45th Session of the World Climate Research Programme

Joint Scientific Committee

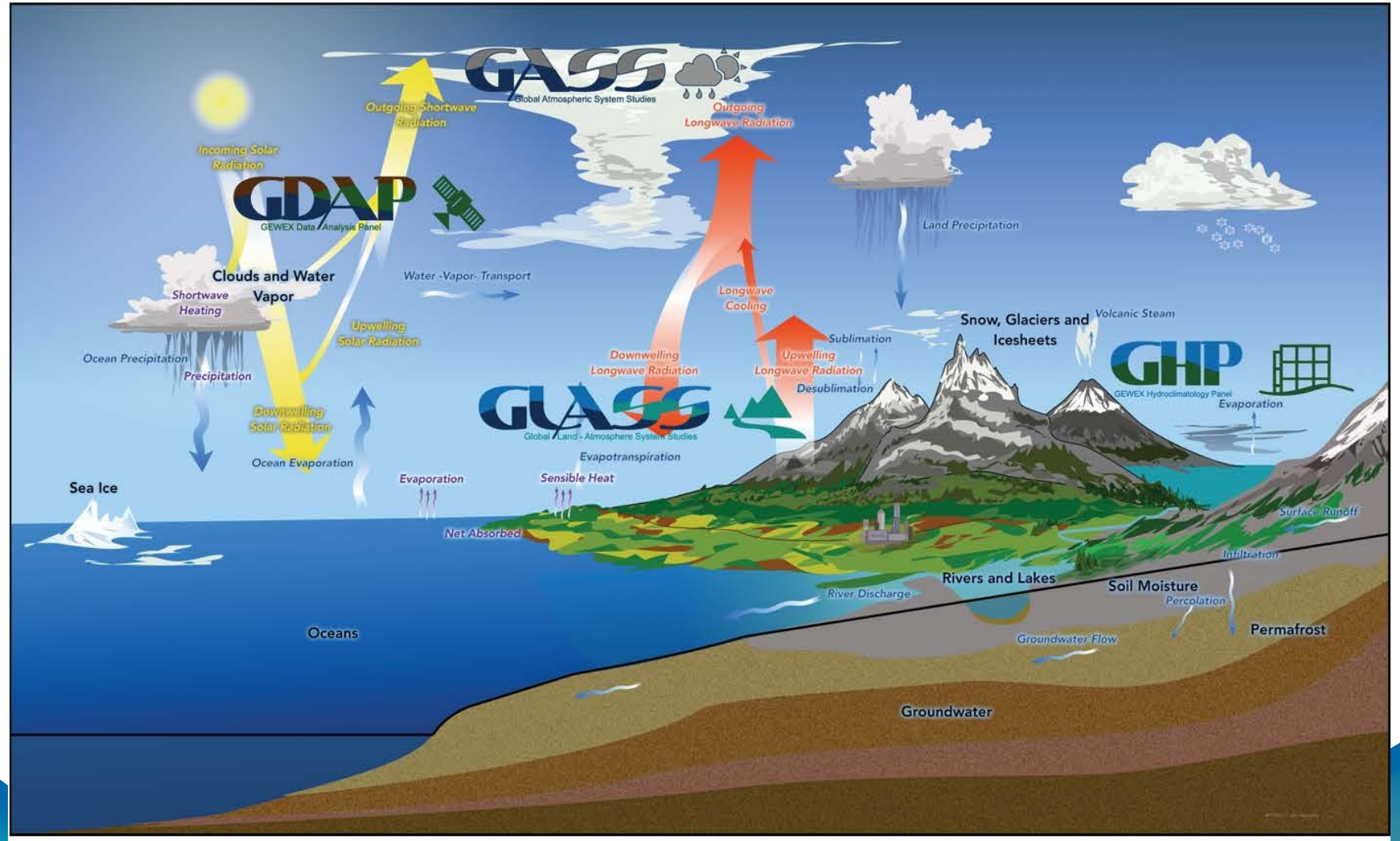
Global Energy and Water EXchanges (GEWEX)

- Overview of GEWEX and its panels
- Two scientific highlights
- The GEWEX Open Science Conference
- Interactions with other WCRP components

Jan Polcher, Xubin Zeng, Peter van Oevelen

May 2024, Lima

GEWEX Panels and their Activities



The focus of the four GEWEX panels in relation to the global and regional water and energy cycles
(© P. van Oevelen, 2020)

GEWEX modelling panels

- **GASS** :
    - New field campaigns in preparation to observe convective organisation.
    - LES and CRM simulations over larger domains but simple surfaces.
    - The 10 on-going projects are in healthy state
    - GASS-CFMIP meeting in July 2023 with over 200 participants
- **GLASS** :
    - An assessment of the needs of the community is underway
    - Refinement of the PLUMBER protocol for systematic comparison of LSM on well observed sites.
    - SIF inter-comparison (for the process understanding of coupled energy-water-carbon cycles) is starting with 3 LSMs on 3 tower sites.
    - Irrigation & km-scale LSMs experiments are in preparation.
    - One new GLAFO site has been initiated and others are in preparation.

Observation oriented panels

- **GDAP** :
  - G-VAPII : Comprehensive assessment of satellite based water vapour products.
  - Convection tracking project is initiating
  - New precipitation products are coming on-line and a third assessment is planned.
  - BRSN : New leadership is in place and there is concern for the long term support of some stations.
  - ISCCP-NG is making good progress and a first demo data set is available.
- GHP :
  - 6 RHPs are active : GWF, ANDEX, PANNEX, BalticEarth, TPE-WS and AsiaPEX
  - A focus on mountain regions is emerging : INARCH, TeamX and ANDEX
  - Groundwater and river modelling activities are starting in collaboration with GLASS.
  - GRDC and GPCC are active and releasing regularly new versions of the global data sets.
  - Global lake level monitoring is being restarted with CNES's effort for SWOT (Hydroweb 2.0)

Preparing new Regional Hydroclimate Projects

It is a continuous effort for GEWEX IPO to foster the development of regional research communities and encourage regional collaborations.

