Session D-3: The challenges and opportunities of taking research activities into operational mode

# APCC's Legacy and Future: Advancing from Seasonal Expertise to Annual-to-Decadal Operational Excellence

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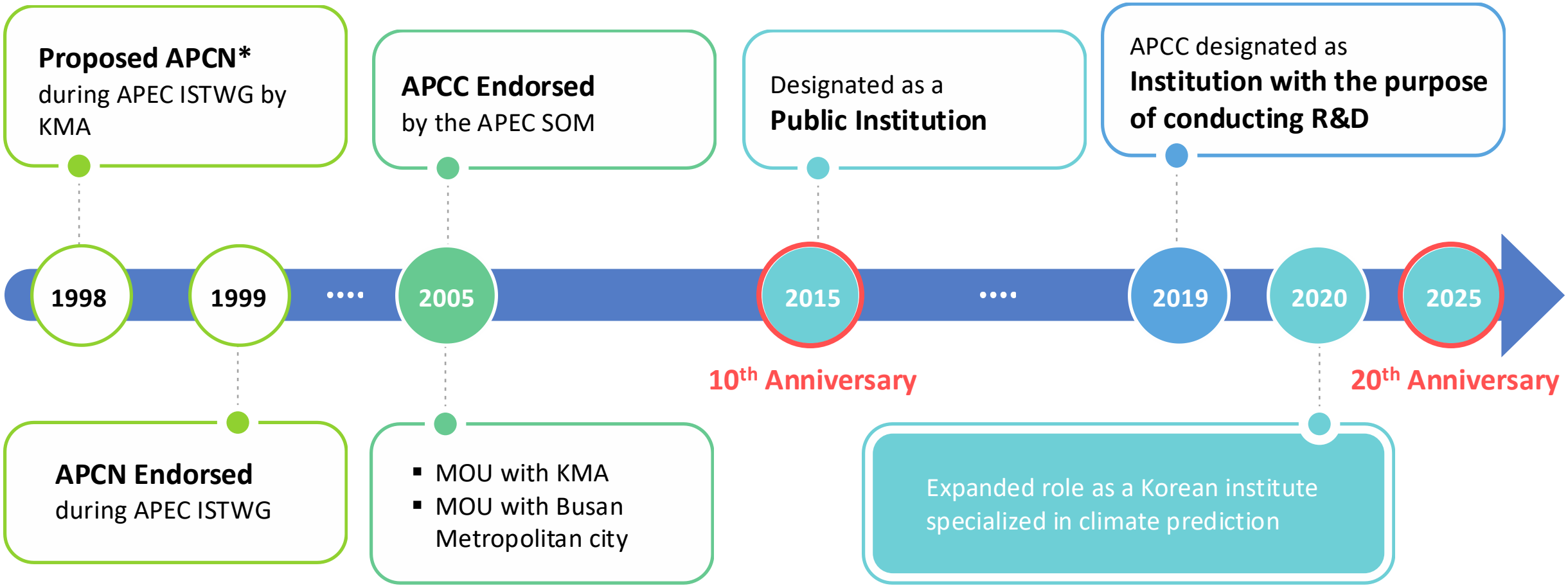
# About US: APCC History

Hub for Climate Prediction Information Services in the APEC region

***APCN** APEC Climate Network

A regional network to improve the monitoring and prediction of the development of extreme climate and to share climate prediction information in the APEC region. Predecessor to APCC.

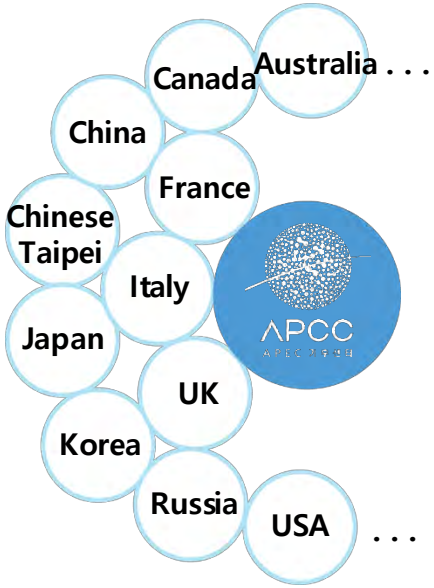


# A Legacy of Trust:

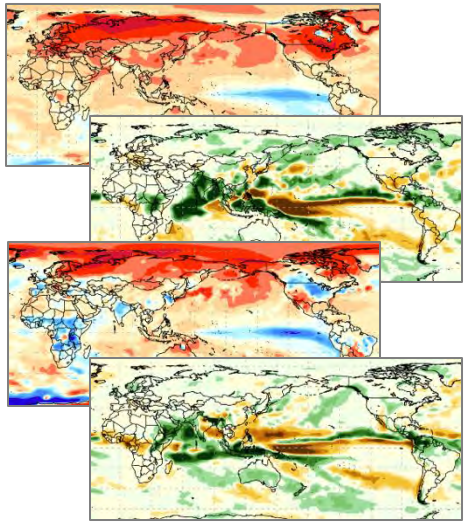


## APCC's enduring **operational excellence**

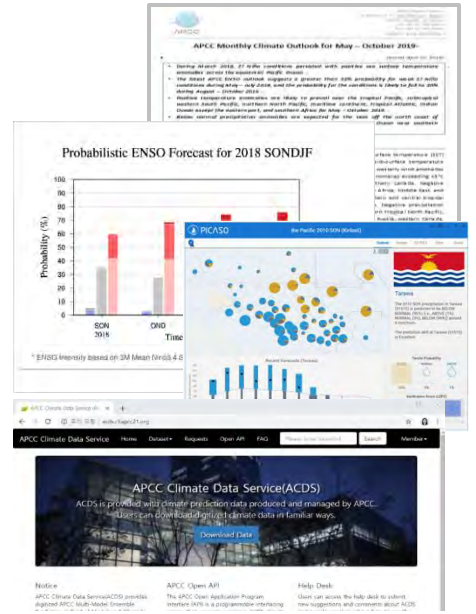
**APEC Climate Center (APCC)** provides seasonal climate forecasts and other climate information products and services, conduct research and development activities, and organize capacity building initiatives for scientists from developing economies.




Collecting prediction data from 15 institutes in 11 economies



Analysis and assessment of model data and developing optimal results
(1~6 month prediction)



