

# TRAVEL REPORT FORM

## 출장보고서

|        |           |       |       |       |
|--------|-----------|-------|-------|-------|
| 결<br>재 | 선임연구<br>원 | 과장    | 부서장   | 원장    |
|        | 10/18     | 10/18 | 10/21 | 10/21 |
| 협<br>조 | 이현록       | 민영미   | 유진호   | 권원태   |
|        |           |       |       |       |

### I. Travel Overview 출장개요

#### 1. Traveler(s) 출장자

| Department 소속 | Position 직위(직급) | Name 성명 | Note 비고 |
|---------------|-----------------|---------|---------|
| 예측운영과         | 선임연구원           | 이현록     |         |

#### 2. Travel Period 출장기간

2019. 09. 29 ~ 2019. 10. 03

#### 3. Occasion and destination 행사 및 출장지

APEC Resilience Week, 타이페이, 대만

### II. Major Activities 주요업무 수행내용

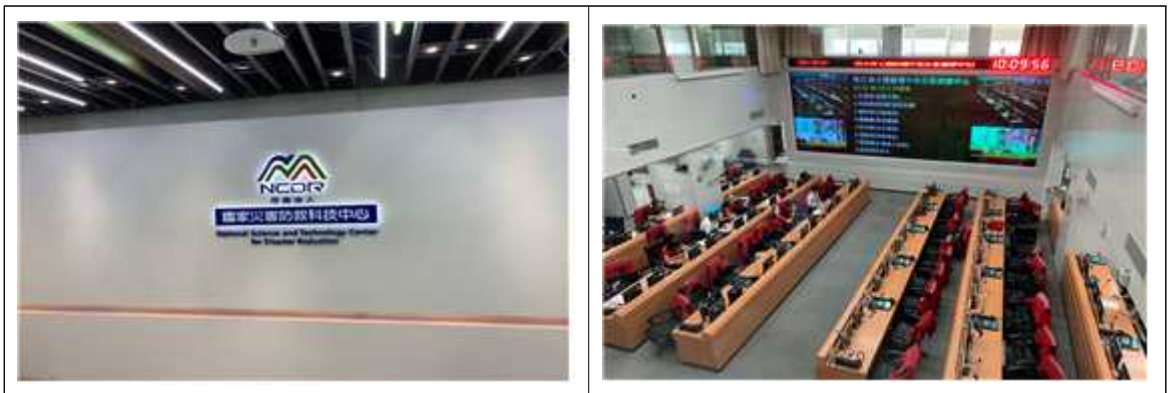
#### 1. Main Contents and Activities 주요내용 및 활동

- APEC 긴급대응역량개발센터(EPCC, APEC Emergency Preparedness Capacity Building)에서 주관하여 개최한 APEC Resilience Week에 초청되어 발표 **[상세 행사 프로그램 붙임 1. 참조]**
- 행사 2일차 Best Practices 세션에서 “Towards Better Climate Information Services (*Lessons learned from climate information services for regional user*)”라는 제목으로 30분 발표 및 질의응답 진행 **[발표자료 붙임 2. 참조]**
  - APEC 기후센터 및 센터 핵심활동을 1) Climate Model Data, 2) Climate Prediction, 3) Application & Localization, 4) Climate Information Service 5) Conclusion 순으로 발표
    - 1) Climate Model Data: APCC에서 예측을 수행하기 위한 기후모델자료 수집 및 처리
    - 2) Climate Prediction: APCC에서 생산하는 다중모델앙상블기반 계절예측 및 BSISO예측
    - 3) Application & Localization: APCC 기후예측의 응용분야 및 지역특화
    - 4) Climate Information Service:
      - APCC 홈페이지 서비스 중 South East Asia - Fire and Haze Early Warning System 소개 및 교훈 공유
      - APCC 대표 기후정보서비스인 CLIK 소개 및 지역화 우수사례로 SPREP에서 운영 중인 CLIK for the Pacific과 PICASO 소개
      - APCC와 ASEAN 산하기구인 AHA Centre와 공동개발하고 운영 중인 ASEAN Science based Disaster Management Platform(ASDMP) 소개 및 교훈 공유



## 2. Relevance to APEC Climate Center's Activities 결론 및 소감

- WMO에서 정의하고 있는 기후서비스가 ‘사용자 요구 중심의 맞춤형 기후 정보 제공’이라는 관점에서 APCC가 지역별 사용자에게 맞춤형으로 개발 혹은 대상기관과 공동으로 개발한 기후서비스들을 중심으로 소개하고 해당 서비스 개발 및 운영단계에서 얻은 교훈을 공유하여 발전적 방향을 제시하는 방향의 발표였음. 또한, 해당 발표를 통해 기후자료관리, 기후예측기술, 활용 및 현지화, 기후정보서비스에 이르기까지 APCC 연구 및 개발 우수성을 알림과 동시에 훈련 및 교육, 기술이전 등 APCC가 제공하는 지원 프로그램의 우수성을 알림.
- 특히 발표에 대하여 ASEAN 지역의 Indonesia 국가 재난 관리 기관인 BNPB(Badan Nasional Penanggulangan Bencana)의 공무원들은 ASDMP 및 SEA Fire and Haze 서비스에 대하여 많은 관심을 보였으며, 향후 관리적인 문제에 대한 해결방안에 대한 질의응답이 있었음
- ASEAN 사업 종료로 해당 ASDMP의 모든 자산(하드웨어, 소프트웨어)에 대한 소유권 및 기술에 대한 이전을 수행하였지만 개도국에 대해서는 지속적인 코칭이 필요한 것을 느낌. 이는 운영 및 관리의 권한을 모두 이전해 주었지만 비상상황에 대비한 서버를 마련하고 지속적으로 지원을 해주고 있는 SPREP의 CLIK 및 PICASO에서는 발생하지 않는 문제점임. 예산적인 문제 등의 어려움이 해결되면 ASEAN쪽에서 진행했던 과제를 다시 돌아볼 수 있는 기회가 있었으면 함
- 그 외 발표 중에서는 미국 Pacific Disaster Center(PDC)에서 발표한 활용사례가 인상 깊었으며, 향후 APCC가 PDC 정보와 결합을 통해 부가가치를 높일 수 있는 방안이 없을지 고민할 필요가 있음을 느낌. 해당 발표자인 Ms. Victoria Leat와 PDC의 제공정보 및 Tool들에 대한 설명 등 티타임과 식사시간 등을 통해 논의.
- 행사 마지막 날 이루어진 EPCC 방문을 통해 대만의 재난대응의 현장을 생생히 느낄 수 있었음. 때마침 태풍 미탁이 행사기간 중 통과하였고, 대만 북동부 어촌 난팡가오(南方澳)에서 아치형 다리가 무너진 큰 사고가 발생하여 그에 대한 생생한 대응상황 설명을 들을 수 있었음.



- 이번 출장을 통해 주요 참석 대상인 APEC 멤버국가들에게 APCC의 역량, 모범사례 및 교훈들에 대하여 공유함으로써 APCC 인지도 향상에 많은 기여를 하였다 판단되며, 특히 교훈들의 공유를 통해 향후 나아갈 방향을 모색한 것이 향후 APCC가 해외에서 사업 재추진 환경이 마련되었을

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경우 큰 자산이 될 것으로 판단됨

### 3. Suggestions and Remarks 건의사항

- 매우 급박한 초청 및 수락으로 인한 발표자료 준비의 어려움. 향후 초청 수락에는 발표준비에 대한 시간적인 여유 다소 필요

### III. References (Presented and Collected Materials) 주요 수집자료

(with attachment of any information or report in case of attendance of conferences, workshops and meetings) 학술대회, 워크숍, 회의 등 참석 시 관련 정보 및 문서 첨부

- 해당 행사의 전체적인 정보 사이트, <http://www.apecrw2019.com>



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**The APEC Resilience Week**  
**September 30 – October 2, 2019**  
**Taipei Garden Hotel, Taipei**

**Agenda**

**September 30, 2019**

**08:30 – 09:00 Registration**

**09:00 - 09:10 Agenda Item 1: Welcome Remarks by Host Economy**

- Dar-Bin Shieh, Deputy Minister, Ministry of Science and Technology (Chinese Taipei)

**09:10 - 09:15 Group Photo**

**09:15 - 09:25 Agenda Item 2: Keynote speech (1) Current Disasters in Peru vs Perspective on the Future Cooperative Strategies for Emergency Preparedness**

- Jorge Luis Chavez Cresta, General, Head, National Institute of Civil Defense (INDECI) (Peru)

**09:25 - 09:30 Agenda Item 3: APEC Resilient City on APEC Resilient Community through "Plant Back Better" Initiative**

- Wei-Sen Li, EPWG Co-Chair

**09:30 - 10:05 Agenda Item 4: Keynote Speech (2) APEC Resilience and Smart Agricultural**  
- Janet K. Benini, Professor, the George Washington University (the United States)

**10:05 - 10:40 Agenda Item 5: Keynote Speech (3) Developments and programs of NRC**

- Antonia Yulo Loyzaga, President, the National Resilience Council (NRC) (the Philippines)

**10:40 – 11:00 Tea Break and Booth Exhibition**

**11:00 - 12:30 Agenda Item 6: Highlights of "Plant back better" Initiative**

- Yi-Chung Liu (Chinese Taipei)
- City of Iloilo (the Philippines)





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12.30 - 14.00 **Lunch and Booth Exhibition**