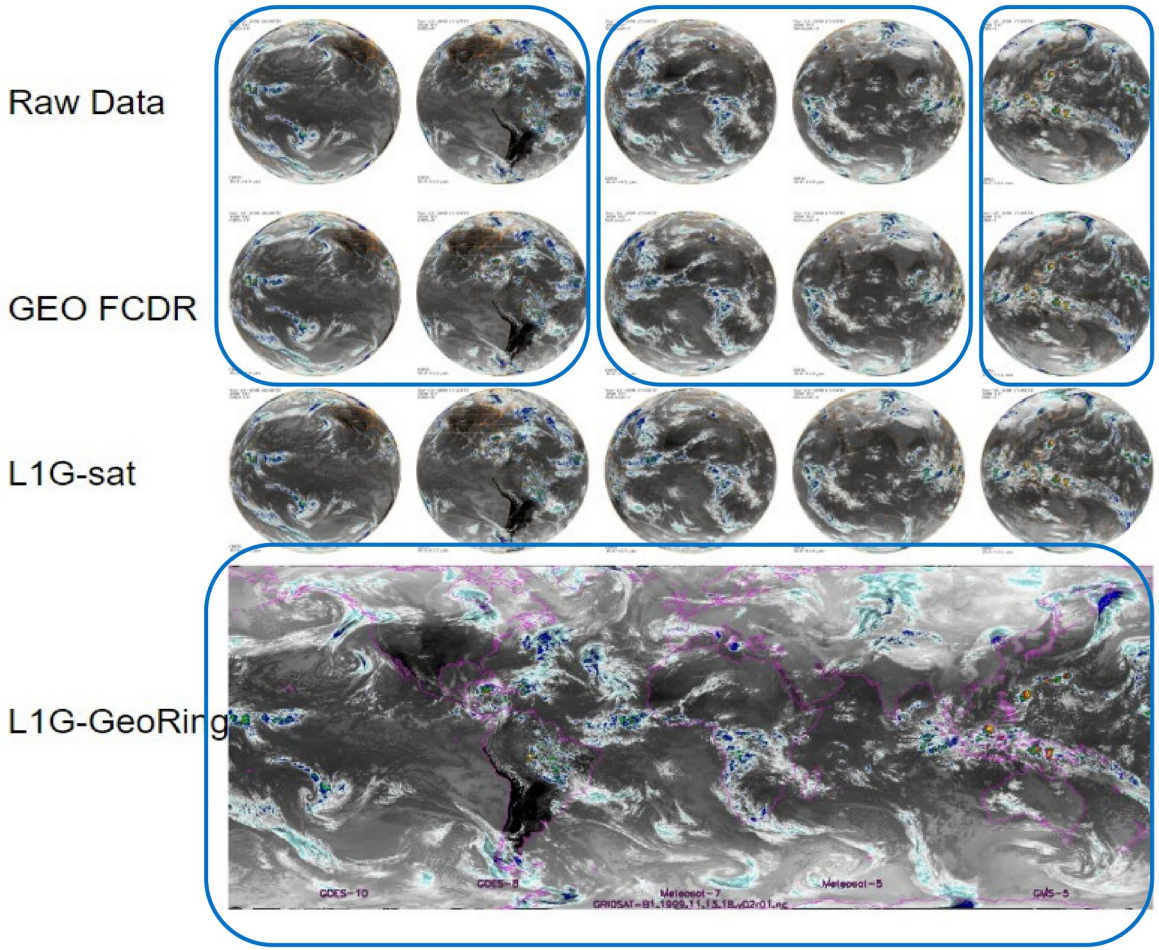
- **Central Asian community** :
  - GEWEX co-organized a conference in Osh in May 2024.
  - Water resources are challenged by climate change and the resulting glacier melt.
  - Observation gaps need to be filled.
  - Modelling capabilities needed in the region.
- **US-RHP now called H2US (Humans and Hydro climate in the US)** :
  - Some new initiatives are underway with the support of some agencies.
  - Proposal submitted to the Schmidt Sciences this year.

Some scientific highlights from GEWEX

- GEWEX's strategic plan calls for higher resolution models for process understanding and projection.
- This needs to be supported by commensurate observation based data sets.
- It also requires to rethink some of the modelling approaches and their validation.

- **Two examples** :
  - The GEO-Ring and ISCCP-NG : GDAP, interactions with space agencies.
  - Surface structures and impact on the PBL processes : GLASS and GASS.