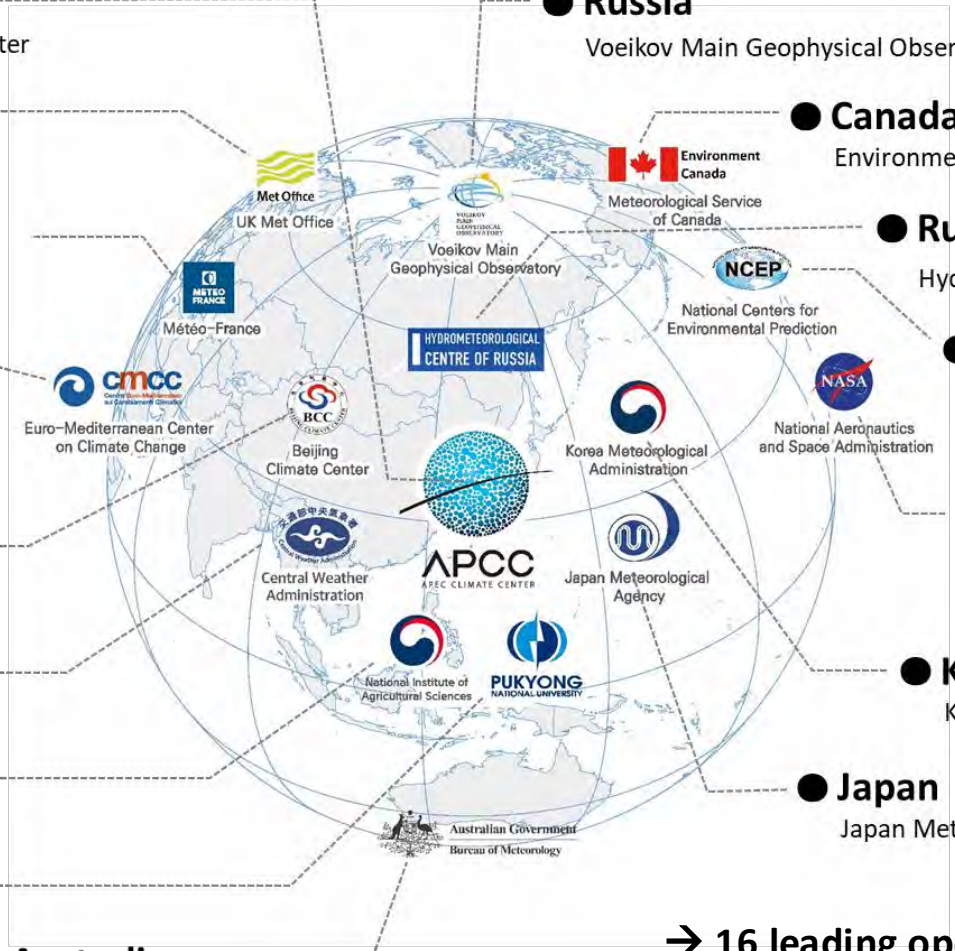

Online prediction information and data service
(700 recipients every month)

# A Legacy of Trust:

Hub for Climate Prediction Information Services in the APEC region

## APCC's enduring **operational excellence**

- **Korea**
  APEC Climate Center
- **Russia**
  Voeikov Main Geophysical Observatory
- **United Kingdom**
  UK Met Office
- **Canada**
  Environment and Climate Change Canada
- **France / New Caledonia**
  Météo-France
- **Russia**
  Hydrometeorological Centre of Russia
- **Europe / Italy**
  Euro-Mediterranean Center on Climate Change
- **United States**
  National Centers for Environmental Prediction
- **China**
  Beijing Climate Center
- **United States**
  National Aeronautics and Space Administration
- **Chinese Taipei**
  Central Weather Administration
- **Korea**
  Korea Meteorological Administration
- **Korea**
  National Institute of Agricultural Sciences
- **Japan**
  Japan Meteorological Agency
- **Korea**
  Pukyong National University
- **Australia**
  Bureau of Meteorology

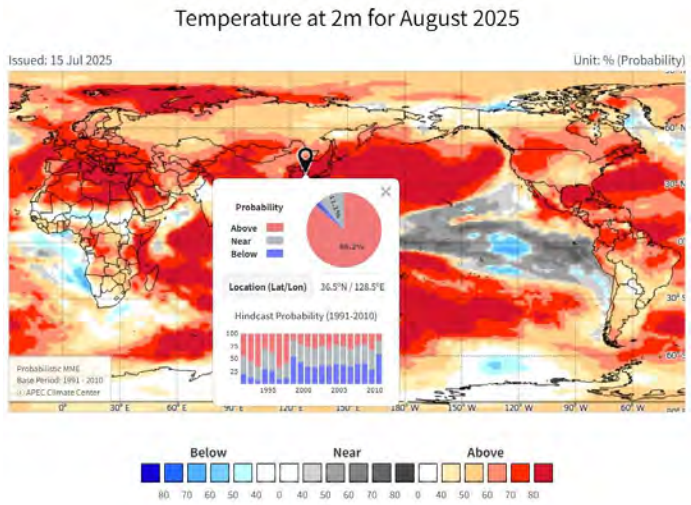


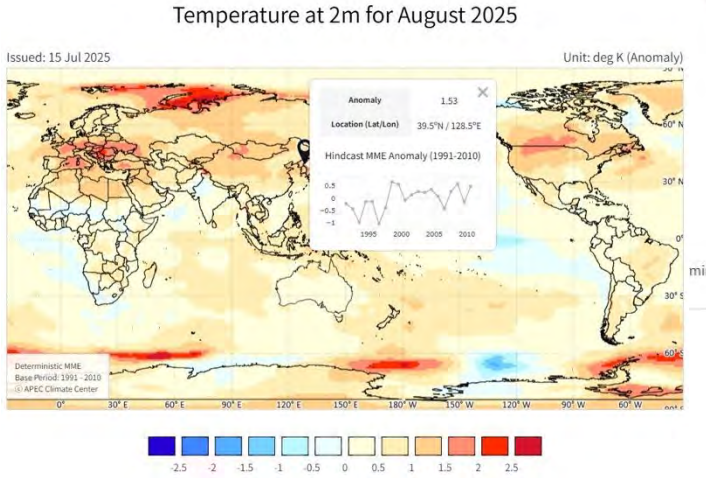

→ **16 leading operational and research centers (11 countries)**

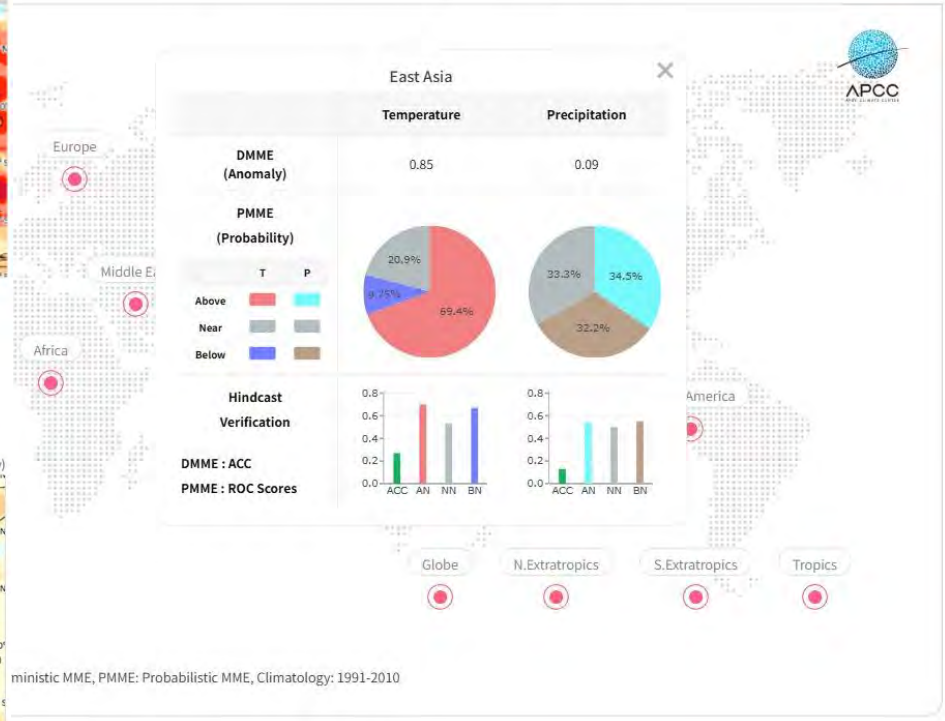
# A Legacy of Trust:

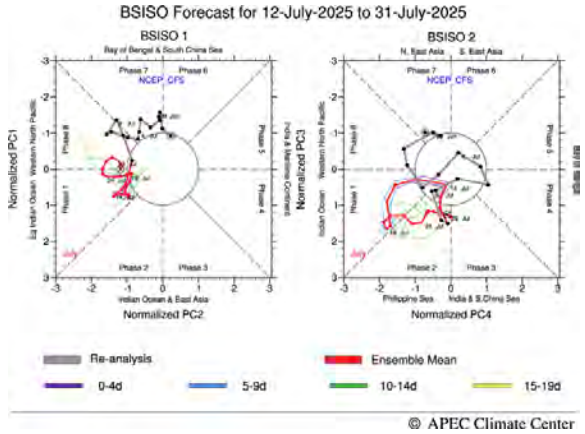
Hub for Climate Prediction Information Services in the APEC region

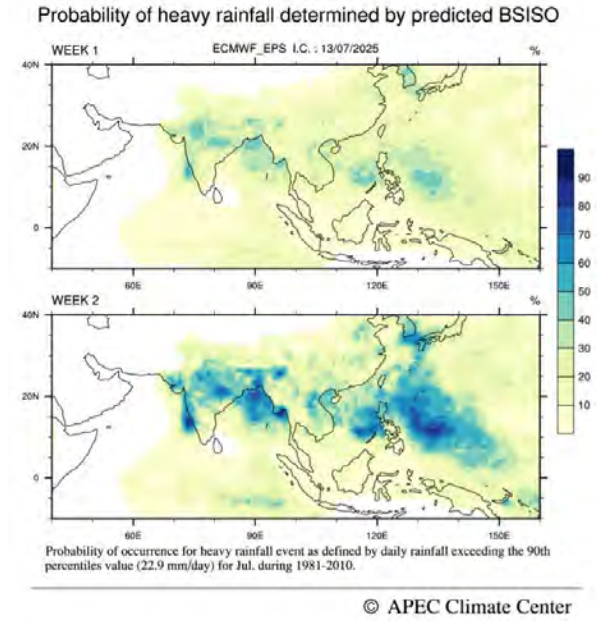
- MME-based seasonal climate forecast information for 1-6 months every month
- MME-based subseasonal forecast information every week from May to October



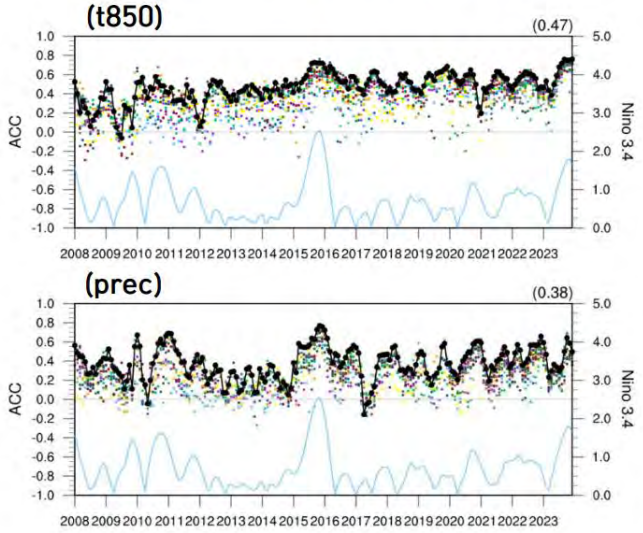



# A Legacy of Trust:

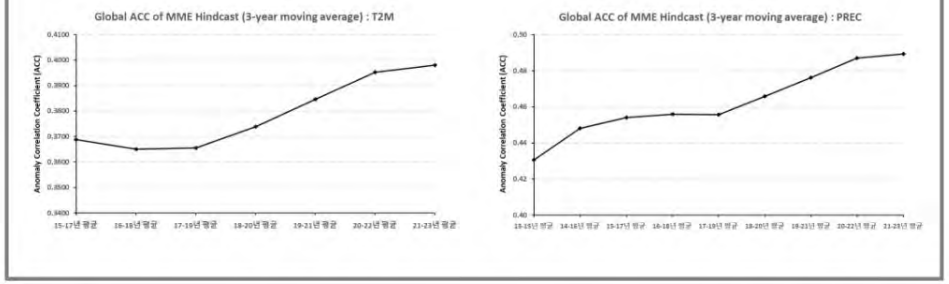


- Continuous improved predictability through **improvement of the participating models** and **diversification of the models** from independent groups

