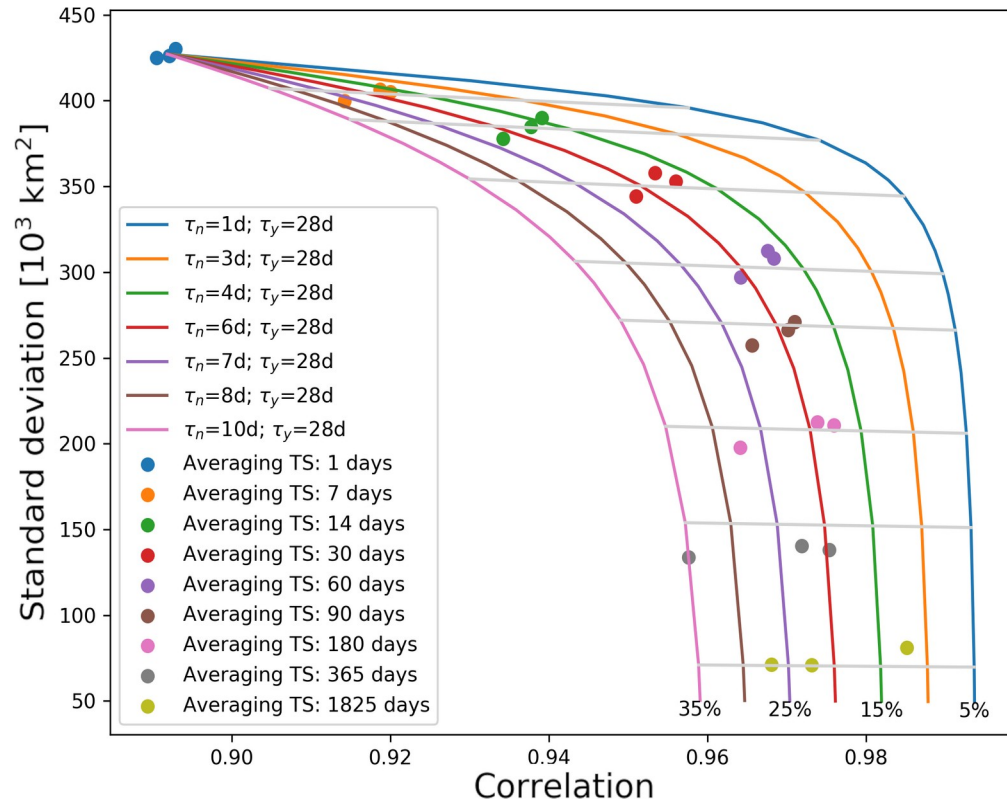
Andreas Wernecke, Dirk Notz (MPI-M)



- Consistency of Sea Ice Area satellite products (CCI/OSI-SAF, NASA-Team, NASA-Bootstrap, NASA-Merged)
- Degrading the temporal resolution reduces signal (STD) and increase consistency (correlation)
- Rate of improvement is informative about error characteristics

D4-4.4 Optimal spatial and temporal scales for model evaluation

Andreas Wernecke, Dirk Notz (MPI-M)



- Short averages: increase in inter-product correlation - Long averages: decrease in STD
- Best fit for statistical model with error correlation of 6 days and SIA correlation of 28 days
- Plan to use this with previous work on spatial correlations to propagate CCI SIC uncertainties to daily/weekly/monthly SIA and SIE uncertainties

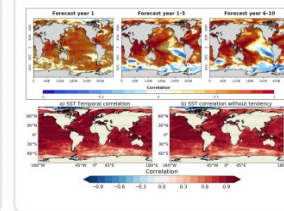
Thank you

CMUG WP4 Science Highlights

Overview

Work Package 4 of the CMUG investigates the new ways to exploit CCI products in MIP experiments. For this summary the main focus is put on the consistency of observational/re-analysis products in the context of CIMP model evaluation. Specifically, we find long (five to 10 year) predictability of the SST, in particular in regions where re-analysis products agree (Topic 1). We further find that Heat Wave (HW) indices are about as constrained in CIMP6 as in re-analysis data (Topic 2). Topic 3 illustrates characteristic impact of a boom on the heat exchange/soil moisture cycle, which will be used for model evaluation. Topic 4 is about the consistency of Arctic Sea Ice Area observations on different time scales to find the optimal temporal averaging scale. Over all this work helps to refine objectives for model evaluation for a meaningful assessment.

Topic 1: Decadal Climate Prediction Project - Skill assessment



An extensive skill assessment of the EC-Earth decadal prediction system (Ref 1) has been performed. The skill for three forecast horizons is shown in Figure 1. Predictions show high levels of skill even for lead times of six to ten years. However, some regions show significantly negative ACG which could indicate initialization shocks (e.g. the North Atlantic), problems with oscillation frequencies (e.g. ENSO) or model drif effects. The consistency between the observational products used for skill verification (ESA-L4, HadISST1.1 and ERA5) is addressed in Figure 1, bottom. It shows that the minimum point-wise correlation between the 3 products is generally very large, and that it is unrelated to the presence of a warming trend.