EUMETSAT-NOAA GEO-Ring project

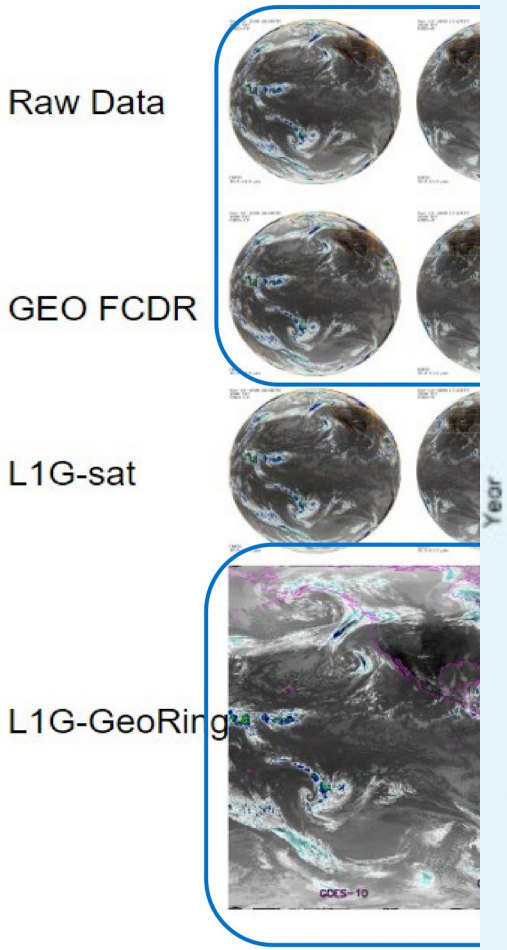


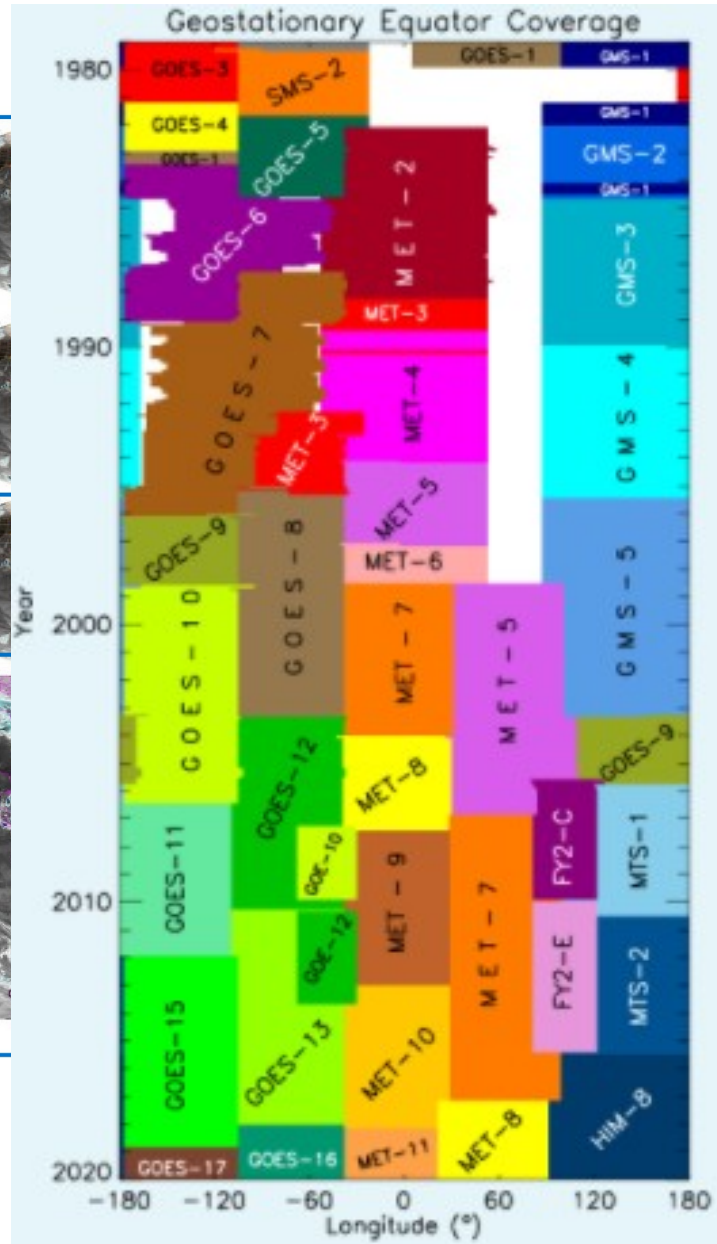
Federated production by agency

Produced in the cloud

- GEO-Ring radiance data 1974-today and beyond
- Project runs 2023-2027 and aims at best and longest radiance climatology ever by addressing:
  - data rescue activities
  - radiometric anomaly detection
  - improved navigation
  - metadata analysis
  - uncertainty characterisation (EUMETSAT only)
  - channel re-calibration
  - channel cross-calibration
  - spectral band adjustment
  - validation
  - mapping on standard grid with fixed temporal sampling
  - combination of individual mapped satellites into quasi-global product
- EUMETSAT and NOAA co-develop on and will distribute data from their cloud infrastructures to enable the most efficient data processing

EUMETSAT-NOAA GEO-Ring project





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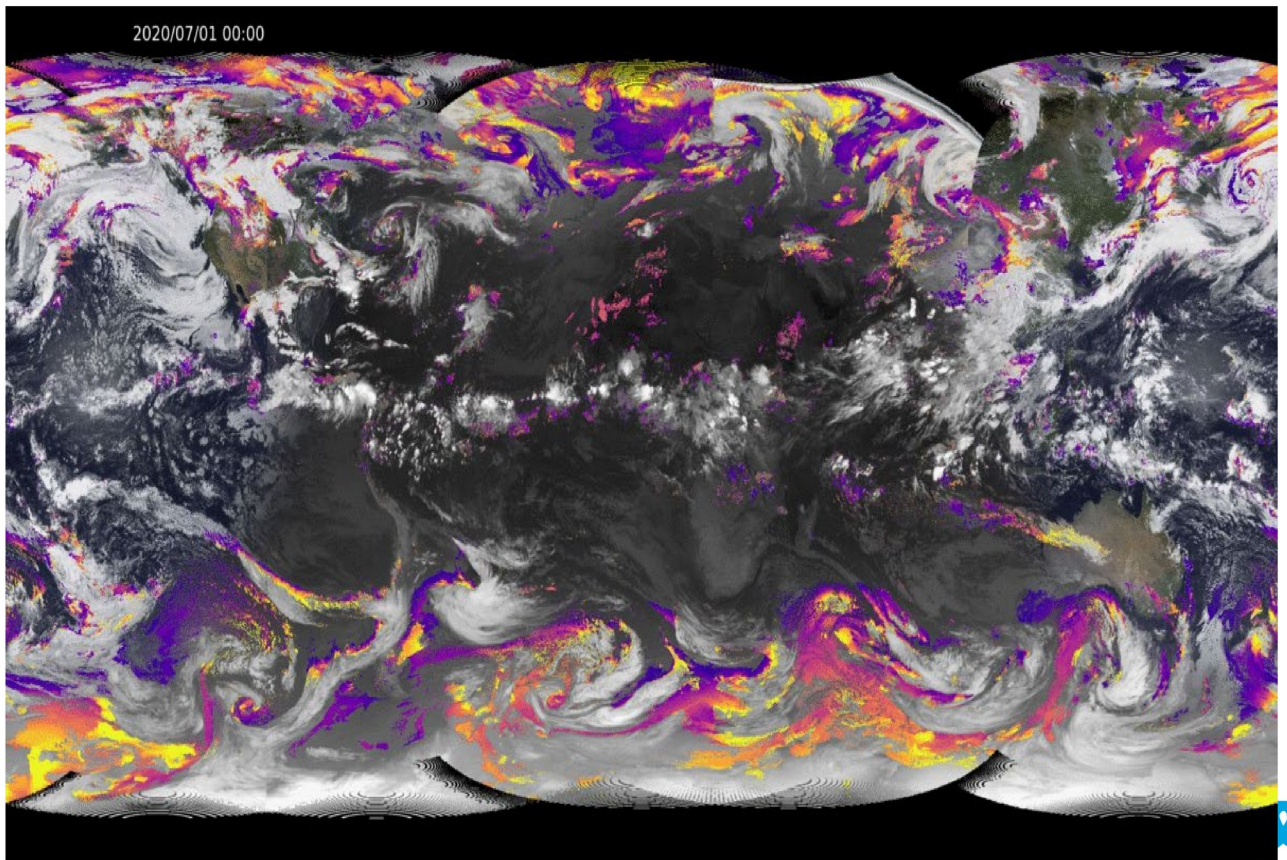
GEO-Ring Application: ISCCP-NG

- ISCCP-NG uses the current GEO-Ring (SEVIRI, AHI, ABI, AMI)
- ISCCP-NG L1g is a prototype method to combine all sats into a seamless GEO-Ring. Code being developed by NESDIS (CIMSS), EUMETSAT and KMA.
- Goal is to support cloud, aerosol, surface temperatures, AMVs, precipitation and other applications
- Nominal resolution is 30 min, 0.05° and all channels
- NOAA/NESDIS and EUMETSAT/CM-SAF have demonstrated use of ISCCP-NG L1g for cloud applications
- Prototypes for 2021 and 2023 available from UW/CIMSS

ISCCP-NG supercooled cloud detection (Martin Stengel, DWD)