<Forecast: DMME (ACC)>



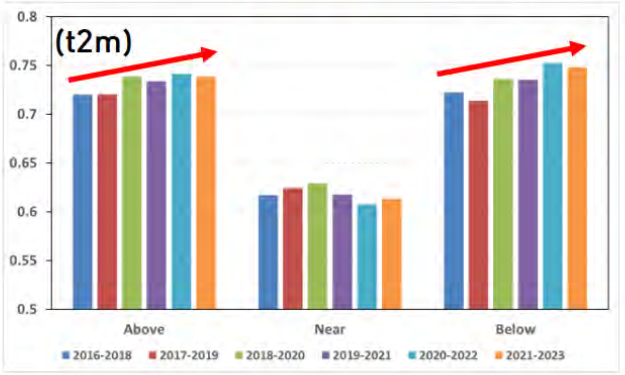

<Hindcast: DMME (ACC)>

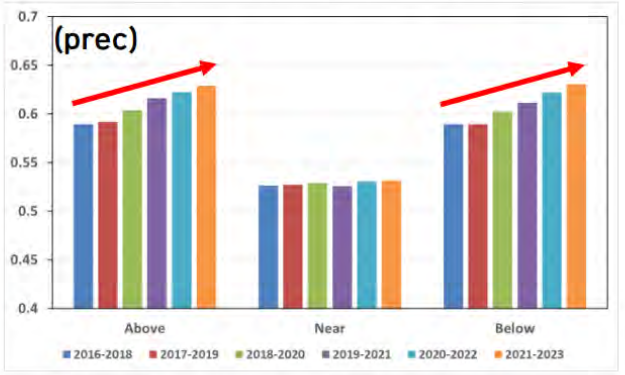



* Relative Operational Characteristics

<Forecast: PMME (ROC)>

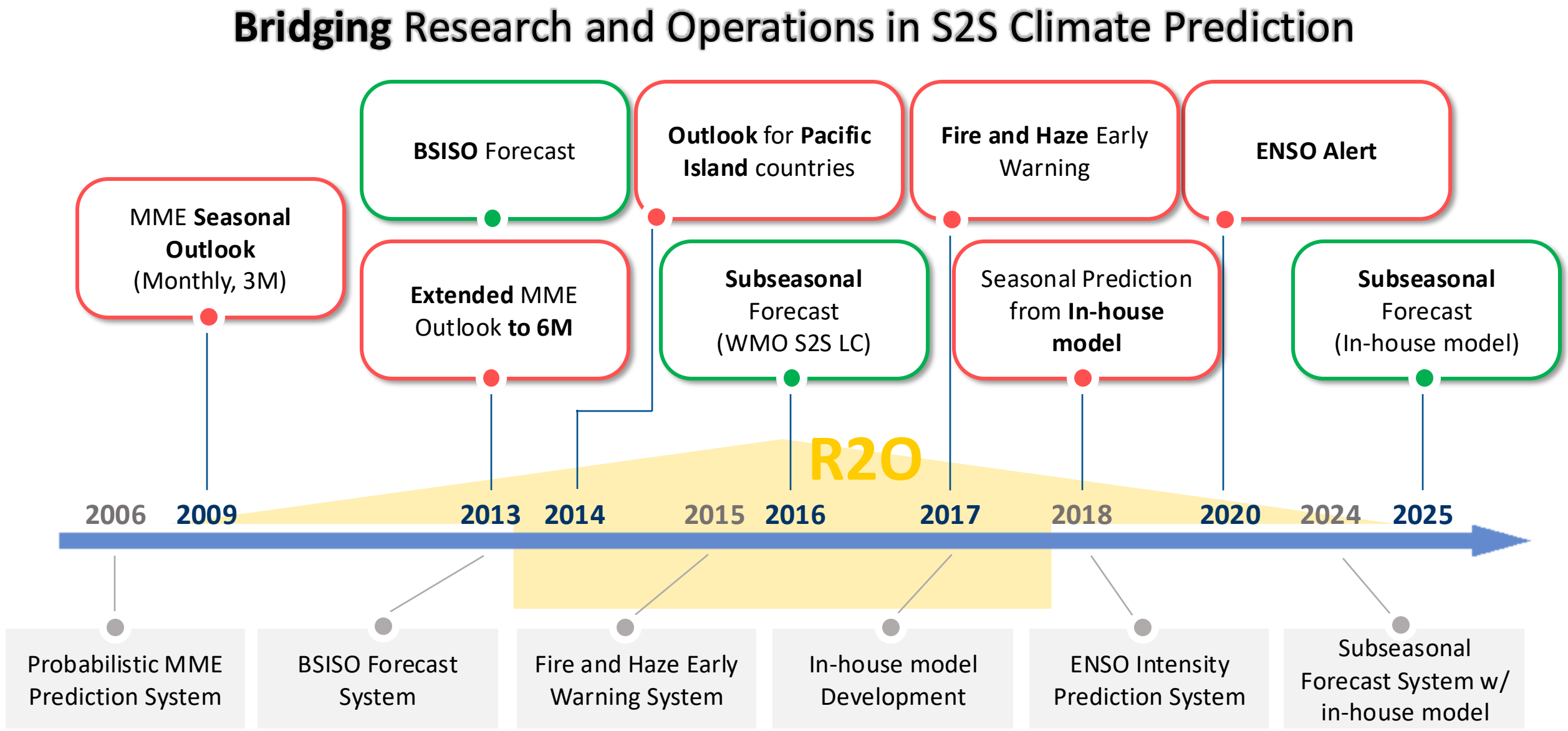
| 2021JFM~ 2023DJF | | APCC | WMO | ECMWF | NCEP | UKMO | JMA | KMA |
|---|---|---|---|---|---|---|---|---|
| Prec. | AN | **0.629** | 0.628 | 0.616 | 0.621 | 0.603 | 0.623 | 0.598 |
| | NN | **0.531** | 0.533 | 0.533 | 0.521 | 0.532 | 0.532 | 0.527 |
| | BN | **0.631** | 0.629 | 0.613 | 0.620 | 0.604 | 0.621 | 0.602 |
| T2M | AN | **0.738** | 0.734 | 0.716 | 0.683 | 0.711 | 0.713 | 0.705 |
| | NN | **0.613** | 0.612 | 0.603 | 0.579 | 0.595 | 0.590 | 0.596 |
| | BN | **0.748** | 0.743 | 0.712 | 0.676 | 0.700 | 0.712 | 0.683 |



# Our 20-year Journey:

Hub for Climate Prediction Information Services in the APEC region



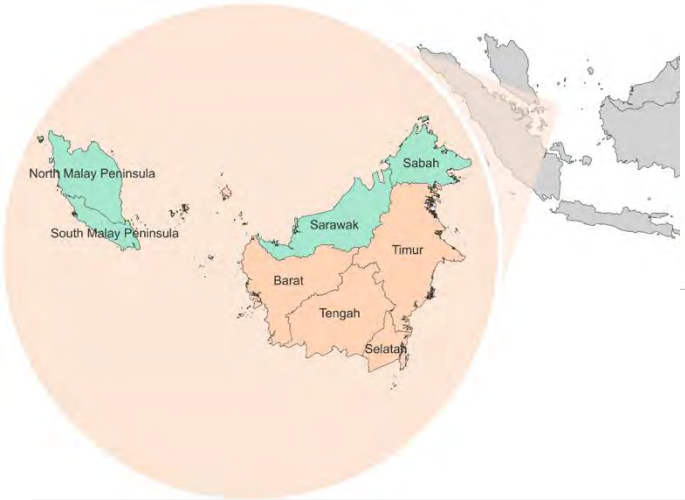
# Beyond Forecasts:

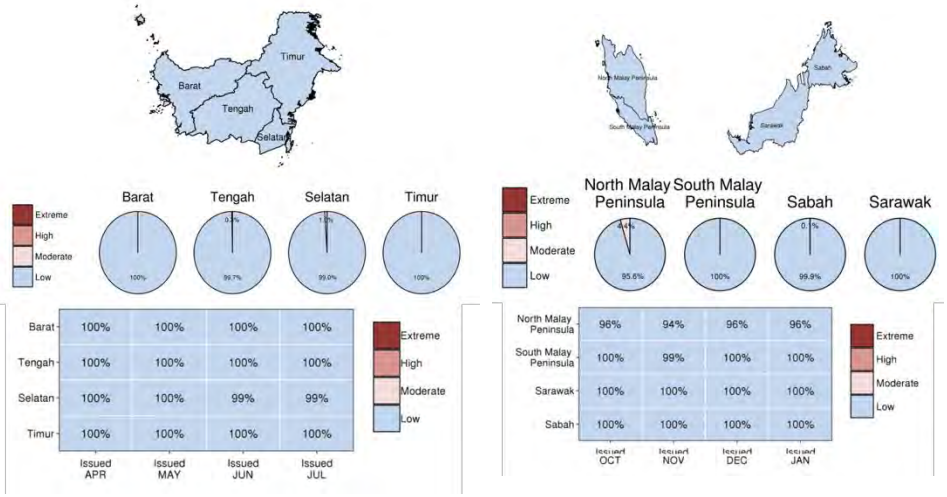


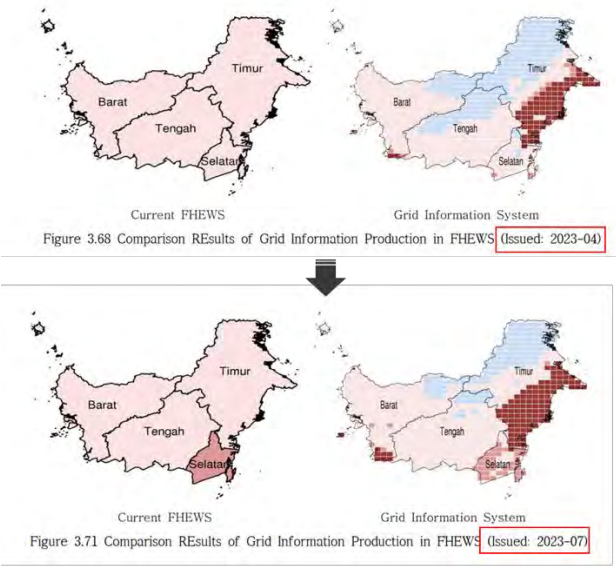
## **Broadening** APCC's Operational Value

**FHEWS : Fire and Haze Early Warning System**

Strengthening and diversifying operational products to support sector-specific decision-making




- FHEWS for Borneo Island from April to July targeting ASO season
- Expanded service to Malaysia (from October to next January targeting FMA season)

