WCRP CORDEX

14-18 OCTOBER 2019 BEIJING, CHINA

ICRC-CORDEX 2019

International Conference On Regional Climate

http://www.mrjules.net/workshops/

WORKSHOPS

D-Sessions

D-Sessions – Workshop oriented sessions

- D1: Third Pole Environment: high resolution simulation/reanalysis and its implication/application

- D2: The Regional Climate Model Evaluation System (RCMES): A systematic evaluation of CORDEX simulations using satellite observations (obs4MIPs)

- D3: Regional responses to global warmings of 1.5 and 2°C

- D4: Urban environment and regional climate change

- D5: Introduction and application of ESGF in CORDEX-EA domain

- D6: Hybrid downscaling methods: How can CORDEX benefit from statistical approaches?

- D7: Climate Services developments in the frame of CORDEX and their transferability

- D8: Coordinated Training Programs for CORDEX

D1: Third Pole Environment high resolution simulation/reanalysis & its implication/application

- New CORDEX FPS in response to the call of the TPE was approved by CORDEX on 17 October, 2019 (PI: Deliang Chen from Sweden): 21 Partners from Austria, China, India, Japan, Nepal, Norway, Pakistan, Spain, UK, US.

- TPE has identified high resolution climate modeling over the Tibetan Plateau as a priority area.

- Non-Cumulus Parameterization experiment captures better the diurnal cycle of precipitation frequency.

- MSKF experiments better reproduced the diurnal cycle of precipitation intensity

- Kilometer-scale models enable enhanced process understanding in often poorly observed mountain regions.

- High resolution topography helps to understand the moisture transport process to TP.

- There is a lack of knowledge about connection between organized convection between synoptic background condition and surface features.

- Need additional parameters from the regional analysis to get clear relationship between meso scale convective system and extreme precipitation.

- Small scale forcing captures the dryness-wetness contrast between northwest and southwest TP.

- Nearly 2km high resolution simulations produce better result compare to 10km and 30km resolutions.

Session D2: Training Session on Regional Climate Model Evaluation System (RCMES)

- Jet Propulsion Laboratory's Regional Climate Model Evaluation System (RCMES) has been used in several hands-on training to evaluate RCM simulations for various CORDEX domains.

- The primary objectives of Session D2 are

    1. to facilitate systematic evaluations of CORDEX RCMs forced by ERA-Interim reanalysis against a suite of satellite observations. How many evaluation studies presented this week were about exotic variables other than temperature and precipitation?

    2. to introduce NASA's statistically downscaled CMIP5 simulations (NEX-GDDP) that are available on Amazon Cloud

RCMES running on Amazon Web Service (Amazon Cloud)

1. Use a web browser to connect to your Jupyter Notebook server

2. Choose one of the 10 CORDEX domains

3. Run the Notebook script.

4. A model evaluation report will be generated. You can download the plots and netCDF files and use your script for further analysis.
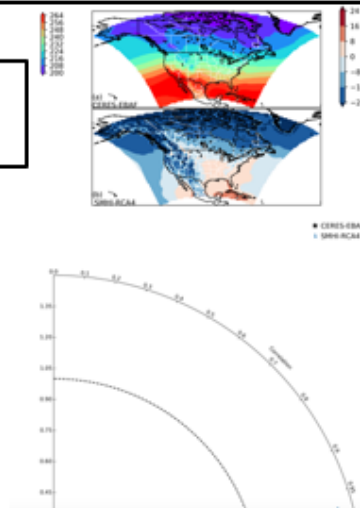
- We set up 55 Linux servers for the session participants, as 53 selected our session during registration.
- With 9 participants, we had very interactive and productive session.
- Conference venue's WIFI connection was the worst.

RCMES Training Feedback From Participants

- Overall, feedback for the training was very positive.

- In general, attendees found the presentations and model evaluation results easy to understand.

- Notebook interface proved to be convenient for users due to no special requirements for installing the software.