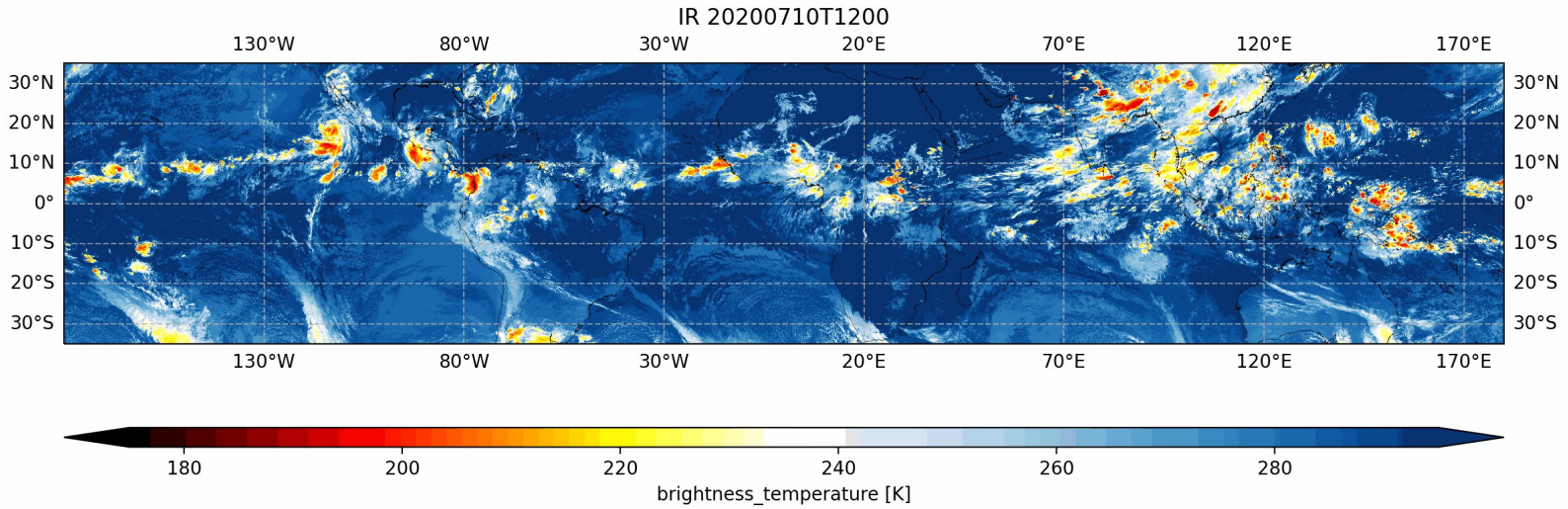


Coordination Group for Meteorological Satellites

EUMETSAT CGMS

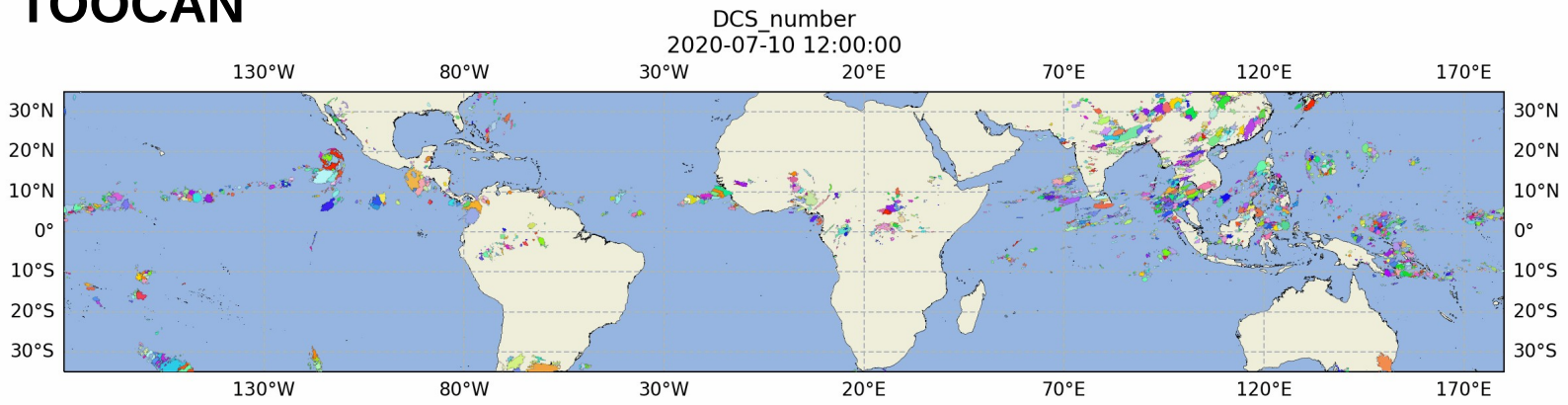
GDAP Application to Deep Convective Strom tracking