- Probabilistic forest fire forecast based on precipitation and CO2 emission

- More elaborated grid-based forecast prediction

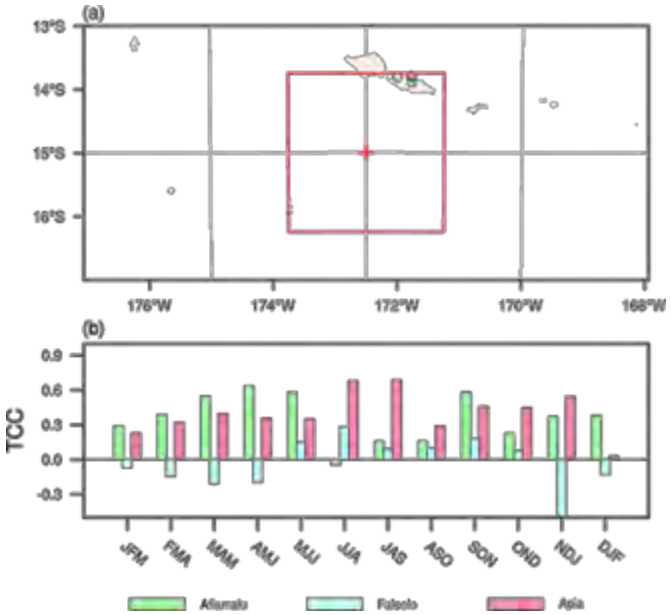
# Beyond Forecasts:

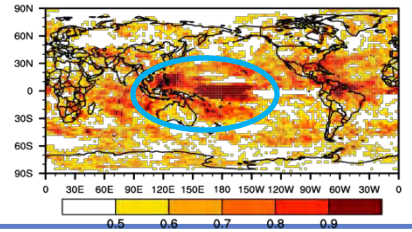
Hub for Climate Prediction Information Services in the APEC region

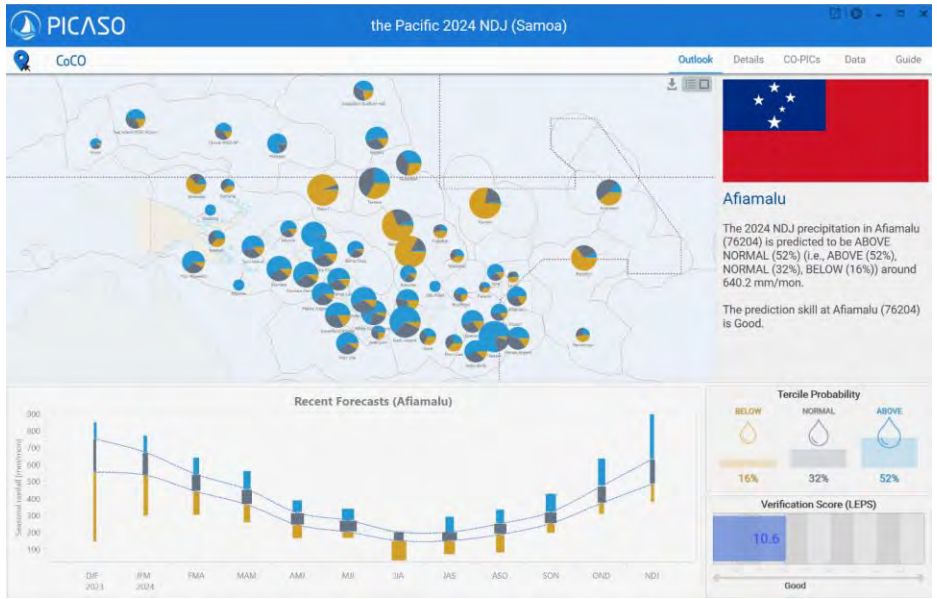
## **Broadening** APCC's Operational Value

**PICASO : Pacific Island Countries Advanced Seasonal Outlook**

Distilling global multi model predictions to support the most vulnerable countries to coup with climate fluctuations




- Localizing large scale predictions
- Easy to use


- Sector applications (on-going)
- Capacity building
- Early warning alerts (mobile app.)

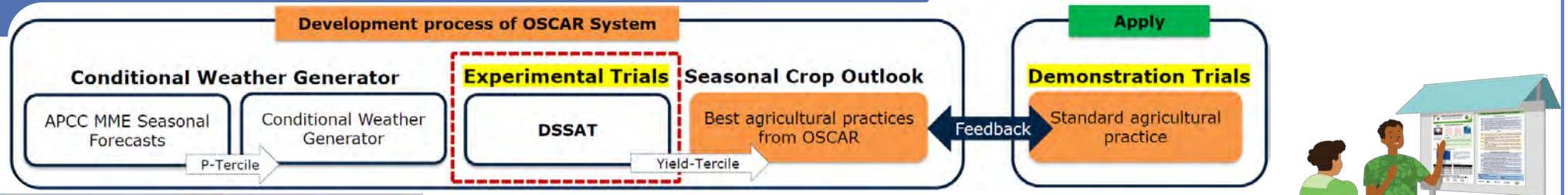
# Beyond Forecasts:

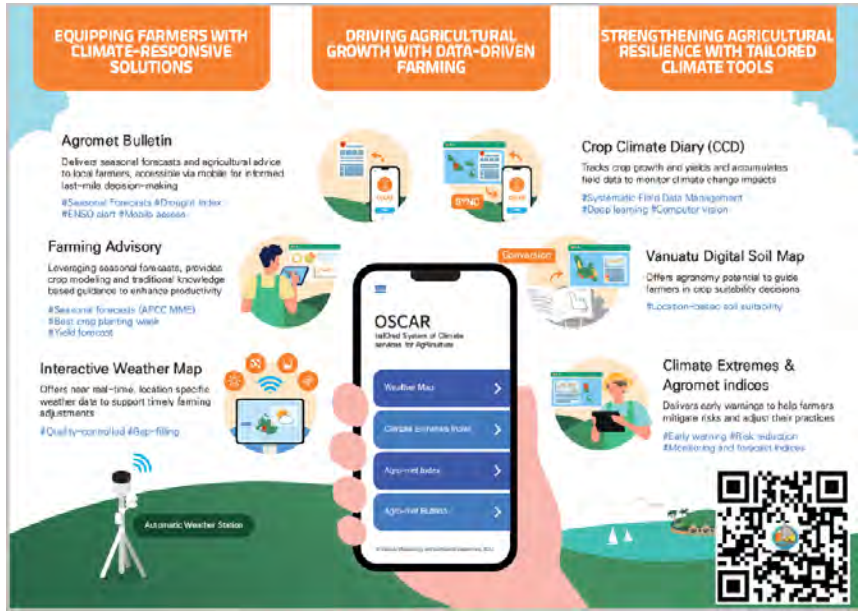
Hub for Climate Prediction Information Services in the APEC region

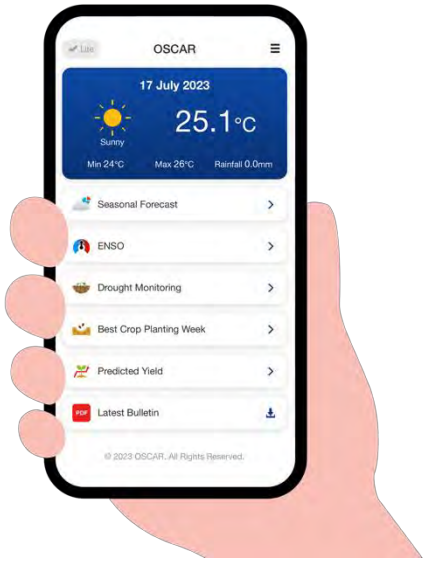
## Broadening APCC's Operational Value

**OSCAR : tailOred System for Climate services for AgRicultur**

Enhancing Agricultural Resilience in Vanuatu through Climate Information Services




- OSCAR : Agro-meteorological platform providing localized and actionable climate and crop information
- Tools underpinned by:
  - ✓ Calibration of staple crops like taro and cassava.
  - ✓ Seasonal forecasts from APCC (APEC Climate Center).
  - ✓ Visualization and access interfaces designed for end-users at local levels.
- Farmers gained enhanced ability to optimize crop yields and manage climate-related risks.