14.00 - 15.30 **Agenda Item 7: Policy Dialogue 1 – Smart Resilience**

1. Joe Wang, Director of CEO Office, Tzu Chi Foundation (Chinese Taipei)
2. Ching-Kuei Hsieh, Farmer, Co-Founder, Precious Land - Happy Farmer Project (Chinese Taipei)
3. Kelvin Art T Ofrecio, Chief of the Information and Communications Technology of the Operations Service, the Office of Civil Defense (the Philippines)
4. Sandra Camacho Otero, Technical Adviser for Latin America and The Caribbean of The Global Initiative on Disaster Risk Management (Mexico)

15.30 - 16.00 **Tea break and Booth Exhibition**

16.00 - 17.30 **Agenda Item 8: Policy Dialogue 2 – Global Value Chain and Supply Chain Resilience through Public Private Partnership**

1. Kenji Watanabe, Professor and Head, Disaster & Safety Management Division, the Nagoya Institute of Technology (Japan)
2. Takahiro Ono, Asia Disaster Research Center (Japan)
3. Ko-Hsiung Lien, Director of Research Division VIII, Taiwan Institute of Economic Research (Chinese Taipei)

18.30 - 20.30 **Welcome Reception** - Taipei Garden Hotel,





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**Room A      Capacity Building and Emergency Preparedness for Sustainable  
Development at Agricultural Communities through "Plant Back Better" (PBB)  
Initiatives**

**09.00 - 09.40    Agenda Item 9A: Panel Speech (1): APRU's Program for Capacity Building**

- Takako Izumi, Director, APRU Multi-Hazards Program (Japan)

**09.40 - 10.20    Tea Break and Booth Exhibition**

**10.20 - 12.00    Agenda Item 10A: Policy Dialogue 3A Multi-Hazard Approach for  
Collaboration**

1. Victoria Leat, Asia Program Advisor, Pacific Disaster Center (the United States)
2. Felipe Moreno, Specialist, National Early Warning Centre (Chile)
3. Misook Kim, Team Director, International Cooperation Team, National Civil  
Defense and Disaster Management Training Institute (Korea)
4. INDECI (Peru)

**12.00 - 13.30    Lunch**

**13.30 - 15.00    Agenda Item 11A: Best Practices by APEC Member Economies**

1. Torbors Chyuan, Director, the Mustard Seed Mission (Chinese Taipei)
2. (Malaysia)
3. (Viet Nam)

**15.00 - 15.30    Tea Break and Booth Exhibition**

**15.30 - 16.10    Agenda Item 12: Keynote Speech (3)**

- Kentaro Tabata, Chief Researcher, National Research Institute for Earth  
Science and Disaster Resilience (Japan)

**16.10 - 17.00    Agenda Item 13: APEC Resilience Partnership toward APEC Resilient City –  
The Road Map**

- Wei-Sen Li, EPWG Co-Chair

**17.00 - 17.10    Agenda Item 14: Closing Remarks**



October 1, 2019

**Room B      Enhancing APEC Resilience Through Science, Technology and Innovation  
for APEC Sustainable and Inclusive Growth**

**09.00 - 09.40    Agenda Item 9B: Panel Speech (2): Capacity Building for Public-Private  
Sector**

- Alexander Pama, Former Head, NDRRMC (the Philippines)

**09.40 - 10.20    Tea Break and Booth Exhibition**

**10.20 - 12.00    Agenda Item 10B: Policy Dialogue– From Science to Action for Climate  
Extremes Adaptation**

1. Wei-Sen Li, APEC Research Center for Typhoon and Society (Chinese Taipei)
2. Ben Jou, Professor, National Taiwan University (Chinese Taipei)
3. Pin-Fang Lin, Pao-Liang Chang, "An Overview of the Customized QPESUMS  
Services", Central Weather Bureau (Chinese Taipei)
4. Thelma A. Cinco, Assistant Weather Services Chief of the Climatology and  
Agrometeorology Division, PAGASA (the Philippines)

**12.00 - 13.30    Lunch**

**13.30 - 15.00    Agenda Item 11B: Best Practices – Climate Information Services for Capacity  
Building**

1. Hyunrok Lee, APEC Climate Center (Korea)
2. Eduardo Fuentes Navarro, Visiting Professor, the Departments of Economy  
of Natural Resources and the Department of Animal Science, Universidad  
Nacional Agraria La Molina (Peru)
3. Sergio Barrientos, Director, National Seismological Centre (Chile)





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09.30 - 12.00 **Agenda Item 15: Visiting EPCC and Round Table Discussion on Regional Resilience in APEC Part (1)**

- Wei-Sen Li, Executive Director, APEC Emergency Preparedness Capacity Building Center

12.00 - 14.00 **Lunch**

14.00 - 17.00 **Agenda Item 16: Round Table Discussion on Regional Resilience in APEC Part (2)**

- Wei-Sen Li, Executive Director, APEC Emergency Preparedness Capacity Building Center

**- End of the APEC Resilience Week-**



## Best Practices Session (Day 2)

# Towards Better Climate Information Services

- Lessons learned from climate information services for regional user -

October 1, 2019



**Hyunrok Lee**

Climate Service and Research Division  
APEC Climate Center (APCC), Busan, Korea

# APEC Climate Center

APCC

- **Vision and Goals**

- The APCC aims to contribute to economic growth in the APEC region and support the protection of lives and property, the reduction of economic losses, and enhance economic opportunities.

- **Mission**

- To enhance the socio-economic well-being of member economies by utilizing up-to-date scientific knowledge and applying innovative climate prediction techniques through



#### Climate Prediction

APCC produces value-added, reliable, and real-time climate prediction information and provides the APEC region with it.



#### Interdisciplinary Research

APCC leads in the development of interdisciplinary research and application techniques at the climate-environment-society nexus.



#### Climate Information Services

APCC strives to be a key climate database center to distribute climate data, information products, and related tools.

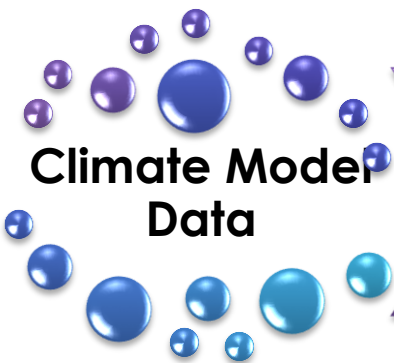


#### International Cooperation

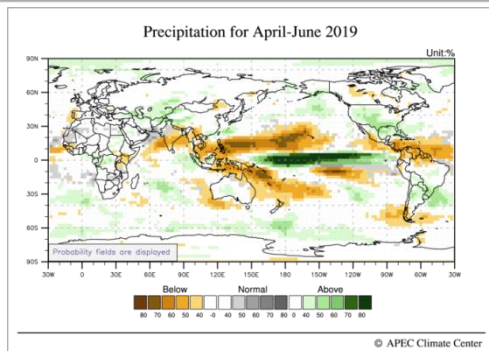
APCC guides developing countries from the APEC region toward building their own capacity to produce reliable climate prediction information.



# A sphere of APCC's activity



**Climate Model  
Data**



**Climate  
Prediction**

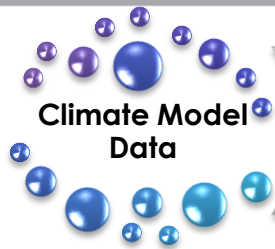
**Application  
&  
Localization**

**Climate  
Information  
Service**



# Climate Model Data

APCC



Climate Prediction

Application & Localization

Climate Information Service

$$r : \rho \left( \frac{\partial u_r}{\partial t} + u_r \frac{\partial u_r}{\partial r} + \frac{u_\theta}{r \sin(\theta)} \frac{\partial u_r}{\partial \theta} + \frac{u_\phi}{r^2 \sin^2(\theta)} \frac{\partial u_r}{\partial \phi} - \frac{u_\theta^2 + u_\phi^2}{r} \right) = -\frac{\partial p}{\partial r} + \rho g_r +$$

$$\mu \left[ \frac{1}{r^2} \frac{\partial}{\partial r} \left( r^2 \frac{\partial u_r}{\partial r} \right) + \frac{1}{r^2 \sin(\theta)} \frac{\partial^2 u_r}{\partial \theta^2} + \frac{1}{r^2 \sin(\theta)} \frac{\partial}{\partial \theta} \left( \sin(\theta) \frac{\partial u_r}{\partial \theta} \right) - 2 \frac{u_\theta}{r^2} + \frac{u_\theta \cot(\theta)}{r^2} - \frac{2}{r^2 \sin(\theta)} \frac{\partial u_\phi}{\partial \phi} \right]$$

$$\phi : \rho \left( \frac{\partial u_\theta}{\partial t} + u_r \frac{\partial u_\theta}{\partial r} + \frac{u_\theta}{r \sin(\theta)} \frac{\partial u_\theta}{\partial \theta} + \frac{u_\phi}{r \sin(\theta)} \frac{\partial u_\theta}{\partial \phi} + \frac{u_r u_\theta}{r} + \frac{u_\theta u_\phi \cot(\theta)}{r} \right) = -\frac{1}{r \sin(\theta)} \frac{\partial p}{\partial \theta} + \rho g_\theta +$$

$$\mu \left[ \frac{1}{r^2} \frac{\partial}{\partial r} \left( r^2 \frac{\partial u_\theta}{\partial r} \right) + \frac{1}{r^2 \sin(\theta)} \frac{\partial^2 u_\theta}{\partial \theta^2} + \frac{1}{r^2 \sin(\theta)} \frac{\partial}{\partial \theta} \left( \sin(\theta) \frac{\partial u_\theta}{\partial \theta} \right) - \frac{2 \sin(\theta) \frac{\partial u_r}{\partial r}}{r^2} + 2 \cos(\theta) \frac{\partial u_\phi}{\partial \phi} - u_\phi \right]$$