Geo-Ring 0.05°/30min



T. Fiolleau,
R.Roca,
L. Gouttesoulard,
LEGOS/CNRS,
Toulouse, France

TOOCAN

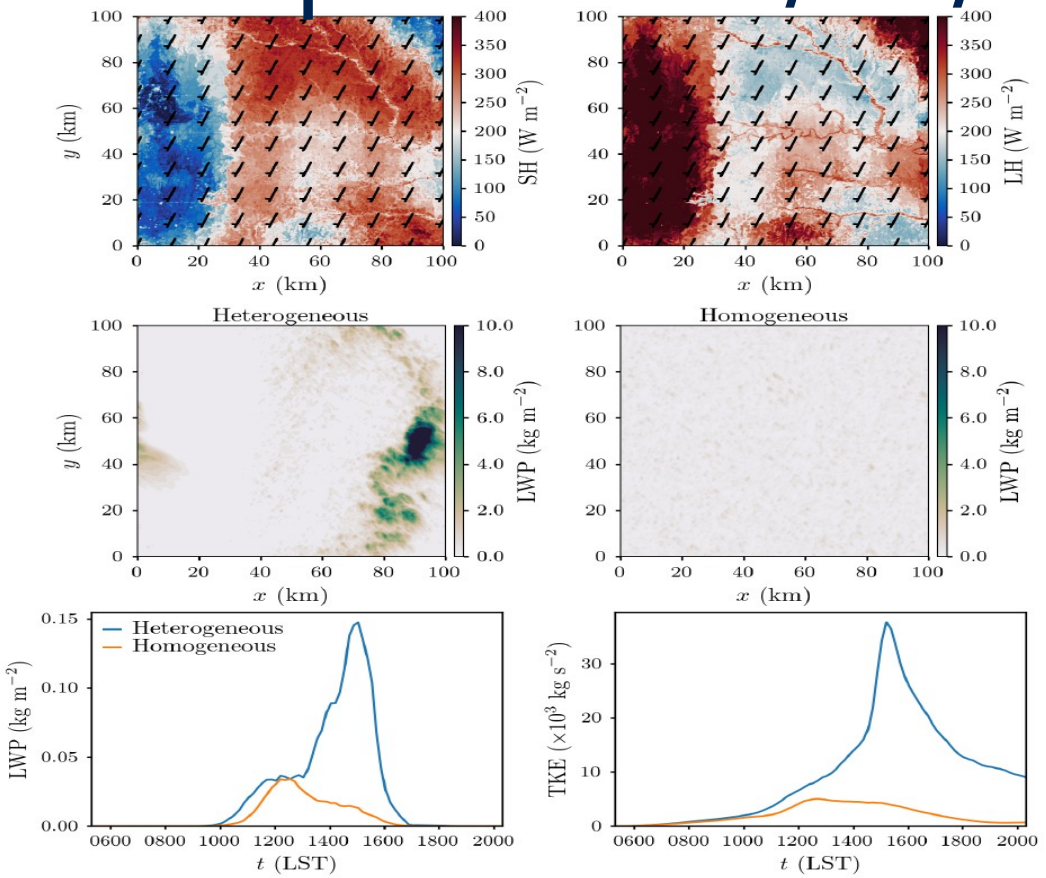


Coordination Group for Meteorological Satellites

EUMETSAT CGMS

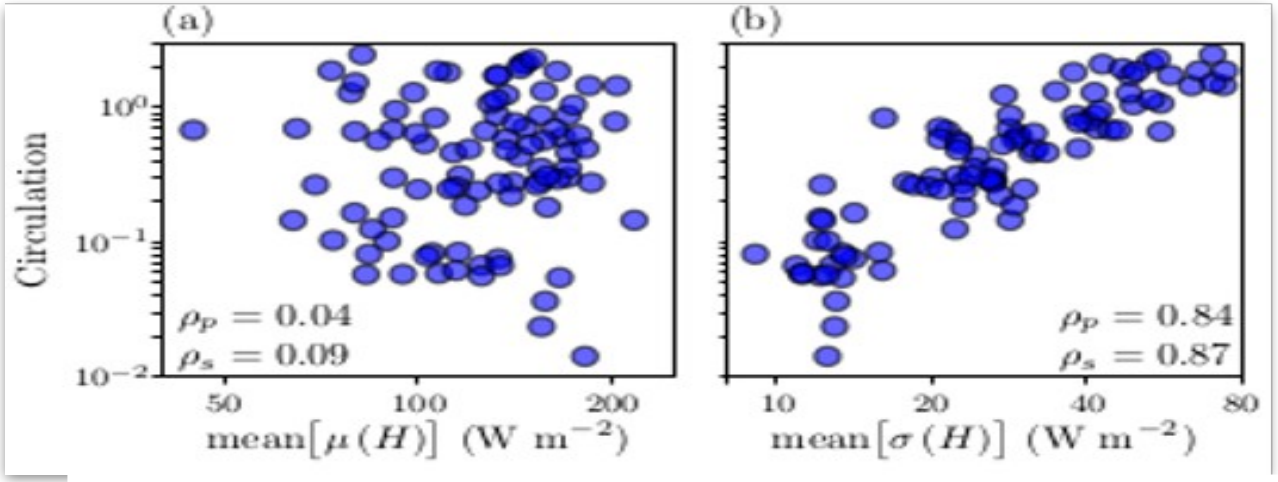
Large Eddy Simulations over Southern Great Plains site on 92 different shallow convection days (2015-2019)

Example: 2017/06/27



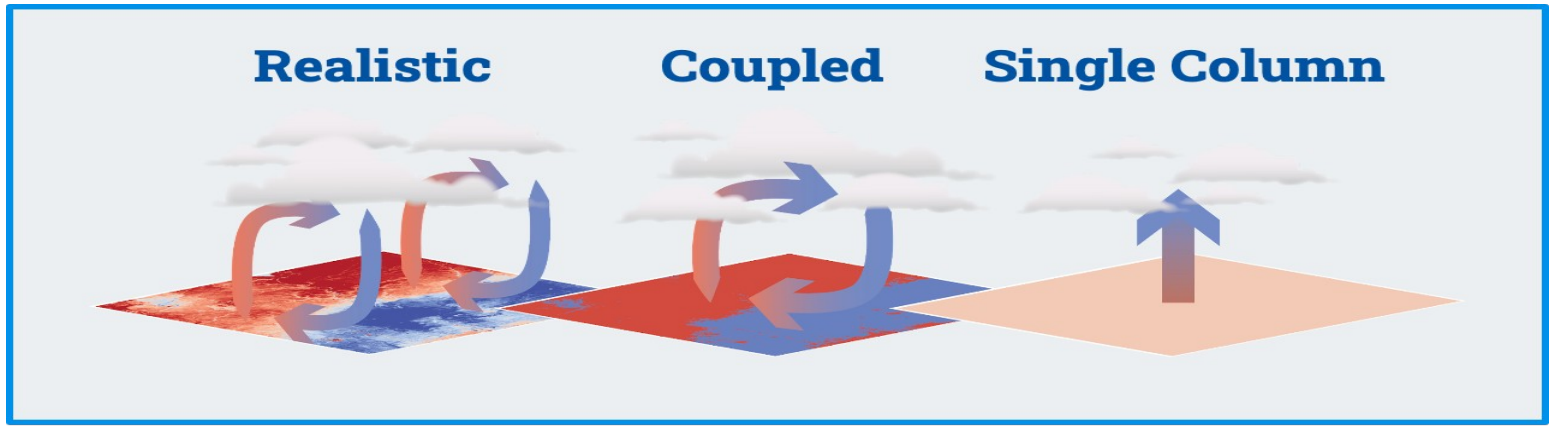
Simon et al., Heterogeneous Land Surface Effects on TKE and Cloud Formation: Statistical Insights from LES Cases, JGR Atmospheres, Accepted