Topic 2: Heat Waves (HW) in CIMP6

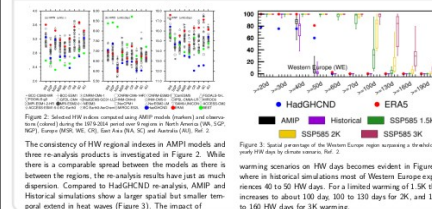


Figure 2: Selected HW index values computed using AMIP models (reanalysis) and observations (based on the ERA5 data) over the region of Western Europe (WE). The models used are: GISS-ER, GISS-ESR, GISS-ESM, GISS-ESM-CM, GISS-ESM-CM2, GISS-ESM-CM3, GISS-ESM-CM4, GISS-ESM-CM5, GISS-ESM-CM6, GISS-ESM-CM7, GISS-ESM-CM8, GISS-ESM-CM9, GISS-ESM-CM10, GISS-ESM-CM11, GISS-ESM-CM12, GISS-ESM-CM13, GISS-ESM-CM14, GISS-ESM-CM15, GISS-ESM-CM16, GISS-ESM-CM17, GISS-ESM-CM18, GISS-ESM-CM19, GISS-ESM-CM20, GISS-ESM-CM21, GISS-ESM-CM22, GISS-ESM-CM23, GISS-ESM-CM24, GISS-ESM-CM25, GISS-ESM-CM26, GISS-ESM-CM27, GISS-ESM-CM28, GISS-ESM-CM29, GISS-ESM-CM30, GISS-ESM-CM31, GISS-ESM-CM32, GISS-ESM-CM33, GISS-ESM-CM34, GISS-ESM-CM35, GISS-ESM-CM36, GISS-ESM-CM37, GISS-ESM-CM38, GISS-ESM-CM39, GISS-ESM-CM40, GISS-ESM-CM41, GISS-ESM-CM42, GISS-ESM-CM43, GISS-ESM-CM44, GISS-ESM-CM45, GISS-ESM-CM46, GISS-ESM-CM47, GISS-ESM-CM48, GISS-ESM-CM49, GISS-ESM-CM50, GISS-ESM-CM51, GISS-ESM-CM52, GISS-ESM-CM53, GISS-ESM-CM54, GISS-ESM-CM55, GISS-ESM-CM56, GISS-ESM-CM57, GISS-ESM-CM58, GISS-ESM-CM59, GISS-ESM-CM60, GISS-ESM-CM61, GISS-ESM-CM62, GISS-ESM-CM63, GISS-ESM-CM64, GISS-ESM-CM65, GISS-ESM-CM66, GISS-ESM-CM67, GISS-ESM-CM68, GISS-ESM-CM69, GISS-ESM-CM70, GISS-ESM-CM71, GISS-ESM-CM72, GISS-ESM-CM73, GISS-ESM-CM74, GISS-ESM-CM75, GISS-ESM-CM76, GISS-ESM-CM77, GISS-ESM-CM78, GISS-ESM-CM79, GISS-ESM-CM80, GISS-ESM-CM81, GISS-ESM-CM82, GISS-ESM-CM83, GISS-ESM-CM84, GISS-ESM-CM85, GISS-ESM-CM86, GISS-ESM-CM87, GISS-ESM-CM88, GISS-ESM-CM89, GISS-ESM-CM90, GISS-ESM-CM91, GISS-ESM-CM92, GISS-ESM-CM93, GISS-ESM-CM94, GISS-ESM-CM95, GISS-ESM-CM96, GISS-ESM-CM97, GISS-ESM-CM98, GISS-ESM-CM99, GISS-ESM-CM100.

Figure 3: Total number of HW days for Western Europe region (averaged over 1000 realizations) for different scenarios. The scenarios are: AMIP, Historical, SSP585 1.5K, SSP585 2K, and SSP585 3K. The number of HW days increases significantly for the 3K scenario compared to the 1.5K and 2K scenarios.

Topic 4: Optimal temporal scales for model evaluation

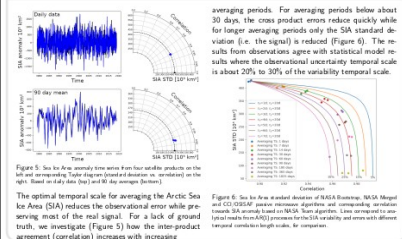


Figure 4: The top row shows the time series of SIA anomalies for real data (blue) and CCI products (red) for different averaging periods. The bottom row shows the correlation between real data and CCI products for different averaging periods. The correlation generally increases with increasing averaging periods.

Topic 3: LST minus T_{AIR} and veg. moisture stress

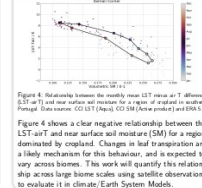


Figure 5: Relationship between the monthly mean LST minus T_{AIR} and the monthly mean veg. moisture stress (MS) for a region dominated by cropland. The plot shows a clear negative relationship between the two variables, indicating that higher LST minus T_{AIR} is associated with lower veg. moisture stress.

References

1. Bibao, R., WM, S., Ortega, P., et al. (2021) Assessment of a full-field initialized decadal prediction system with the CIMP6 version of EC-Earth. *Earth Syst. Dynam.* 12, 173-196. doi: 10.5194/esd-12-173-2021
2. Zhao, Ai-Yan, Cheny, H. (in preparation): Heatwave characteristics and uncertainties in historical and future climate based on the CIMP6 models

Authors

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Institutions

Met Office, Exeter, U.K.; Barcelona Supercomputing Centre (BSC), Barcelona, Spain; Institut Pierre Simon Laplace (IPSL), Paris, France; Max-Planck Institute for Meteorology (MPI-M), Hamburg, Germany

See also our poster