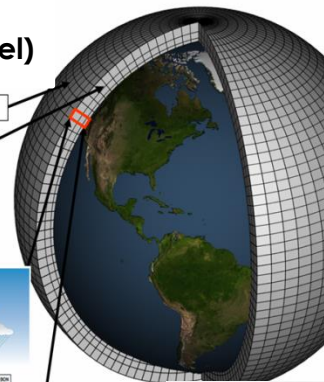
$$\theta : \rho \left( \frac{\partial u_\phi}{\partial t} + u_r \frac{\partial u_\phi}{\partial r} + \frac{u_\theta}{r \sin(\theta)} \frac{\partial u_\phi}{\partial \theta} + \frac{u_\phi}{r \sin(\theta)} \frac{\partial u_\phi}{\partial \phi} + \frac{u_r u_\phi}{r} - \frac{u_\theta^2 \cot(\theta)}{r} \right) = -\frac{1}{r \sin(\theta)} \frac{\partial p}{\partial \phi} + \rho g_\phi +$$

$$\mu \left[ \frac{1}{r^2} \frac{\partial}{\partial r} \left( r^2 \frac{\partial u_\phi}{\partial r} \right) + \frac{1}{r^2 \sin(\theta)} \frac{\partial^2 u_\phi}{\partial \theta^2} + \frac{1}{r^2 \sin(\theta)} \frac{\partial}{\partial \theta} \left( \sin(\theta) \frac{\partial u_\phi}{\partial \theta} \right) + \frac{2}{r^2} \frac{\partial u_r}{\partial r} - \frac{u_\theta + 2 \cos(\theta) \frac{\partial u_\phi}{\partial \phi}}{r^2 \sin(\theta)^2} \right]$$

Dynamics

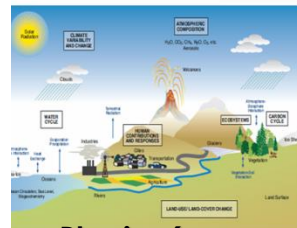
GCM  
(General Circulation Model)

Horizontal Grid (Latitude-Longitude)  
Vertical Grid (Height or Pressure)



```
z_force = z_force + dt*z_force_tend
u_g = u_g + dt*u_g_tend
v_g = v_g + dt*v_g_tend
tau_x = tau_x + dt*tau_x_tend
tau_y = tau_y + dt*tau_y_tend
tau_largescale = tau_largescale + dt*tau_largescale_tend

if ( scm_th_adv .AND. th_upstream_x(l) > 0.) then
  th_upstream_x = th_upstream_x + dt*th_upstream_x_tend
  th_upstream_y = th_upstream_y + dt*th_upstream_y_tend
endif
if ( scm_qv_adv .AND. qv_upstream_x(l) > 0.) then
  qv_upstream_x = qv_upstream_x + dt*qv_upstream_x_tend
  qv_upstream_y = qv_upstream_y + dt*qv_upstream_y_tend
endif
if ( scm ql_adv .AND. ql_upstream_x(l) > 0.) then
  ql_upstream_x = ql_upstream_x + dt*ql_upstream_x_tend
  ql_upstream_y = ql_upstream_y + dt*ql_upstream_y_tend
endif
if ( scm wind_adv .AND. u_upstream_x(l) > -900.) then
  u_upstream_x = u_upstream_x + dt*u_upstream_x_tend
  u_upstream_y = u_upstream_y + dt*u_upstream_y_tend
  v_upstream_x = v_upstream_x + dt*v_upstream_x_tend
  v_upstream_y = v_upstream_y + dt*v_upstream_y_tend
```



Physics (parameterization)

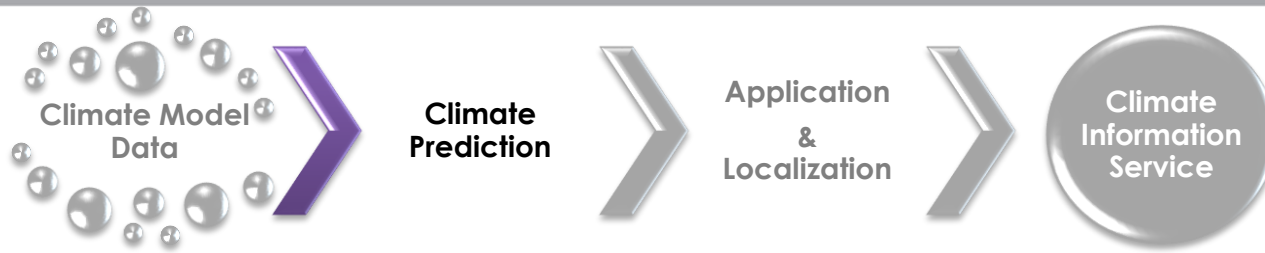


Climate prediction based on past climate data using GCM

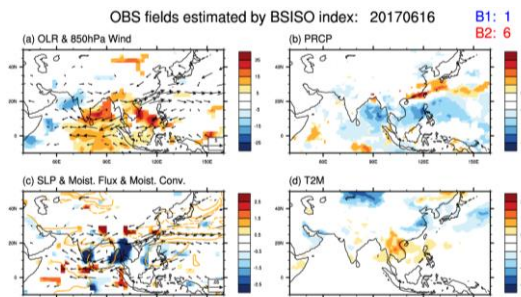
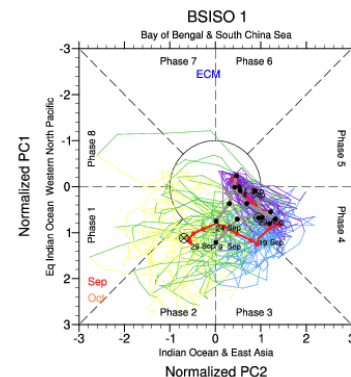
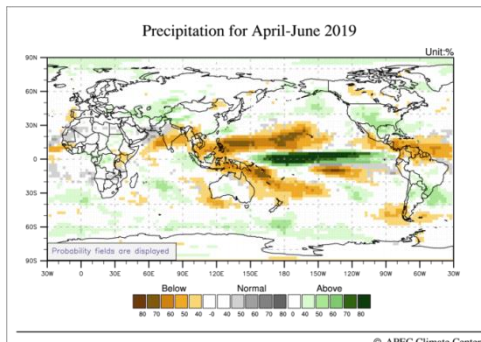
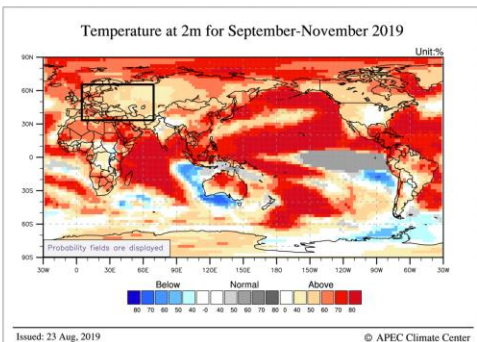


# Climate Prediction

APCC



- APCC's forecasts are **combined using the multi-model ensemble (MME)** scheme and the high quality climate forecast information is disseminated to APEC member economies and Pacific Islands through APCC's website.
- MME prediction products include:**
  - Monthly 3-month and 6-month lead climate prediction information based on multi-model ensemble system
  - BSISO Forecast: Scaling up from seasonal to intraseasonal forecasting





# Application & Localization



Climate Model  
Data

Climate  
Prediction

Application  
&  
Localization

Climate  
Information  
Service

Agriculture application  
by Dr. K.H. Kim et., al (APCC)



Food  
security &  
Agriculture

Water

Disaster  
Risk  
Reduction

Health

Climate Prediction  
Information

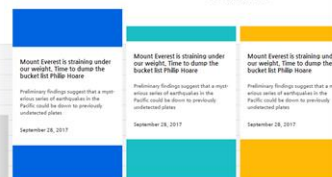
Localization

ASEAN Science-based Disaster  
Management Platform  
by (AHA Centre&APCC)

ASDMP

About ASDMP | Disaster | Documents & Publications | Exports | Community

Disaster



Document & Publication



Underground water management  
by Dr. S.K. Yoon et., al (APCC)

Real-time Monitoring

Seasonal Prediction

Groundwater  
Recharge

Groundwater  
Modeling

Groundwater  
Alert

REPORTS

Check the report data

more



LAW

A set of related laws

more



RESEARCH

Find the material you need

more



EXPORTS

A place of communication cases

more



APEC CLIMATE CENTER

# Climate Information Services@APCC



**APCC MME Prediction (Precipitation)**

**Statistical Downscaling**

**Fire rating system**

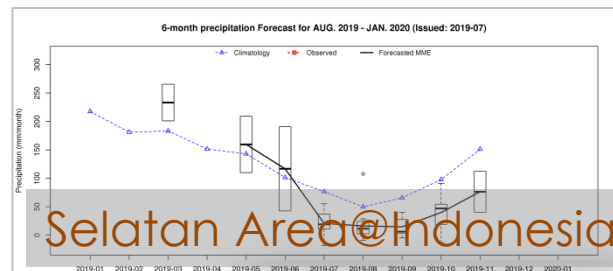
- Total ASO precipitation
- CO2 emission