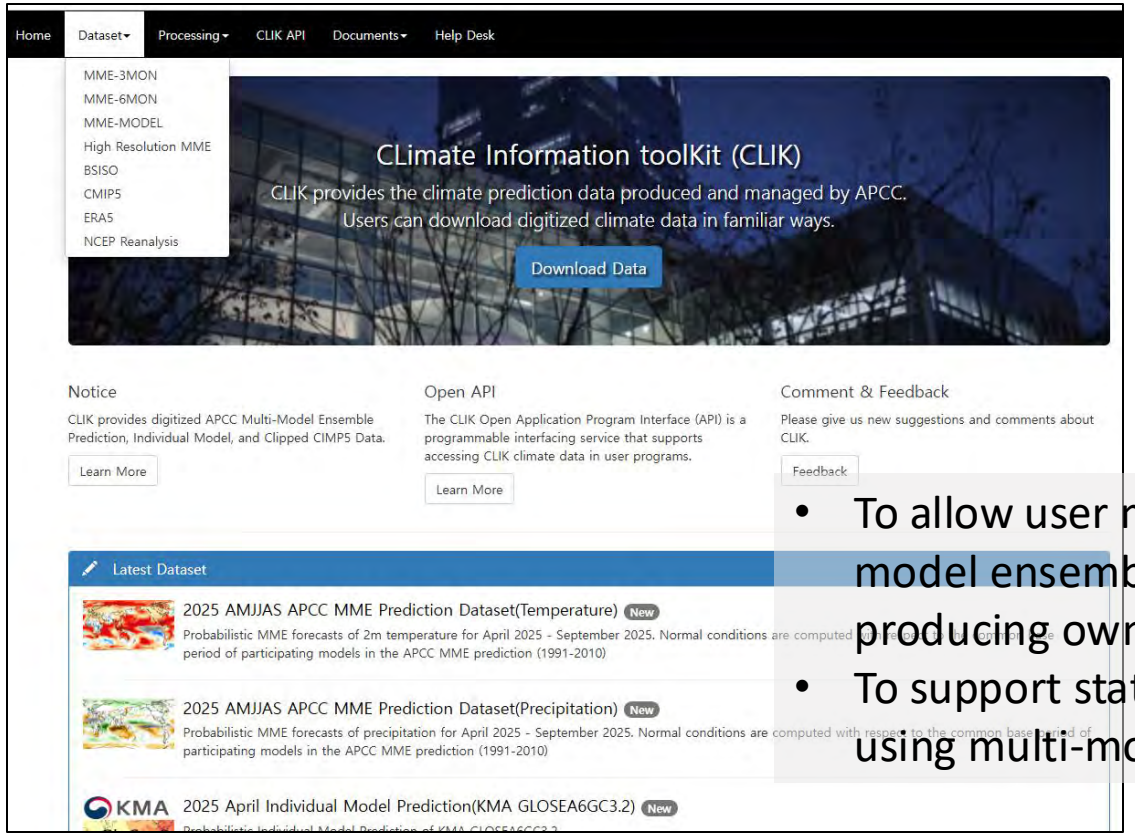
# Beyond Forecasts:

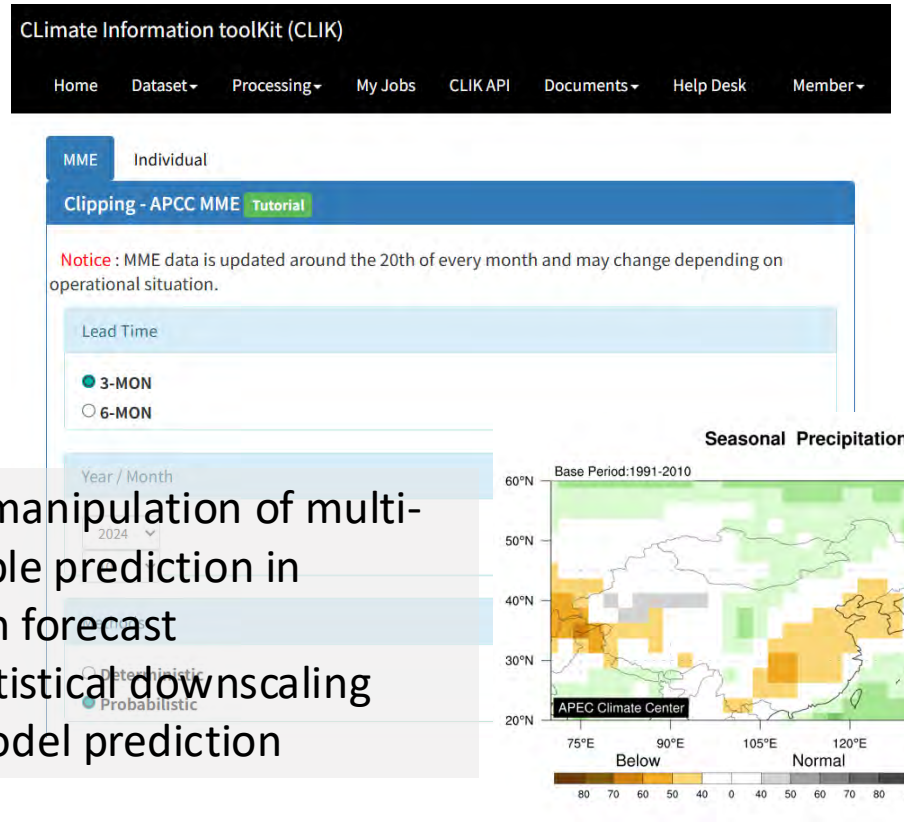


## **Broadening** APCC's Operational Value

**CLIK : CLimate Information toolkit** (cliks.apcc21.org)

Advancing platforms and systems that deliver data conveniently and facilitate broad user engagement




- To allow user manipulation of multi-model ensemble prediction in producing own forecast
- To support statistical downscaling using multi-model prediction

# Strengthening Our Core:

Hub for Climate Prediction Information Services in the APEC region

## **Proven Capabilities** in S2S Research and Operations

*20 Years of Reliable S2S Climate Service*

### 1. Two Decades of Operational Excellence

Delivering trusted seasonal and subseasonal forecasts through advanced multi-model systems and continuous improvement.

### 2. Strong Global Collaboration Network

Partnering with 15+ leading centers in 11 countries to secure diverse data, expertise, and regional value.

### 3. Seamless Research-to-Operation Pipeline

Successfully transforming research outputs (e.g., BSISO, ENSO alerts, in-house models) into operational services.

### 4. Proven Sector Applications

Expanding impact through tailored services like fire and haze early warnings, regionals tools (PICASO) and agriculture (OSCAR).