- The RCMES team has to ensure reliable internet access and reasonable connection speed to Amazon Cloud prior to any future hands-on training.

D3: Regional responses to global warmings of 1.5 and 2°C

- Using multi-model (CMIP5, HAPPI, CESM-low warming etc.) and multi-methods (Dynamic/statistical downscaling, machine learning etc.) to identify the responsive hotspots, precipitation under 1.5°C and 2 °C warming. Results show that the highly impacted areas of increasing extreme temperature are different with extreme precipitation.

- Using EURO-CORDEX's simulation, find that in Europe there exist a strong relationship with the large-scale circulation and its internal variability as given by the choice of GCMs and regional processes have a strong impact on the simulated climate change. RCMs also can alter the results leading either to attenuation or amplification of the climate change signal in the underlying GCMs.

- Applying the ONI index and modified Cai index to investigate the characteristics of the inter-decadal variation of the atmosphere-ocean interaction, results show a slight decrease of extreme El Niño events and a slight increase of extreme La Niña events under global warming; and during strong El Niño, the anomalous Consecutive Dry Days (CDD) can be more than 50% compared to normal years.

- Except for the various regional projection results, the examination can be explored by self-organizing map method. The overall intensification of rainfall over Yangtze-Huaihe river basin in the late 21st century can be linked to the raise of extreme wet pattern with westward Subtropical High and eastward South Asia High and the reduction of extreme dry pattern with far-away Subtropical High and South Asia High.

D3: Regional responses to global warmings of 1.5 and 2°C

- The highly impacted areas of increasing extreme temperature are different from those impacted by extreme precipitation.

- In Europe there exists a strong relationship with the large-scale circulation (GCMs). RCMs also can either to attenuate or amplify the climate change signal.

- Results (from GCMs?) show a slight decrease of extreme El Niño events and a slight increase of extreme La Niña events under global warming

- Intensification of rainfall over Yangtze-Huaihe river basin in the late 21st century can be linked to an increase in the extreme wet pattern with westward Subtropical High and eastward South Asia High

D4: Urban environment and regional climate change

Session purpose

- to gather members of the CORDEX community interested in discussing and exploring a common approach to include the urban effects within the CORDEX simulations and framework

- to gather and communicate the knowledge and expertise already achieved in the studies of urban effects in high resolution regional climate simulations

- to discuss the urban effects

- to propose and discuss way forward – **CORDEX FPS**

Summary, Outcomes – FPS on urbanization

- As cities are becoming one of the most vulnerable environments under climate change, increasing effort dedicated to these aspects is becoming highly relevant to the CORDEX community, and to enhance the discussion on climate change interaction with urban environment within the wider CORDEX community in a more coordinated fashion is necessary, especially when aiming higher resolution in up-to-date CORDEX simulations

- A clear option, consistent with CORDEX structure, is **to develop an FPS on urbanization**, which is expected going across the CORDEX domains considering a few selected big cities (even megacities) in interested CORDEX domains.

- This could be seen to be supported by – and contributing to –

  – Special IPCC Assessment Report planned for cities after AR6,

  – WCRP Grand Challenges – Weather and Climate Extremes – on local scale, and

  – SDG (Sustainable Development Goal) on sustainable cities (#11), climate action (#13) and health (#3)

Basics of foreseen FPS on urbanization and regional climate change

Scientific aims:

- To enlighten on the interactions of cities and climate change
- To better understand the urban environment vulnerability in changing world as well as its effects on climate change impact in the cities

Specific tasks:

- Overview of the urban effects incorporation in high resolution regional climate models used in CORDEX and possible options for that
- Analysis of results available (EuroCORDEX 0.11, CORDEX-CORE 0.22, CP simulations within FPS Convection, EUCP CP simulations, …)

  · Phase 1

- Coordinated (CP) experiments with urbanization for selected cities
- Sensitivity experiments for different options and settings

  · Phase 2*

- Coupling to CTM
- Climate services for health effects, city management and planning, etc.