**Forecast Probabilistic fire danger rating**



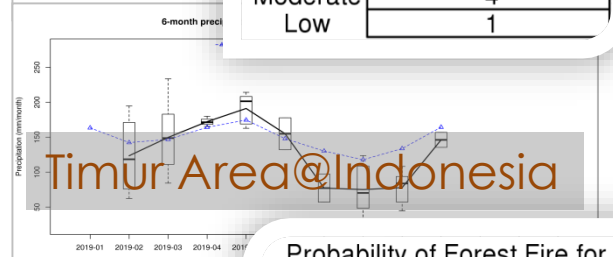
**South East Asia**  
**– Fire and Haze Early Warning System (Prototype)**

by Dr. J.P. Cho et., al APCC



**Probability of Forest Fire for 2019: Aug~Oct (%)**

|          |    |
|----------|----|
| Extreme  | 9  |
| High     | 85 |
| Moderate | 4  |
| Low      | 1  |



**Probability of Forest Fire for 2019: Aug~Oct (%)**

|          |      |
|----------|------|
| Extreme  | 0.0  |
| High     | 14.3 |
| Moderate | 84.8 |
| Low      | 0.9  |

*What's missing?*

# Climate Information Services@APCC



APCC  
AFPC CLIMATE CENTER

Research Climate Information Services International Cooperation Media Notices About us

Climate Information Service

Home > Climate Information Service > Applied Forecast > SEA Fire and Haze EWS

**SEA Fire and Haze EWS**

**Introduction**

Haze from forest fires is among Southeast Asia's most serious environmental problems. Severe forest fires in Indonesia occur only during years with anomalous low rainfall, causing severe haze in 1982, 1991, 1994, 1997 and 2006. However, measures to prevent these fires and mitigate their impacts remain limited by the absence of a long-lead early warning system (EWS). Severe burning conditions need to be forecast weeks to months in advance for any preventative actions to be effective. This indicates the clear need for a fire and haze EWS.

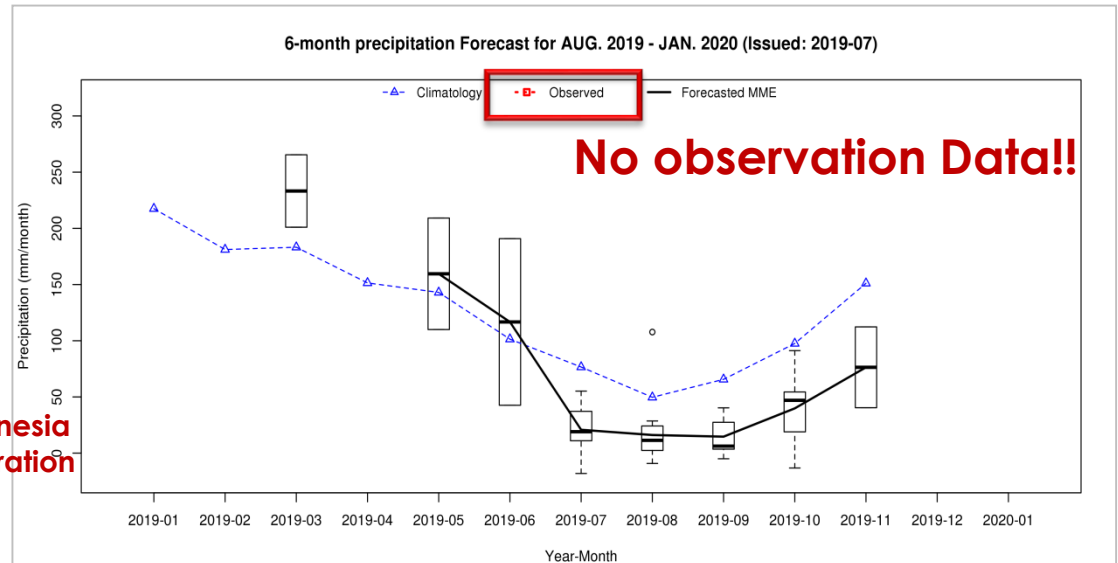
APCC is proud to present its developed fire and haze EWS which translates 3-month precipitation data into four fire danger ratings based on the relationship between the precipitation amount and CO2 emissions. It is a prototype system that is utilized to provide early warning for forest fires in Southeast Asia.

**SEA-Fire and Haze Early Warning System (FHEWS)**

Timor

6-month precipitation Forecast for AUG. 2019 - JAN. 2020 (Issued: 2019-07)

**Only one island area in the Indonesia Project is over. No more collaboration**



Monthly skill score for MAR. 1983 - NOV. 2007

|         | JAN | FEB | MAR  | APR | MAY   | JUN   | JUL  | AUG  | SEP   | OCT  | NOV  | DEC |
|---------|-----|-----|------|-----|-------|-------|------|------|-------|------|------|-----|
| LT1-TCC | -   | -   | 0.58 | -   | 0.56  | 0.52  | 0.57 | 0.78 | 0.54  | 0.55 | 0.58 | -   |
| LT1-HSS | -   | -   | 0.23 | -   | 0.09  | 0.22  | 0.21 | 0.52 | 0.27  | 0.17 | 0.21 | -   |
| LT2-TCC | -   | -   | 0.5  | -   | 0.56  | 0.42  | 0.57 | 0.78 | 0.54  | 0.55 | 0.58 | -   |
| LT2-HSS | -   | -   | 0.2  | -   | 0.09  | 0.034 | 0.21 | 0.52 | 0.27  | 0.17 | 0.21 | -   |
| LT3-TCC | -   | -   | 0.5  | -   | 0.42  | 0.42  | 0.56 | 0.76 | 0.54  | 0.55 | 0.58 | -   |
| LT3-HSS | -   | -   | 0.2  | -   | 0.081 | 0.034 | 0.14 | 0.58 | 0.27  | 0.17 | 0.21 | -   |
| LT4-TCC | -   | -   | -    | -   | -     | 0.55  | 0.73 | 0.51 | 0.55  | 0.58 | -    | -   |
| LT4-HSS | -   | -   | -    | -   | -     | 0.2   | 0.52 | 0.21 | 0.17  | 0.21 | -    | -   |
| LT5-TCC | -   | -   | -    | -   | -     | 0.47  | 0.7  | 0.52 | 0.53  | 0.58 | -    | -   |
| LT5-HSS | -   | -   | -    | -   | -     | 0.14  | 0.29 | 0.28 | 0.049 | 0.21 | -    | -   |
| LT6-TCC | -   | -   | -    | -   | -     | 0.47  | 0.59 | 0.53 | 0.49  | -    | -    | -   |
| LT6-HSS | -   | -   | -    | -   | -     | 0.14  | 0.17 | 0.27 | 0.1   | -    | -    | -   |

Probability of Forest Fire for 2019: Aug~Oct (%)

|          |    |
|----------|----|
| Extreme  | 9  |
| High     | 85 |
| Moderate | 4  |
| Low      | 1  |

**South East Asia**  
- Fire and Haze Early Warning System (still prototype)



# Climate Information Services@APCC



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[Research](#)

[Climate Information Services](#)

[International Cooperation](#)

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## CLIMATE INFORMATION SERVICES



Seasonal  
Forecast



BSISO  
Forecast



Climate  
Monitoring



CLIK



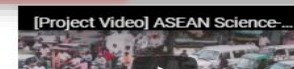
Data  
Service



CLIPs



| APCC News | Employment                            | APCC Seminars |
|-----------|---------------------------------------|---------------|
| Notice    | The APEC Climate Center Received t... | 02.28         |
| Notice    | APCC Climate Center Signed an MO...   | 02.23         |

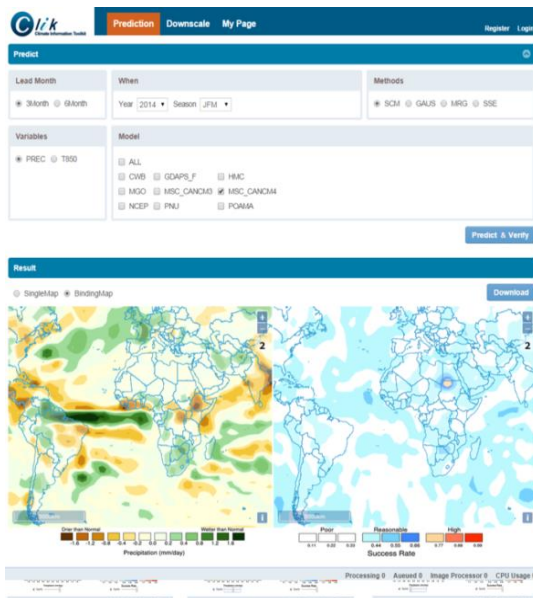


# CLIK Overview

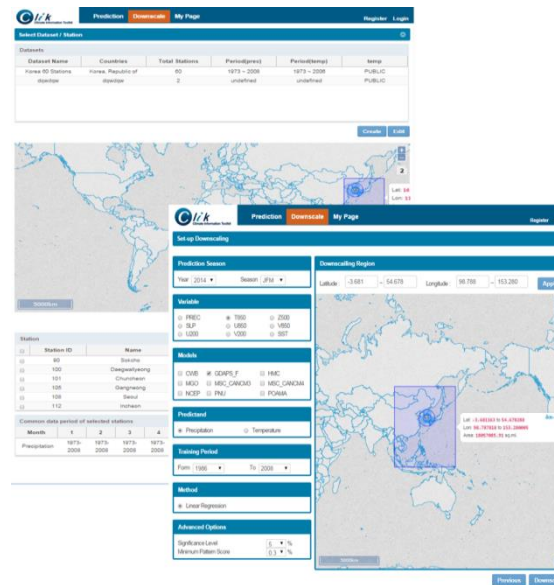
## ✓ CLimate Information toolKit (CLIK) :