### 5. User-Centered Information Systems

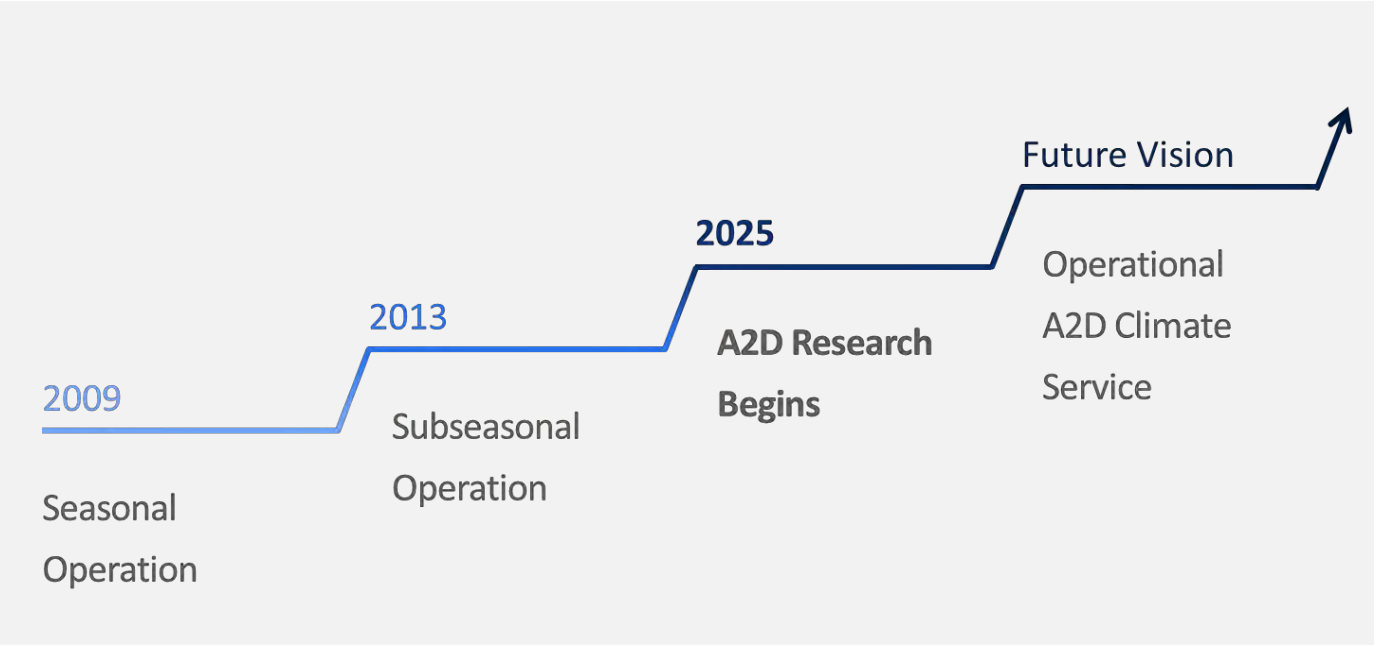
Providing accessible, flexible platforms (e.g., CLIK) that empower users to apply high-quality climate information.

# Toward the Future:



## **Advancing** APCC's Reach to the A2D Scale

*Extending our proven S2S expertise to deliver actionable climate insights on annual-to-decadal timescales*




- **Leverage proven S2S Strengths:**
  Apply operational experience, infrastructure, and stakeholder trust to the A2D domain
- **Advance Predictive Science:**
  Develop robust annual-to-decadal models, bridging climate variability and predictability gaps.
- **Co-Create with Stakeholders:**
  Engage regional and global partners to ensure A2D outputs meet real-world needs.
- **Enhance Data and Delivery:**
  Expand data archives, strengthen sharing platforms, and design tailored A2D information services

**From seasons to decades** – empowering communities, sectors and policymakers with longer-range climate foresight.

# A First Step Forward:



## **Research Framework** for A2D prediction in the Asia-Pacific region

Spring Drought

Winter Cold Wave


Summer Heatwave & Heavy Rain

**(Quantitative)**

- Near-future extreme climate prediction in the Asia-Pacific region
- Decadal model bias correction and model sub-sampling
- Deterministic and probabilistic prediction

**(Qualitative)**

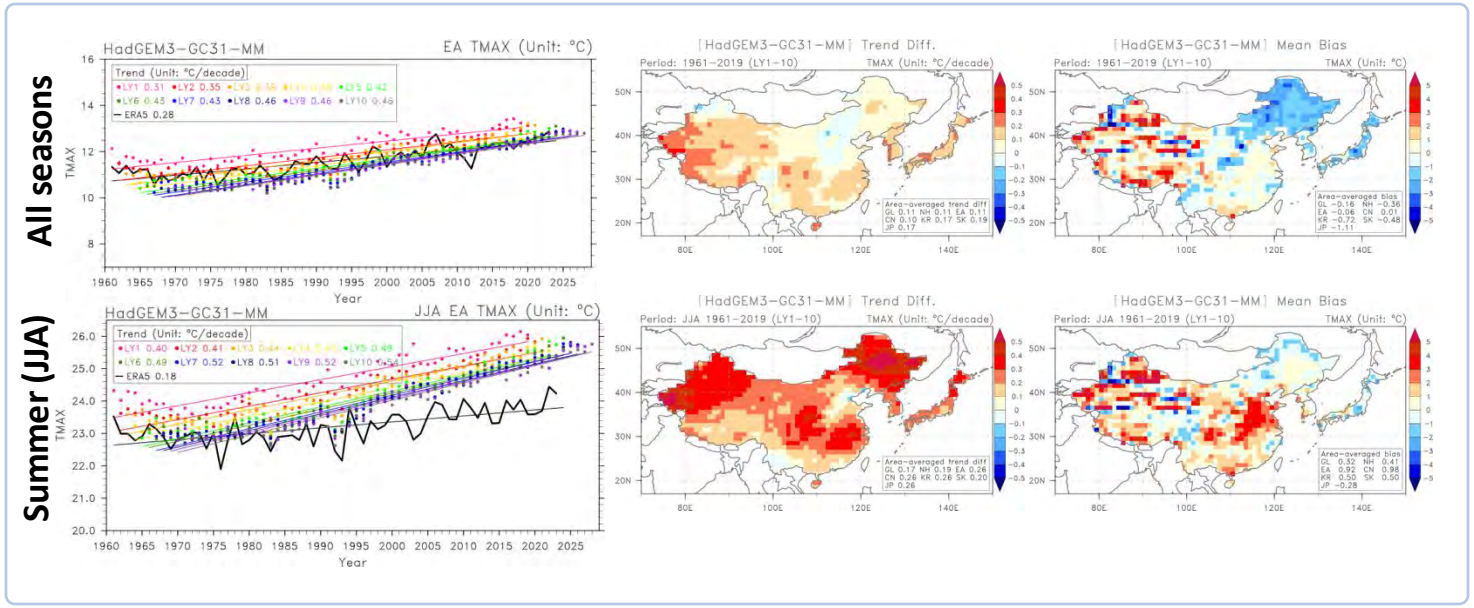
- Explainable near-future extreme climate prediction
- Relationship between key drivers related to extreme climate