  · Phase 3*

Interested? Contact tomas.halenka@mff.cuni.cz

* Not necessarily so strictly separated – on-line vs. off-line coupling, etc.

# D5: Introduction and Application of ESGF in CORDEX-East Asia Domain

Session summary

In late 2018, an ESGF data node for CORDEX-East Asia (EA) domain was established at the APEC Climate Center (APCC) in Korea. In D5 session, the overall system and infrastructure of the ESGF data node was introduced, and how to generate metadata and distribute CORDEX-EA data through the ESGF node at the APCC was explained. In addition, application researches using CORDEX-EA data from ESGF were presented, which included analysis of future changes in high impact weather and climate and impact studies of regional climate change on hydrology and eco-system.

Conveners

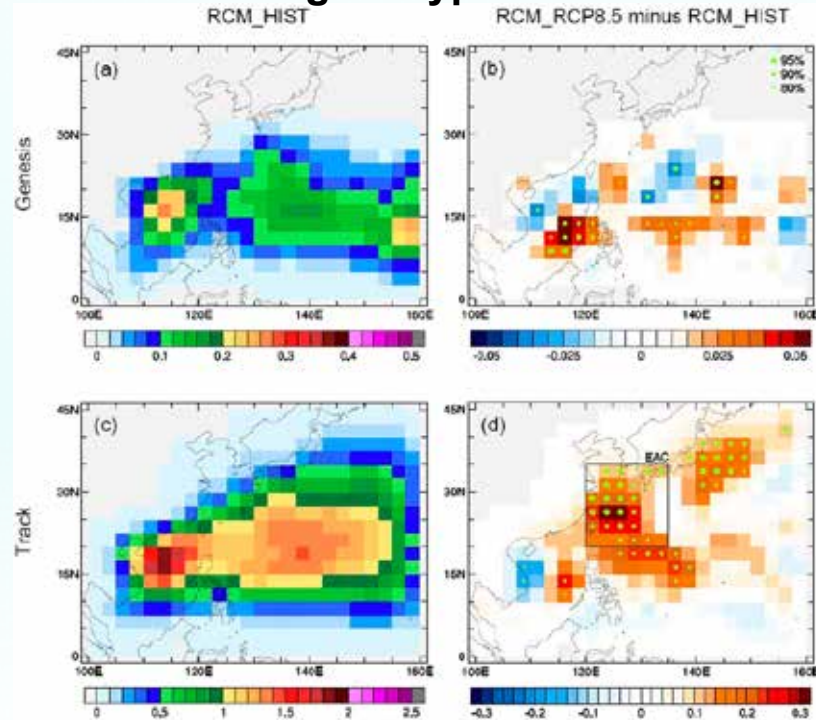Dong-Hyun Cha, Young-Hwa Byun, and Jeougmin Han