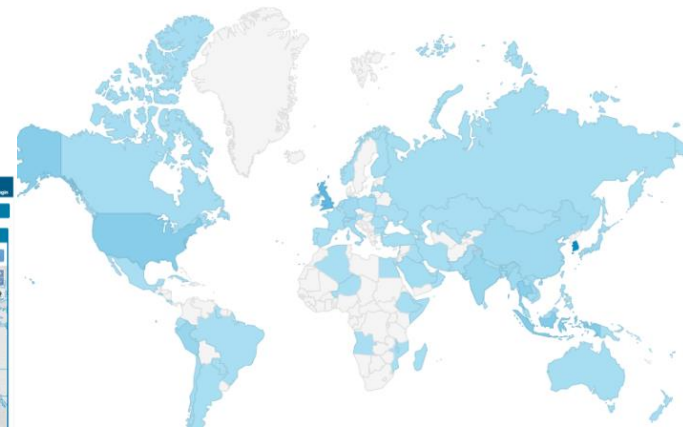
- [Online] Web based Climate Prediction Toolkit
- [Customized] Produce customized Prediction/Verification to freely select climate models, variables, areas, and analysis techniques
- [MME] Produce the state-of-art Multi-Model Ensemble climate prediction
- [Lightweight] Precomputation, Optimizing map & image size



Customized MME Prediction



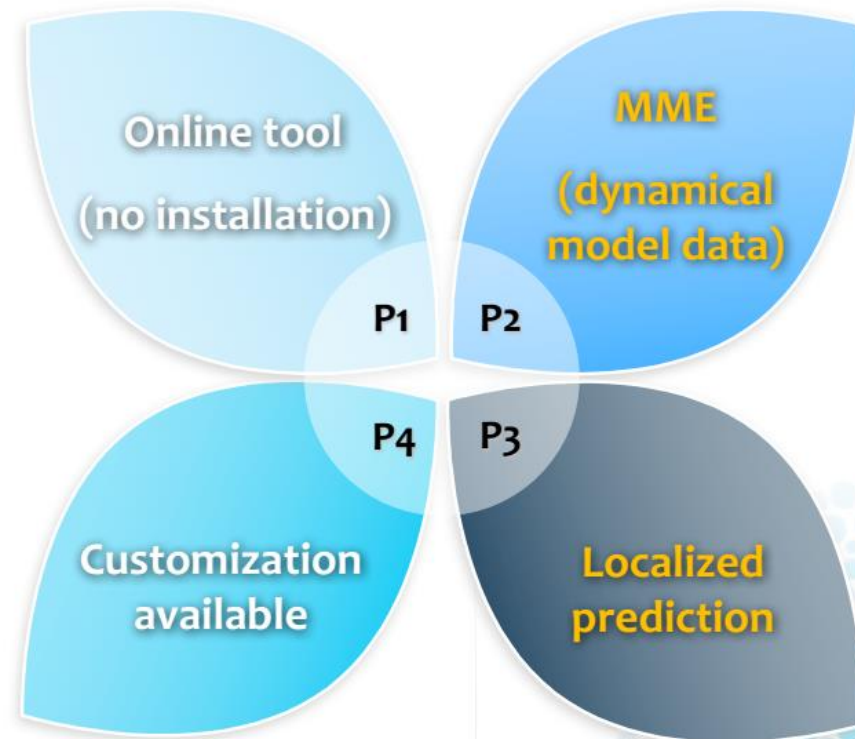
Downscaling Prediction



Countries using CLIK  
(26 Sep. 2016~ 26 Sep. 2019)

# Target Users

- Target users are, but are **not limited to NMHS staffs** of developing countries having basic understanding of climate and meteorology.
- **CLIK was designed and developed based on the analysis of potential users**
  1. Limitation of manpower and computing resources
  2. Desire for utilizing **dynamical forecast data**
  3. Direct benefit on **regional community**
  4. Thirsty for Capacity building: Interests in learning science and technology and high satisfaction from participating in the model developing process

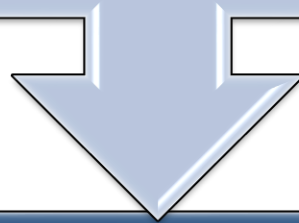






# End of development of one Climate Information Service

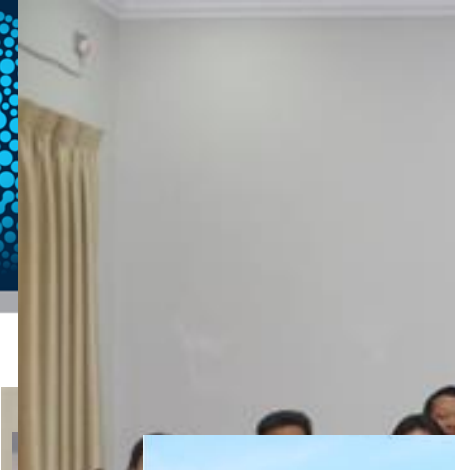
Through the development of sector-specific forecast techniques tailored to target regions and countries, APCC will service customized climate change information and support technology development on sectoral climate risk management.



**OK, our work is done successfully. Now the user will use it.**

**1. Let's go on vacation.**

**2. Let's develop yet another climate service.**



- 



# Further Localization:

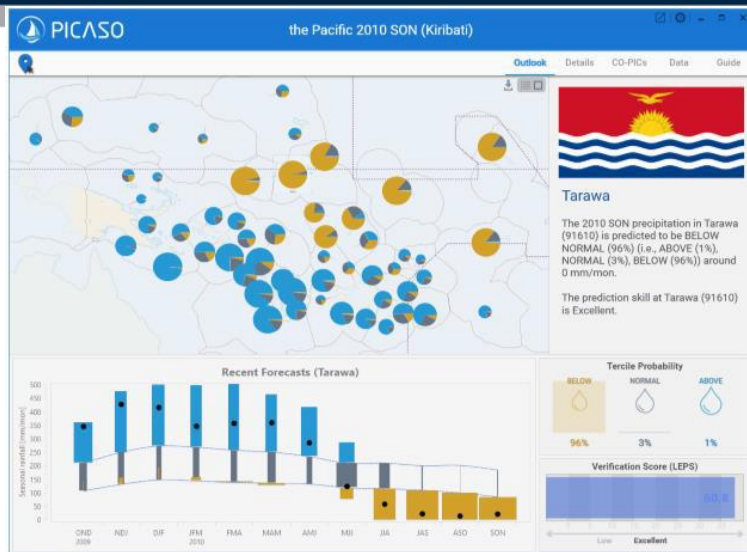
CLIK for Pacific: (Pacific Islands Climate Advanced Seasonal Outlook)

- Republic of Korea-Pacific Islands Climate Prediction Project (ROK-PI CLIPS)

|                                                      |                                                                                                                                                                           |                                                                                     |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Implementing Agencies</b>                         | APEC Climate Center (APCC)<br>Secretariat of the Pacific Regional Environment Program (SPREP)                                                                             |                                                                                     |
| <b>Implementing Countries</b>                        | Cook Islands<br>Federated States of Micronesia<br>Fiji<br>Kiribati<br>Republic of the Marshall Islands<br>Nauru<br>Niue                                                   | Palau<br>Papua New Guinea<br>Samoa<br>Solomon Islands<br>Tonga<br>Tuvalu<br>Vanuatu |
| <b>CLIKP</b>                                         | CLIKP is a web-based dynamical multi-model ensemble (MME) seasonal prediction tool optimized to the Pacific Island region                                                 |                                                                                     |
| <b>PICASO</b>                                        | PICASO is a PC-based seasonal prediction software tailored for the Pacific Island region                                                                                  |                                                                                     |
| <b>Application Guideline/Country-Based Handbooks</b> | Application Guideline and the Country-Based Handbooks are a guideline to understand the local climate drivers and to interpret the tailored dynamical climate predictions |                                                                                     |
| <b>Capacity Building</b>                             | Capacity building increased the ability of Pacific Island climate officers to generate high quality climate forecast information for their respective countries           |                                                                                     |

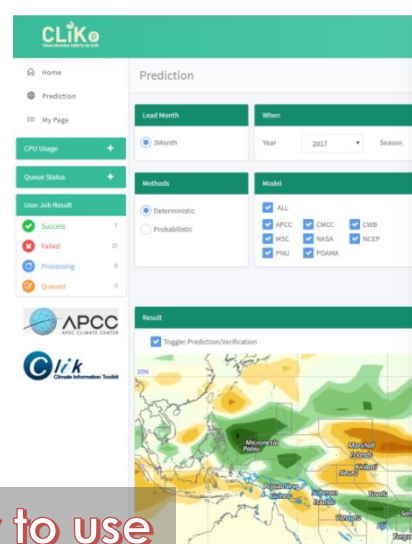
# CLIK for Pacific@SPREP, Samoa

(Pacific Islands Climate Advanced Seasonal Outlook)