Correlation between spatial mean (and spatial variance) and circulation strength

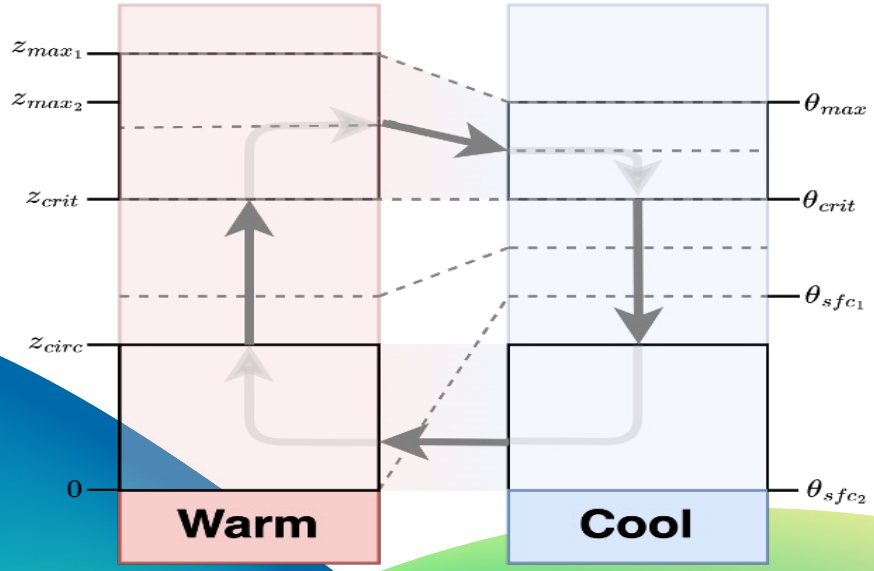


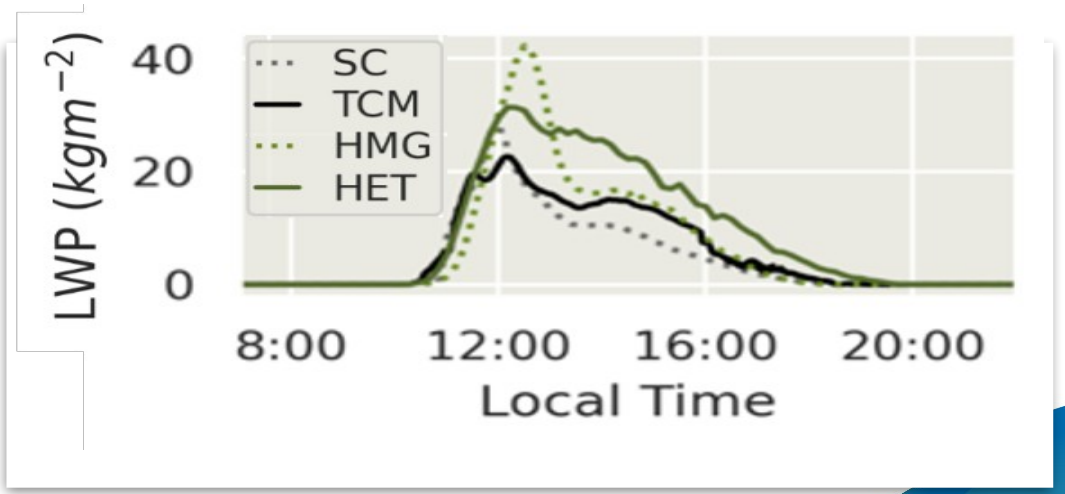
- Spatial variance and characteristic spatial length of surface fluxes plays a key role in cloud development.
- Secondary circulations drive the differences between HMG and HTG. These emerge when the surface is sufficiently “organized”.

CLASP parameterization: Secondary circulations



The impact of surface heterogeneities will still need to be parametrized in km-scale ESMs !

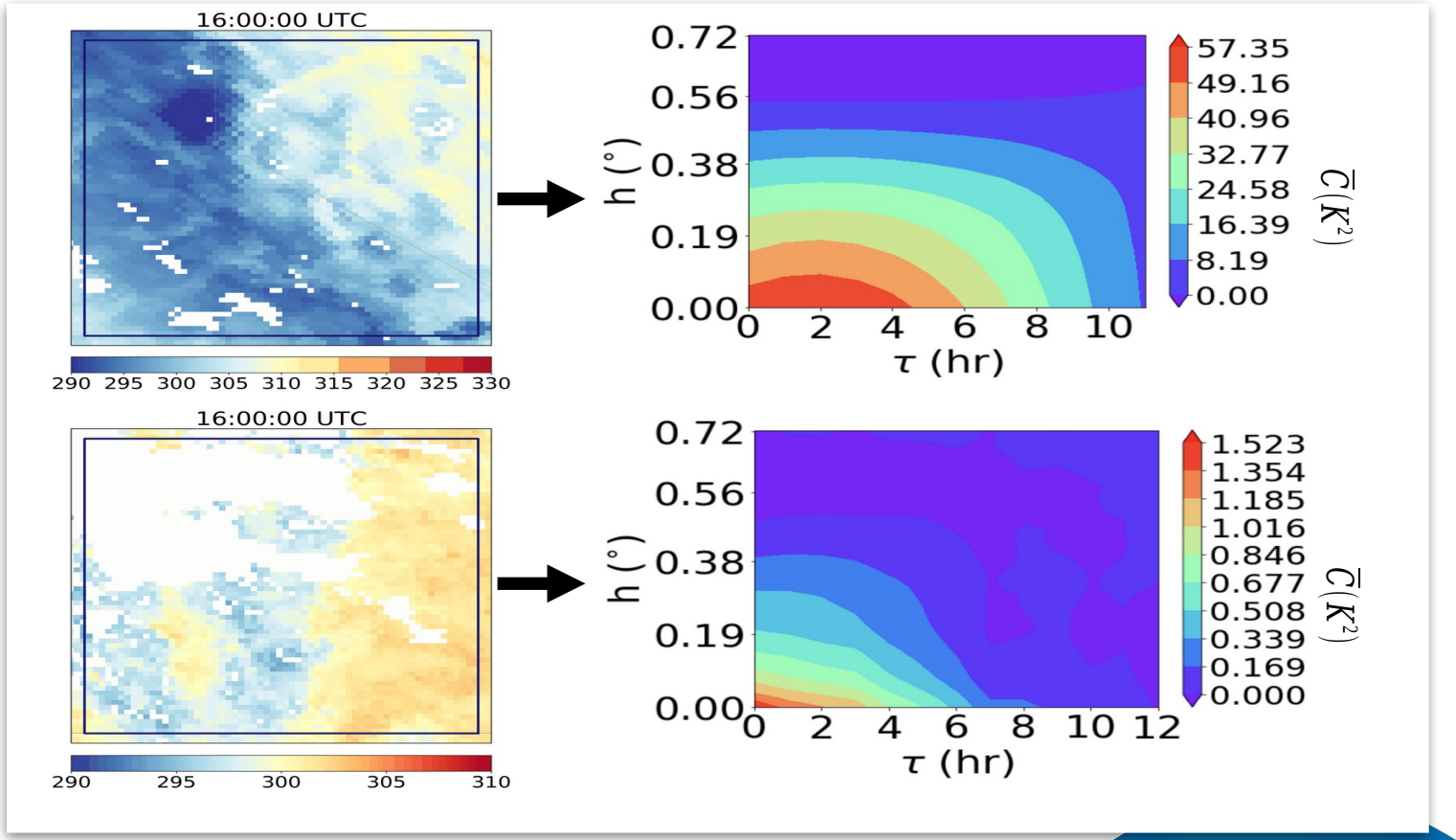




Waterman et al., A Two-Column Model Parameterization for Subgrid Surface Heterogeneity Driven Circulations, JAMES, 2024