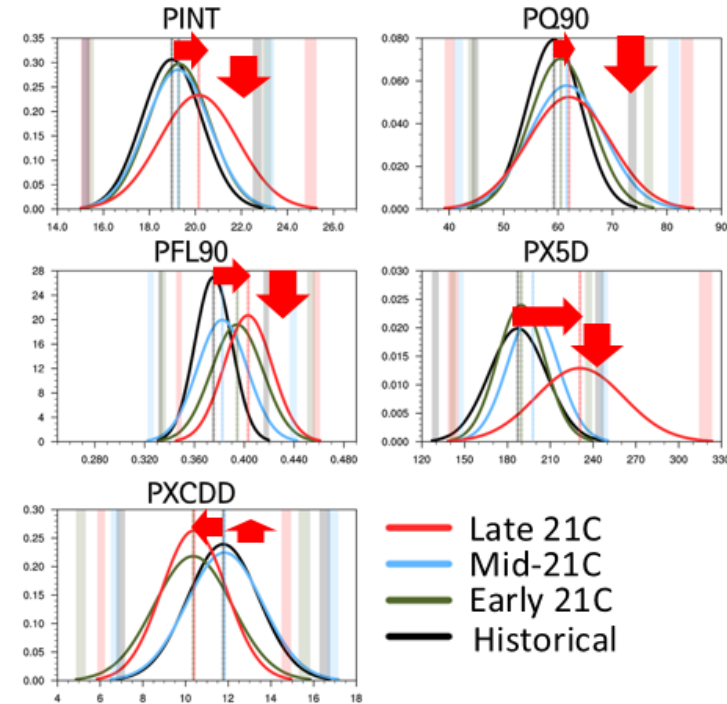# Introduction of APCC ESGF in CORDEX-East Asia Domain
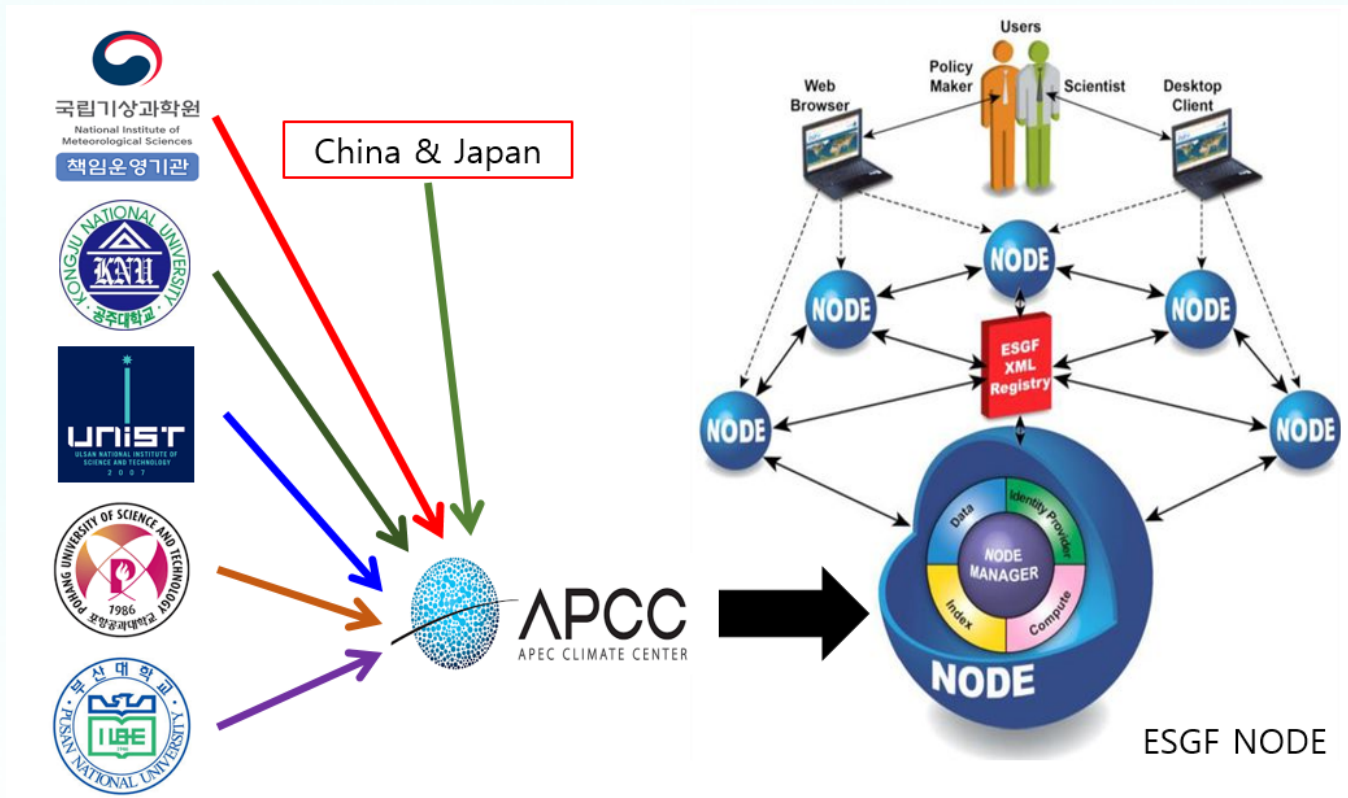
Recently, APCC established ESGF Node for CORDEX-EA data. CORDEX-EA data are now being collected and transferred to APCC ESGF Node (D5-1, D5-2, & D5-3).