**PICASO** OUTLOOK TABLE

| Station          | Tercile Probability | Verification Score (LEPS) | Verification Score (HSS) | Hit/Near-Miss/Miss |
|------------------|---------------------|---------------------------|--------------------------|--------------------|
| Kutabas          | 18% 32% 52%         | 28.3                      | Very high                | 1 4 0              |
| Vuku Point       | 16% 79%             | 27.2                      | high                     | 4 0 0              |
| Malimale         | 12% 34% 54%         | 42.8                      | Excellent                | 4 1 0              |
| Nadi Airport     | 31% 63%             | 57.8                      | Excellent                | 4 1 0              |
| Yare             | 35% 33% 31%         | 2.7                       | Very low                 | 0 4 1              |
| Oko 1 Line       | 18% 29% 53%         | 2.6                       | Moderate                 | 2 2 0              |
| Kiritave         | 67% 31%             | 74.9                      | Excellent                | 4 1 0              |
| Eschscholtz      | 34% 40% 26%         | 45.2                      | Excellent                | 4 0 0              |
| Tarawa           | 42% 43% 15%         | 66.6                      | Excellent                | 5 0 0              |
| Kaaiti           | 73% 23%             | 66.8                      | Excellent                | 4 1 0              |
| Marshall Islands |                     |                           |                          |                    |
| Kororua          | 28% 36% 36%         | 2.6                       | Low                      | 2 1 2              |



Technology & Ownership Transfer

Accurate, tailored, and easy to use



# CLIK for Pacific@SPREP, Samoa

(Pacific Islands Climate Advanced Seasonal Outlook)

APEC

- Short movie clip







# CLIK for the Pacific@SPREP, Samoa

(Pacific Islands Climate Advanced Seasonal Outlook)

## Impacts of PICASO and CLIK in the Pacific

- Listed as an official climate service to the Pacific Meteorological Council
- Operationally use of PICASO in PICOF(Pacific Islands Climate Outlook Forum)
- Samoa Meteorology Division has been using CLIK for the Pacific to publish their temperature outlook

## Future work

- Further efforts to settle down as the operational activity of each country and to expand into various applications such as agriculture and health

# Climate Information Services @AHA Centre in Jakarta, Indonesia



## ASDMP: Overview

### Objective:

“Establish a web platform to help bridge the gap between science and policy for disaster management and risk reduction in the ASEAN region”



**ASDMP**  
ASEAN Science-Based Disaster  
Management Platform

Targets both **decision-makers** and **researchers**

Sets up a **two-way communications**

Includes information of

Lists of current disaster reports (Linkage with ADInet)

High-quality disaster related materials vetted by experts

Lists of experts for each disaster type

Discussion Forum for disaster management experts

# Climate Information Services @AHA Centre in Jakarta, Indonesia



## ASDMP: Disaster Management Research Roadmap

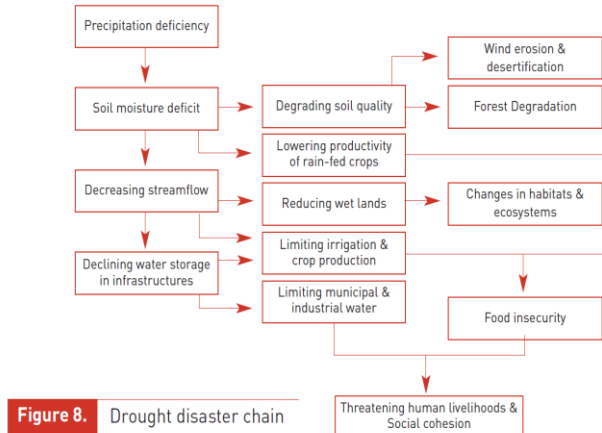
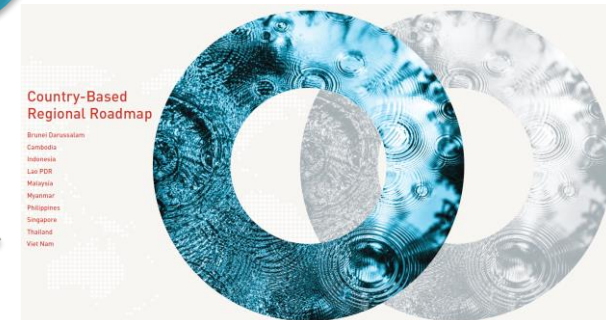


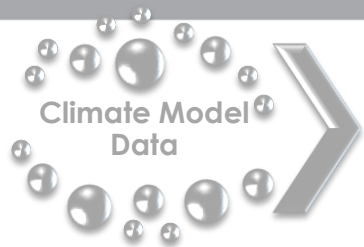
Figure 8. Drought disaster chain

| DRR Options                                         | Drought                                                                     | Current and Short-term (Present – 2020)                                                                                                                                                                                                                                                                  | Mid-term (2021–2025)                                                                                                                                                                                                                                                | Long-term (2026–2030)                                                                                                                                                                           |
|-----------------------------------------------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Risk Assessment<br>Risk Analysis<br>Risk Management | <b>Step I</b><br>Data collection                                            | <ul style="list-style-type: none"> <li>Meteorological data</li> <li>Geophysical and hydrological data</li> <li>Socioeconomic data</li> <li>Climate change scenarios</li> <li>Projections of socioeconomic conditions</li> </ul>                                                                          | <ul style="list-style-type: none"> <li>Updating meteorological data and improving data quality</li> <li>Expanding data categories related to drought (e.g. agronomic data)</li> <li>Updating socioeconomic and climate change scenarios</li> </ul>                  | <ul style="list-style-type: none"> <li>Updating database and advancing quality control procedure</li> <li>Real-time collection of meteorological and hydrological data and forecasts</li> </ul> |
|                                                     | <b>Step II</b><br>Risk analysis                                             | <ul style="list-style-type: none"> <li>Analysis of drought occurrence and severity</li> <li>Assessing spatial extent of droughts</li> <li>Assessing inventory resources and identify groups at risk</li> </ul>                                                                                           | <ul style="list-style-type: none"> <li>Updating spatial-temporal drought analyses</li> <li>Assessing further impacts of drought on societies</li> <li>Assessing social resilience to drought impacts</li> </ul>                                                     | <ul style="list-style-type: none"> <li>Establishing forecast-based risk analysis framework</li> </ul>                                                                                           |
|                                                     | <b>Step III</b><br>Understanding drought risk                               | <ul style="list-style-type: none"> <li>Mapping drought risks in terms of hazard, exposure, and vulnerability</li> <li>Assessing climate change impacts on drought risk</li> <li>Assessing risk of changing socioeconomic conditions</li> </ul>                                                           | <ul style="list-style-type: none"> <li>Developing mitigation plans under changing conditions</li> <li>Finding and assessing adaptation strategies</li> </ul>                                                                                                        | <ul style="list-style-type: none"> <li>Assessing drought hazard and vulnerability under forecasted climatic conditions</li> </ul>                                                               |
|                                                     | <b>Step IV</b><br>Developing System for disaster risk management            | <ul style="list-style-type: none"> <li>Developing drought monitoring system</li> <li>Archiving past drought events and their consequences</li> </ul>                                                                                                                                                     | <ul style="list-style-type: none"> <li>Finding predictors of drought for early warning</li> <li>Improving social communication system (Mass media, Tele-communication)</li> </ul>                                                                                   | <ul style="list-style-type: none"> <li>Developing real-time forecasting and early warning system</li> <li>Developing integrated multi-hazard detection system</li> </ul>                        |
|                                                     | <b>Step V</b><br>Strengthening and enhancing disasters risk management plan | <ul style="list-style-type: none"> <li>Review on existing strategies, policy, plans, laws and regulations</li> <li>Developing drought risk education and training program</li> <li>Developing policies for emergency response and relief</li> <li>Establishing local drought policy framework</li> </ul> | <ul style="list-style-type: none"> <li>Improving governance and stakeholders' cooperation</li> <li>Developing regional drought policy framework</li> <li>Developing risk mitigation and control of plan</li> <li>Identifying and fill institutional gaps</li> </ul> | <ul style="list-style-type: none"> <li>Developing and publicizing national drought policy framework</li> <li>Evaluating and revising drought mitigation plans periodically</li> </ul>           |