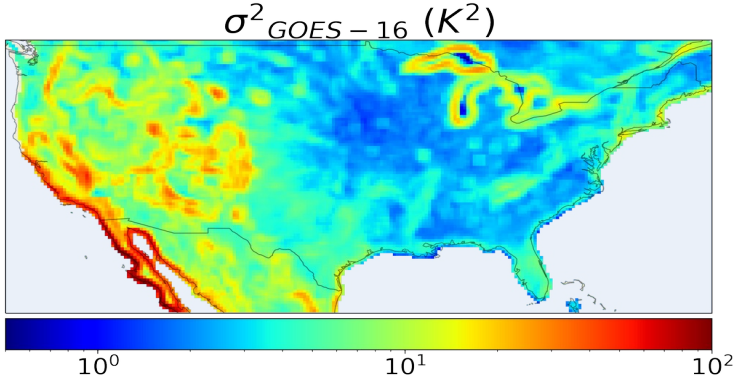
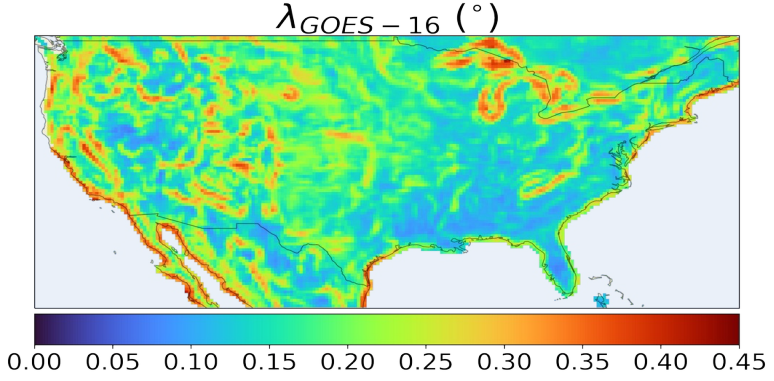
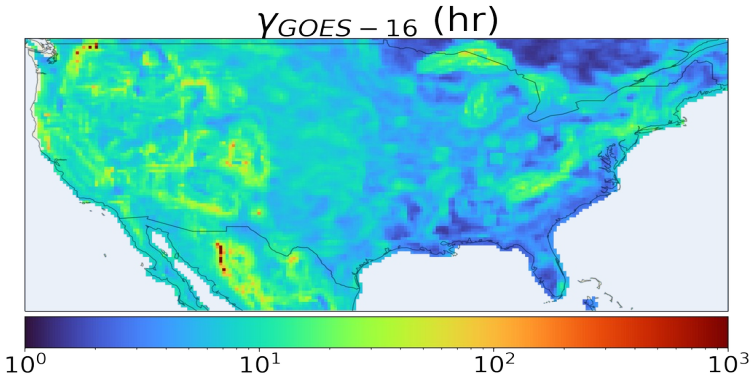
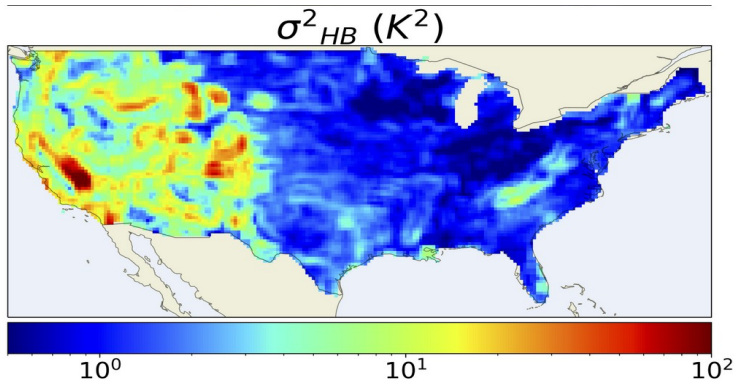
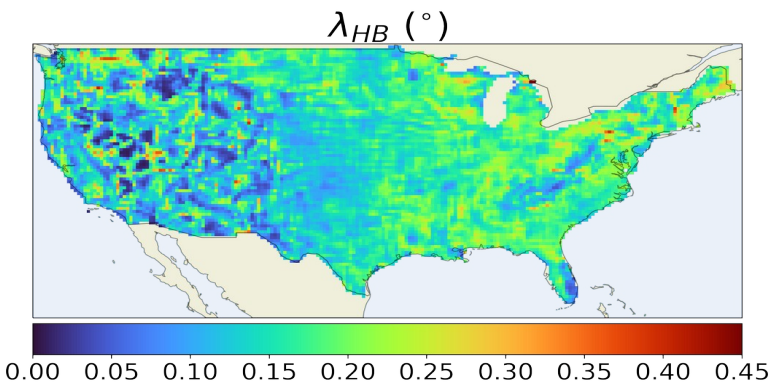
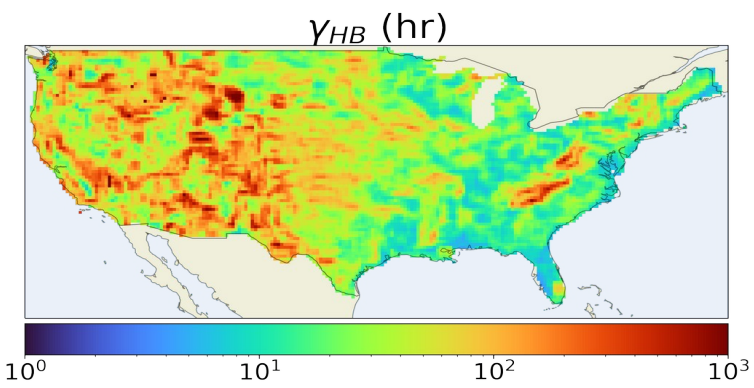
Space-time structure of land surface temperature

- Km-scale simulations rely on robustness of representation of land heterogeneity
- Rarely (if ever) evaluated the sub-grid space-time structure of land surface models
- Space-time covariance enables a tool to summarize the 3D (2D + time) of surface fields (e.g., LST)