Application of CORDEX-East Asia Data

Future change in typhoon activities

PDF changes of extreme precipitation Indices

There have been a number of studies on future projection of regional climate change using CORDEX-East Asia Data, One of examples is the estimation of increasing high-impact weather and climate events such as heavy rainfall (D5-4) and typhoon (D5-5).

D6: Hybrid downscaling methods: How can CORDEX benefit from statistical approaches?

1. Can we validate and expand RCM results to cover the full multi-model ensemble of GCMs using ESD and hybrid methods?

2. Can we use ESD to study how the physical connections are captured? E.g. Non-convective vs. Convective RCMs?

3. Can we build a consistent framework to be used in the CORDEX FPS protocol?

Outcomes

2.   Yes, this is complementary to #1. This can help build process-based emulators and is also a potential avenue for Machine Learning applications.

1. Yes, but there are still challenges:

    1. Employ intermediate complexity models (large ensembles!) with enhanced statistics, e.g. ICAR https://github.com/NCAR/icar.

    2. Hybrid approaches (e.g. Sun et al., 2016 http://journals.ametsoc.org/doi/10.1175/JCLI-D-14-00197.1) but challenge is to go down to higher spatial and temporal resolutions and include more fine scale features.

3.   The FPS Protocol should elevate these approaches in the CORDEX consciousness, aspire to transferability and transparency/traceability.

D7: Climate Services developments in the frame of CORDEX and their transferability

- In this session, the dialogue on climate services in connection with CORDEX and its related communities is stimulated.
- Aims of the session:
  - assess whether CORDEX activities, climate service needs and expectations can be matched
  - highlight the developments of climate services
  - explore their potential transferability (especially between sectors and CORDEX regions).
- Topics of the session:
  - Best practises on how CORDEX products were recently used for climate service purposes
  - Existing collaborations on co-development of climate services with relevant stakeholders and policymakers
  - How can CORDEX be further integrated in climate service developments?

D7: Climate Services – Main Outcomes

1. To advance climate services the participants (devided into two groups) developed two different ideas:

- Providing access to climate scenario data, observations and "train the trainer" (local trainers trusted by local people).

- Invest in basic research to develop km-scale regional climate models via process understanding and field campaigns.

2. Across different countries, CORDEX data was used to help develop the Nationally Determined Contributions (NDCs) documents, an example of CORDEX enabling the transition of research outputs to policy makers. (Stephanie Gleixner)

3. Various forms of Climate Services provided in specific regions are planned to be transferred to other regions (e.g., in the EPICC and AFTER projects) using CORDEX simulations as resources.

4. Copernicus Data Store (CDS) and Toolbox aims at being a single point of entry for climate data. (Andras Horanyi)

D7: Climate Services – Workshop team

Which regions do you analyze?

D8 - CORDEX Training summary slide

1. Common approach/structure in running workshops that could be transferable across CORDEX domains

2. Four types of workshops should be considered:
   - Training on theory and execution of regional climate models
   - Data analysis (including software training, e.g RCMES, ESMvalTool; python, CDO, NCO, etc)
   - Paper writing
   - Training on basic understanding of climate data/information

3. Coordinated repository of presentations, analysis software, scripts, documentation (also assists with helping people who could not attend workshops)

4. Funding for workshop always a problem
   - SAT and regional POCs to identify potential funders
   - Support from WCRP?