# A First Step Forward:

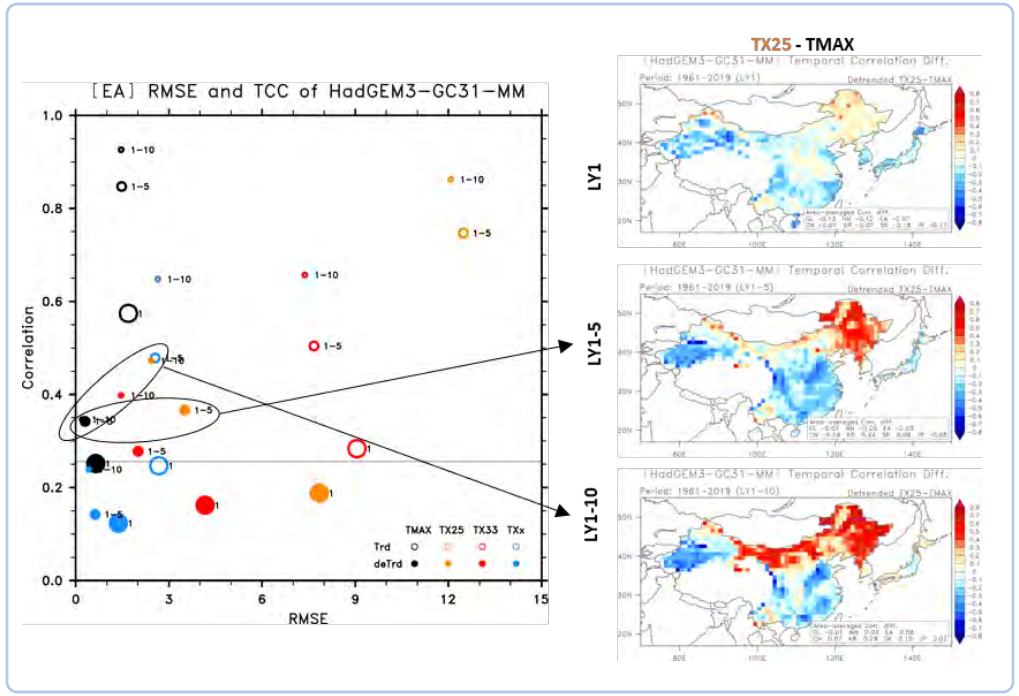


## **Pioneering** A2D high-temperature prediction in the Asia-Pacific region

Performance of DePreSys hindcast on temperature extremes in East Asia




The trend and model bias of East Asian summer maximum temperature are greater than in other seasons.



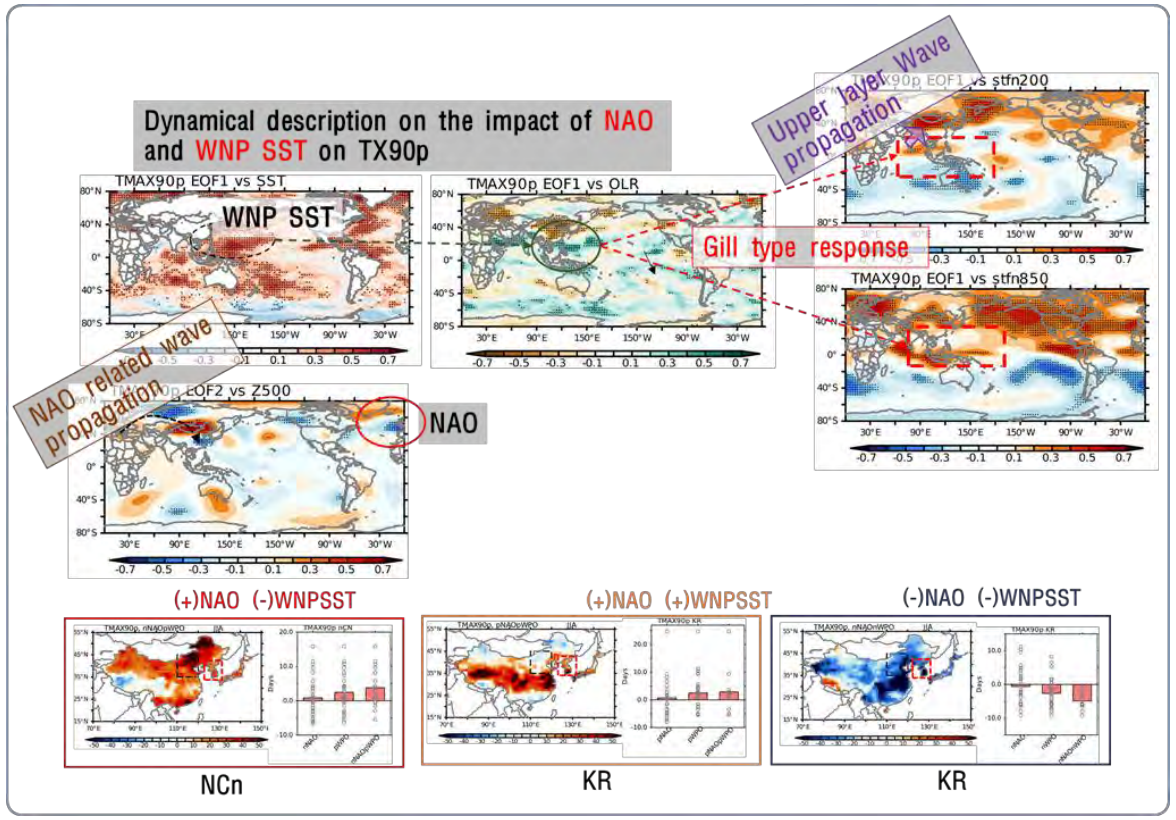

Temperature extremes show higher skills than maximum temperature itself at longer lead times.

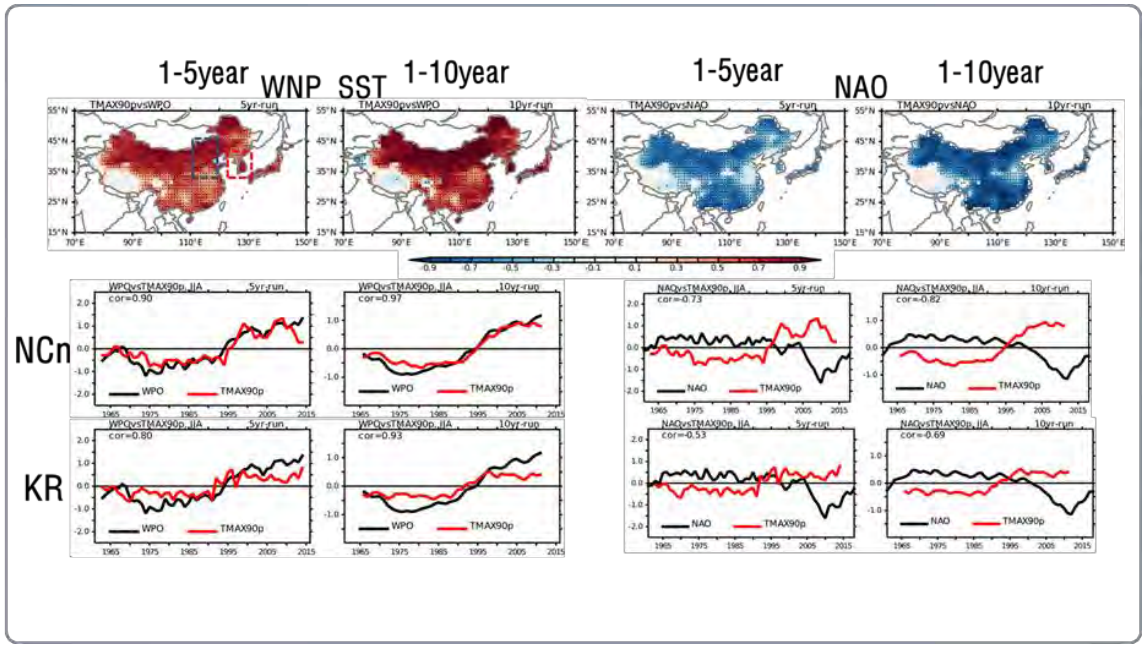
# A First Step Forward:



## **Pioneering** A2D high-temperature prediction in the Asia-Pacific region

Finding Predictors on interannual time scale → Extending to the decadal time scale



Thank you for your attention.