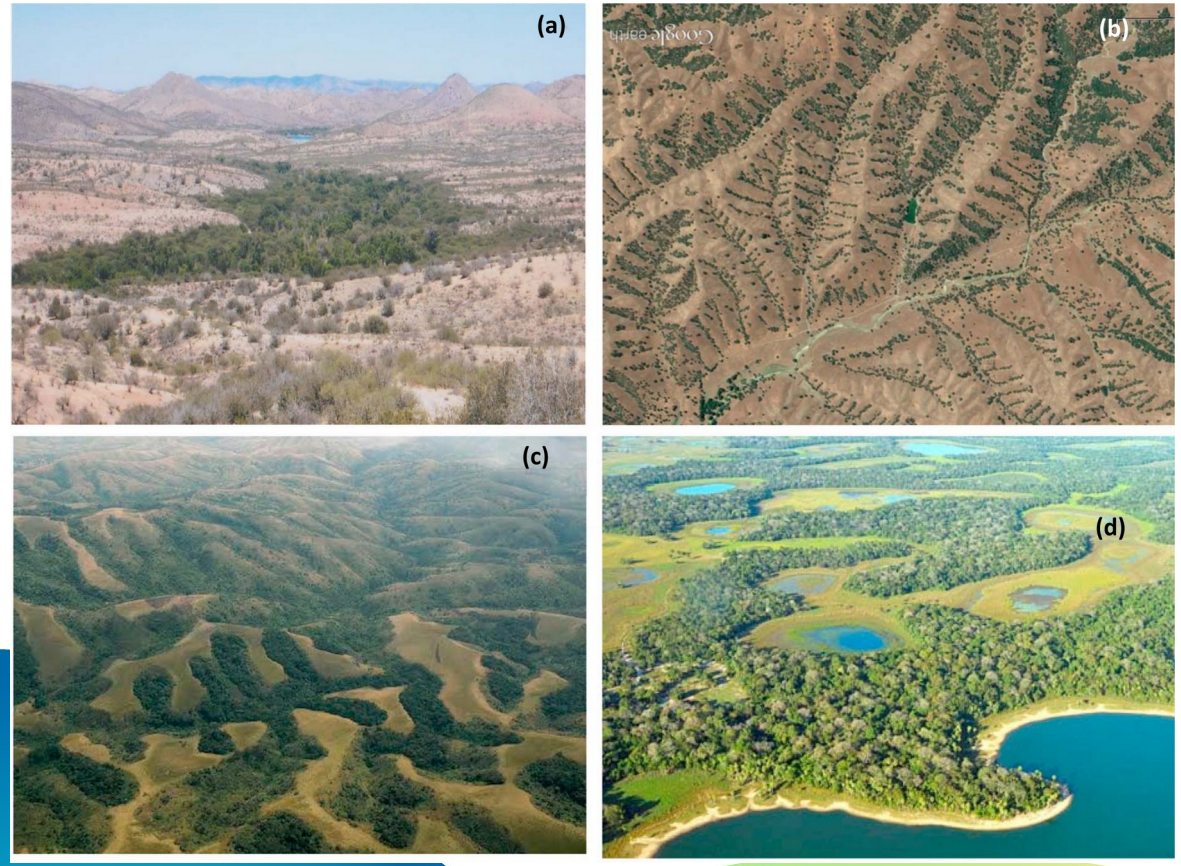


Evaluating simulated LST space-time structure

$$C(h,\tau) = \sigma^2 e^{-\left(\frac{\tau}{\gamma}\right)^a - \left(\frac{h}{\lambda}\right)^a}$$

	Space-time variance	Characteristic spatial scale	Characteristic time scale
Observations			
Simulations			

It is the water/vegetation interactions which organize the landscapes



- At km-scales the surface heterogeneities are the result of interactions between the hydrology, vegetation and human activities.
- High resolution models will need to predict them in order to generate the observed heterogeneities and PBL circulations.
- GLASS will encourage the land surface modelling community to integrate these processes into their models.
- The impact of these heterogeneities on the atmosphere will be done jointly with GASS.
- This process will be in interaction with Digital Earths to ensure integration into km-scale ESMs (regional & global).

9th The Global Energy and Water Exchanges Open Scientific Conference

Water • Climate | 水 • 気 候

7–12 July 2024
Sapporo, Japan
Keio Plaza Hotel

- 30 Sessions (29 oral sessions with 372 presentations and 30 poster sessions with approx. 480 presentations)
- 4 stakeholder meetings in parallel. With a strong involvement of GEWEX scientists
- 4-6 July : ECR workshop jointly organized by Hokkaido university, YESS and and H3S (American Geophysical Union (AGU) Hydrology Section Student Subcommittee).
- 7th of July : Space agency day with presentations of 8 agencies and round table discussions with ECRs

GEWEX OSC cont.

Numbers for the OSC :

- Total number of paid registrations: 792
- Total number of submitted abstracts: 860
- Total number of ECRs: 354
- Total number of travel support requests: 150
- Gender balance : 1/3 general and 1/2 for ECRs

Two “GEWEX Lifetime Contributions” will be awarded :

Jack Kay
(NASA)

Toshio Koike
(ICHARM)

Plans for future meetings :

- 2025/26 PAN – GEWEX / RHP Conference
- 2026/27 PAN GASS/GLASS Conference
- 2028 10th GEWEX Open Science Conference (South America?)

Planned products, high-level assessments or other key outputs/publications

Assessments:

- G-VAPII : Comprehensive assesment of satellite based water vapour products.
- Third assessment of precipitation products
- Earth energy imbalance assessment

Planned products:

- ISCCP-NG
- Comprehensive datasets from each RHP project (e.g., GWF)
- GRDC and GPCC datasets and BSRN data.

Key publications:

- Each GEWEX project will produce key publication (e.g., LS4P overview article).

Linkages with other WCRP activities

- ESMO : High resolution modelling and new data sets. In collaboration with Digital Earth. How can expertise on global observational products be provided to ESMO ?
- RifS : Close links with GHP as we have common regional interests. This also covers our interactions with CORDEX.
- With CLIVAR the joint coordination of the monsoon panel. Some discussions around coastal oceans indicate a new area to explore.
- APARC : The role of monsoons in the climate could be a meeting point.
- CliC : The increasing focus on mountain climate there is a common will to collaborate in some regions : ANDEX, TPE, Alps
- Difficulty to coordinate with other Core Projects as there are too many WCRP activities to monitor.
- Monsoon Panel (MP):
  - We encourage the MP to interact more with GEWEX panels : GASS, GHP, GLASS (?)
  - Some RHPs are relevant to the MP and are on the panel (ANDEX, AsiaPEX)
  - Model inter-comparison could be an action to raise the visibility of the MP.

Partnerships with entities outside of WCRP

- **WWRP** : Regular exchanges on prediction of water resources in a changing climate :
  - Strong links of our two modelling panels with WGNE.
  - Active collaboration with the InPRHA initiative on flood forecasting.
- **WMO Hydrology** :
  - GEWEX can help the NHS to adapt their water resource management to climate change.
  - Collaboration on the annual state of the global water resources. This would require to operationalize the GSWP effort of GLASS.
  - Evaporation could be a common focus area as it is one of the main challenge for NHSs in a warming climate.

Suggestions, issues or challenges

- We would like to see more co-construction with the JSC.
- There should be regular meetings between CP-chairs and JSC chairs.
  - On the other hand WCRP activities already takes-up a significant part of the working week for co-chairs !
- The LHAs should be collaboration tools for the CPs :
  - “Digital Earths” plays that role for our collaboration with ESMO.
  - “Explaining and Predicting” also offers a number of collaboration opportunities but no concrete plans yet.
  - “My Climate Risk” has chosen another dynamic. Thus coordination is only possible at the hub level.
  - “Safe Landing” should interact with GEWEX for water resource projections.
  - "Global Precipitation EXperiment" has a close interaction with GEWEX, and links to other CPs.

Thank You

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World Climate Research Programme

www.wcrp-climate.org

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