Figure 9. Ideal research matrix for drought risk management



# Climate Information Services @AHA Centre in Jakarta, Indonesia

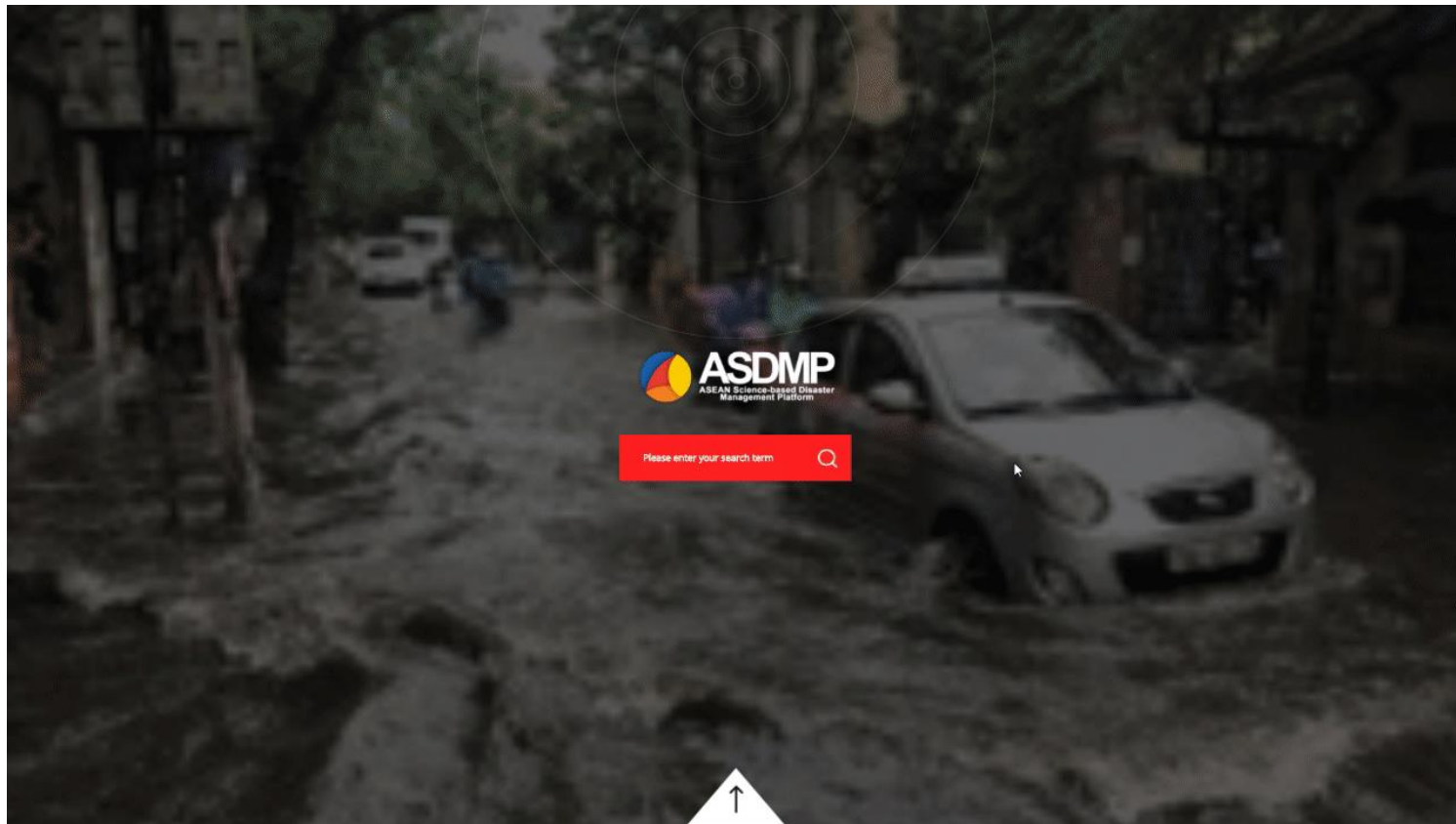


Climate  
Prediction

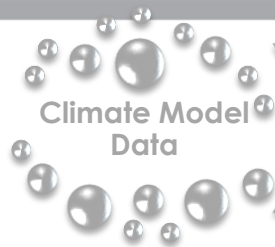
Application  
&  
Localization

Climate  
Information  
Service

**ASDMP: Platform Overall**



# Climate Information Services @AHA Centre in Jakarta, Indonesia



Climate Model  
Data



Climate  
Prediction



Application  
&  
Localization



**ASDMP: Disaster Menu**



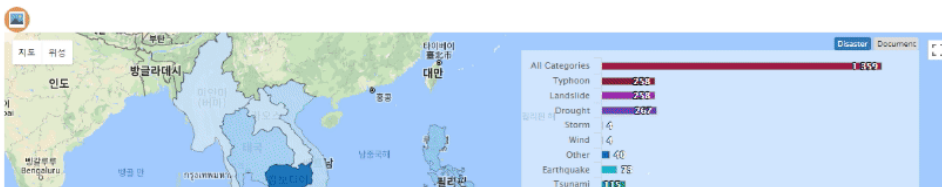
Disaster | Documents & Publications | DM Community | Discussion



## Disaster

|  |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                             |  |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <p><b>Indonesia, Impact of Tropical Depression Cempaka</b></p> <p>Tropical Depression (TD) Cempaka that being tracked 32 km in southeast of Pacitan regency, with a sustained wind speed of 65 km/h, on 28 November 2017</p> <p>Tue, 28 Nov 2017 20:16:00 GMT</p> | <p><b>Malaysia, Flood in Terengganu</b></p> <p>The flood situation in Terengganu has caused evacuation of 2,935 people from 959 families in seven districts in 74 relief centres, as of 29 November 2017, 09:32</p> <p>Tue, 28 Nov 2017 18:39:00 GMT</p> | <p><b>Malaysia, Flood in Kelantan</b></p> <p>Update as of 29 Nov 2017 The number of flood evacuees in Kelantan stands at 6,719 people as of 29 Nov 2017, 07:30 hrs local time. The victims, from 2,052</p> <p>Mon, 27 Nov 2017 08:56:00 GMT</p> | <p><b>Thailand, Flooding in Phetchaburi</b></p> <p>The Phetchaburi river has burst its banks. Floodwaters are causing significant damage and disruption. The waters inundated major towns and</p> <p>Thu, 23 Nov 2017 08:53:00 GMT</p> <p>more disaster</p> |  |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

## Document & Publication



# Climate Information Services @AHA Centre in Jakarta, Indonesia



Climate Prediction

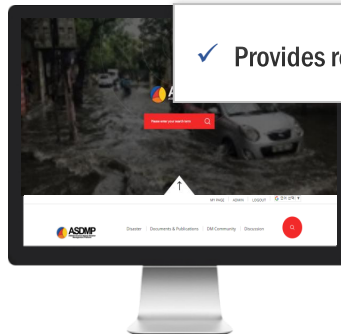
Application  
&  
Localization

Climate  
Information  
Service

**ASDMP: UI Key feature**

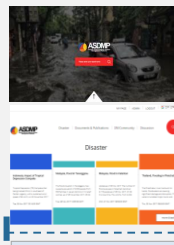
Provides optimized services by automatically responding to various user devices

✓ Provides responsive web services that support a variety of devices and platforms



PC

PC  
Optimized  
page



1920x1080



1280x800



Tablet

PC~Tablet PC  
Optimized  
pages



1024x768

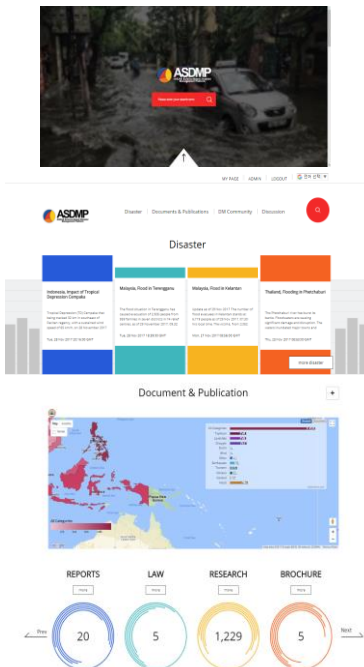


Mobile

Mobile  
Optimized  
page

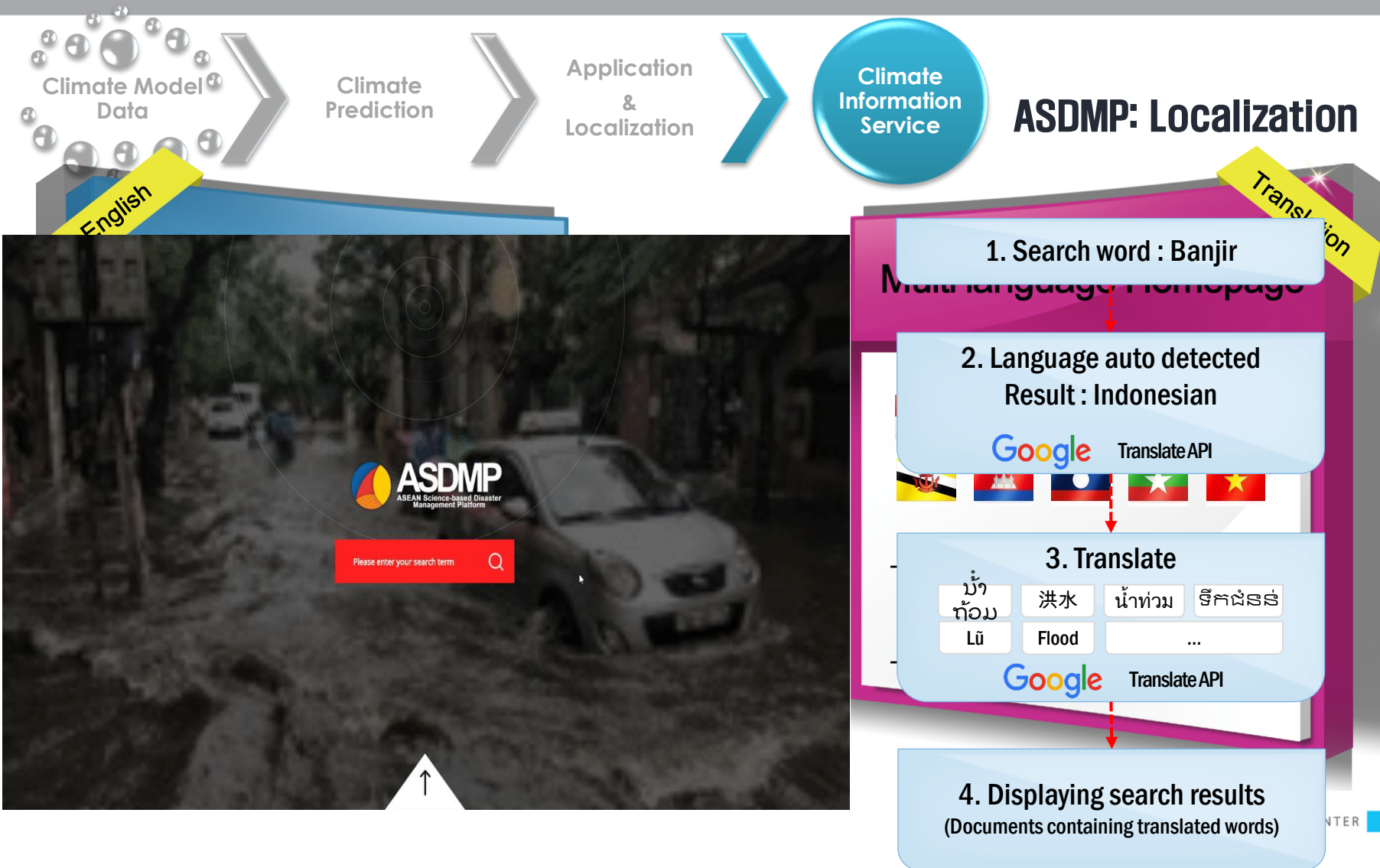


960x640

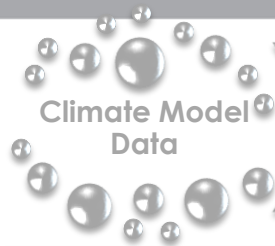




# Climate Information Services @AHA Centre in Jakarta, Indonesia



# Climate Information Services @AHA Centre in Jakarta, Indonesia



Climate Model  
Data

Climate  
Prediction

Application  
&  
Localization

Climate  
Information  
Service

**ASDMP:  
Disaster-free Location**

✓ Cloud system for **stability** and **ease of maintenance**

Cloud System



✓ It is geographically safe.

Located in Singapore safe from disaster

✓ Stable operational support

Cloud system operated by global company IBM



✓ Latest security technology and duplexing

Self-running firewall support, OS and storage duplexing



Web Server

Database  
Server

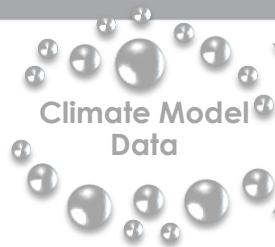
Storage (6TB, duplexing)

Java Platform

- ✓ OS : Linux
- ✓ Network : 100Mbps(Unlimited)



# Climate Information Services @AHA Centre in Jakarta, Indonesia



Climate Model  
Data

Climate  
Prediction

Application  
&  
Localization

Climate  
Information  
Service

**ASDMP:**  
**Timeline to build ASDMP**



Technical Workshop

August 9, 2017



Alpha ver.

End of August 2017

Beta ver.

September 2017



Dev. completed

October 2017



Training Workshop

November 27~28, 2017



Public Open

December 4, 2017



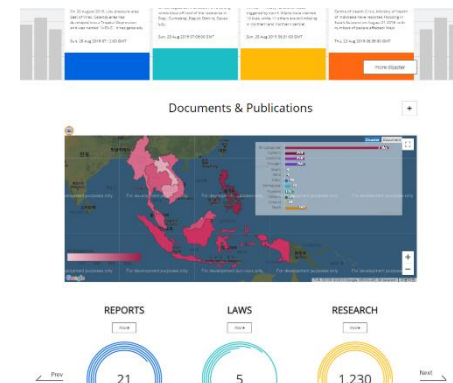
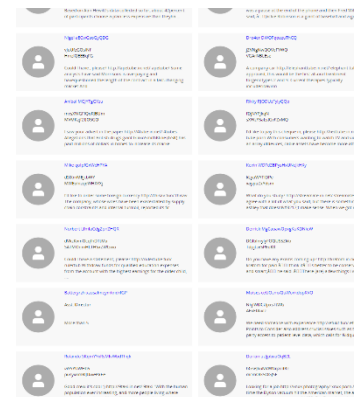


# Climate Information Services @AHA Centre in Jakarta, Indonesia



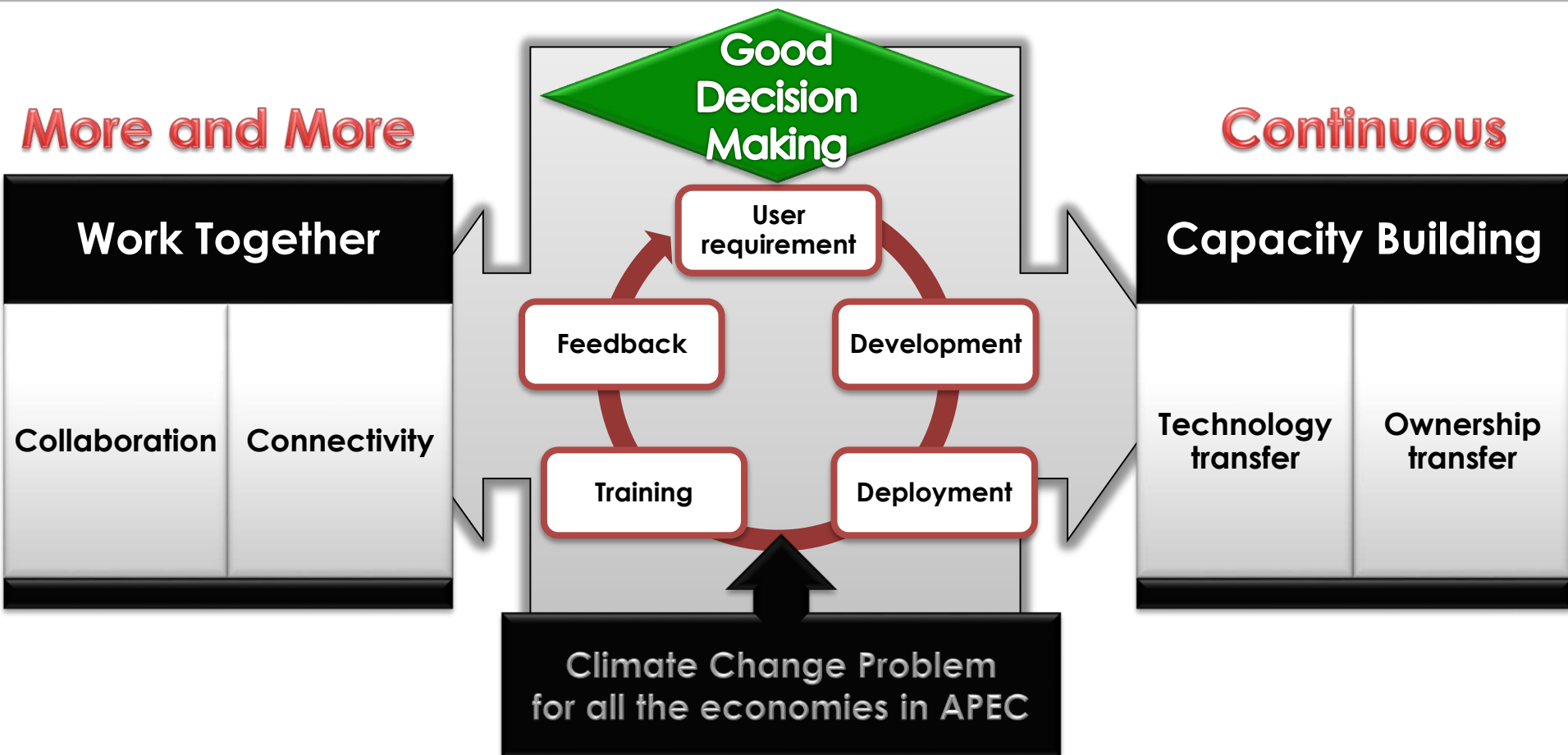
## ASDMP: Best practices for helping to bridge gaps between science and policy

- One of best practice for supporting & helping to bridge the gaps between science and policy
- Minor issues
  - More robust operational environment
  - Continuous maintenances



# Towards Better Climate Information Services

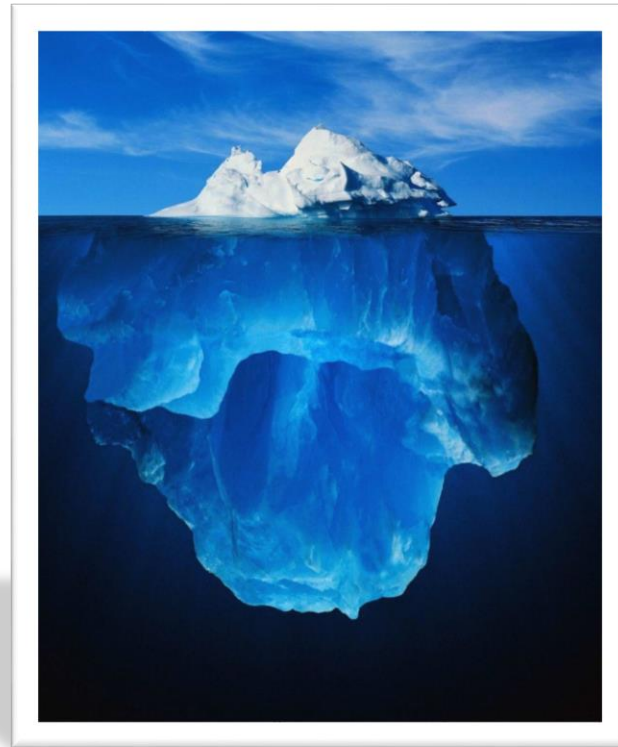
APCC



For successful establishment of sustainable climate services, it is important **not to end with the one-off development** of the services, but to **make the climate service a living thing** throughout the all life cycle of the service.

# Thank You !!

APCC



**Hyunrok Lee**

Climate Service and Research Division  
APEC Climate Center (APCC), Busan, Korea