Thailand wind map forecasting

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Outline

- Meso-scale model (downscaling) for wind map
  - RAMS (Regional Atmospheric Modelling System Model)
  - WRF (Weather Research and Forecasting Model)
- HAII's HPC (High Performance Computer)
  - 2 cluster systems (RAMS and WRF) for 72-hours forecast
- Computing domains
  - RAMS: Thailand wind map at 3x3 km
  - WRF: Rainfall map, 3 nested domains, Regional 27x27 km to Thailand 3x3 km
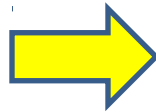- Uses of wind map

Regional Atmospheric Modelling System (RAMS)
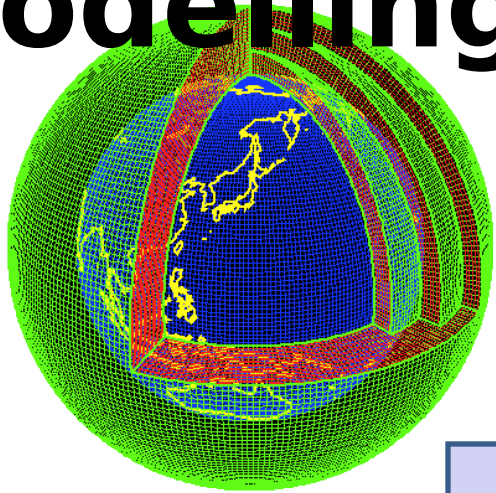
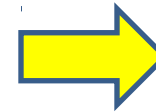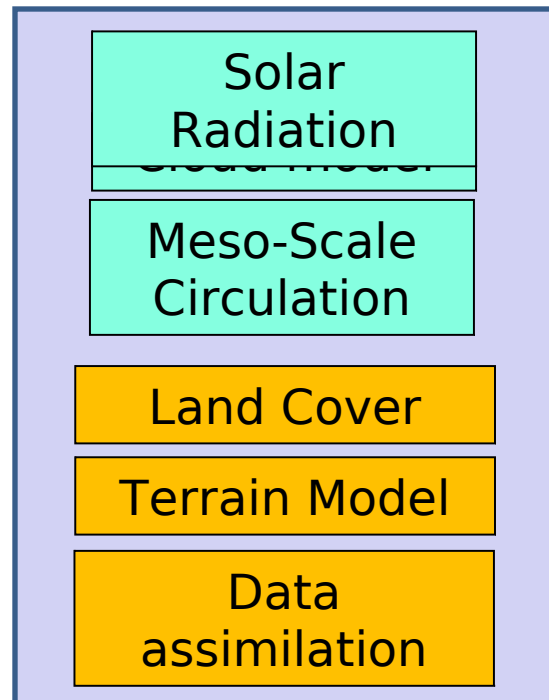Meso-scale meteorological model provide meteorological parameters in each grid cells

RAMS

| NCEP Global Circulation Model Outputs |
| Sea Surface Temperature |
| Land surface characteristics |

| Solar Radiation |
| Meso-Scale Circulation |
| Land Cover |
| Terrain Model |
| Data assimilation |

| Wind speed & direction |
| Rain |
| Temperature |
| Solar radiation |
| Air pressure |

WRF Workflow
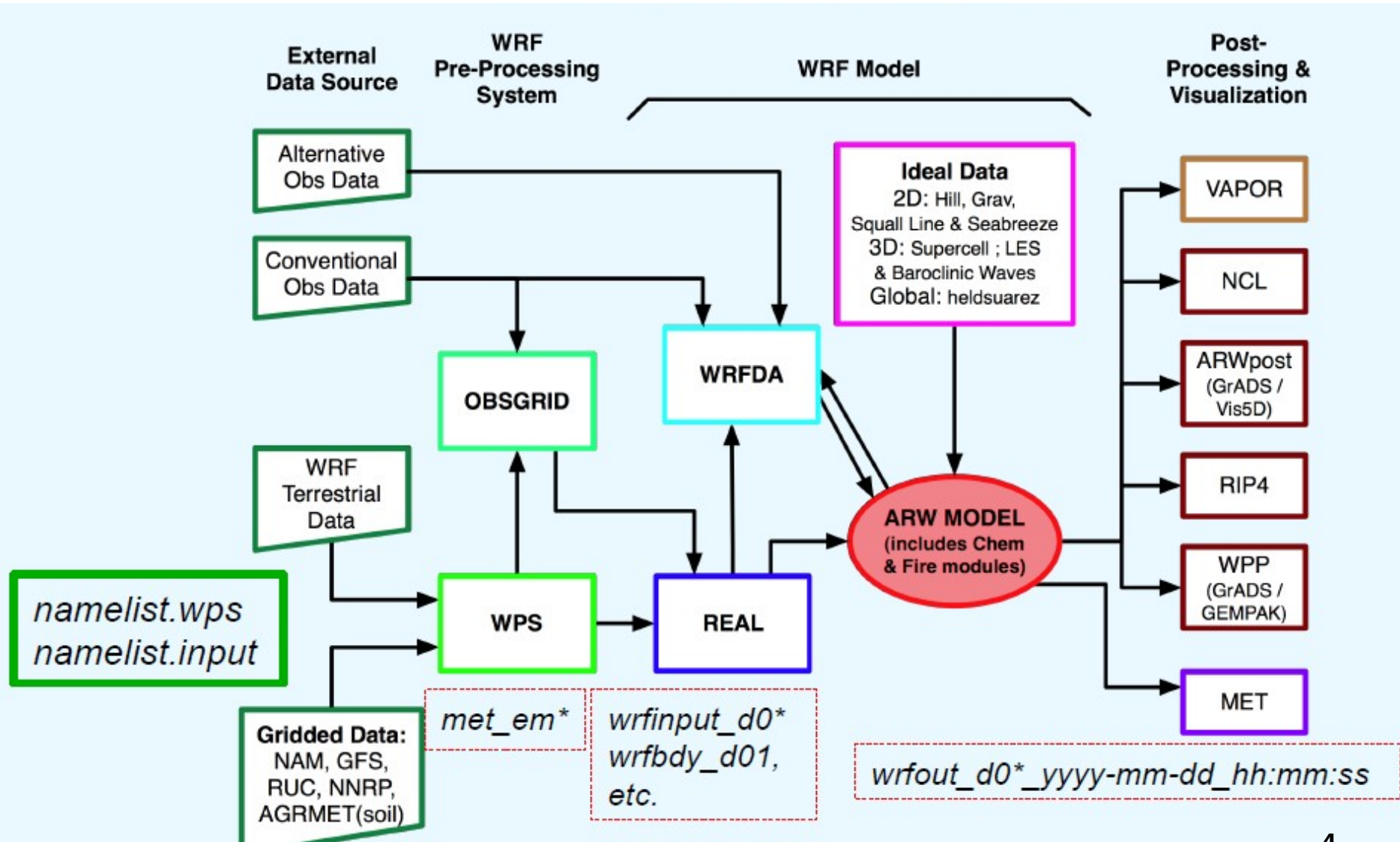
HAII High Performance Computing System

RAMS Model

Head Node

UTP

IB 40 Gb/s

CPU: 192 cores
RAM: 512 GB

Compute Node

IO Node

IO Node

WRF Model

Head Node

UTP

IB 40 Gb/s

CPU: 192 cores
RAM: 512 GB

Compute Node

IO Node

IO Node

SAN 12TB

UTP
IB
FC
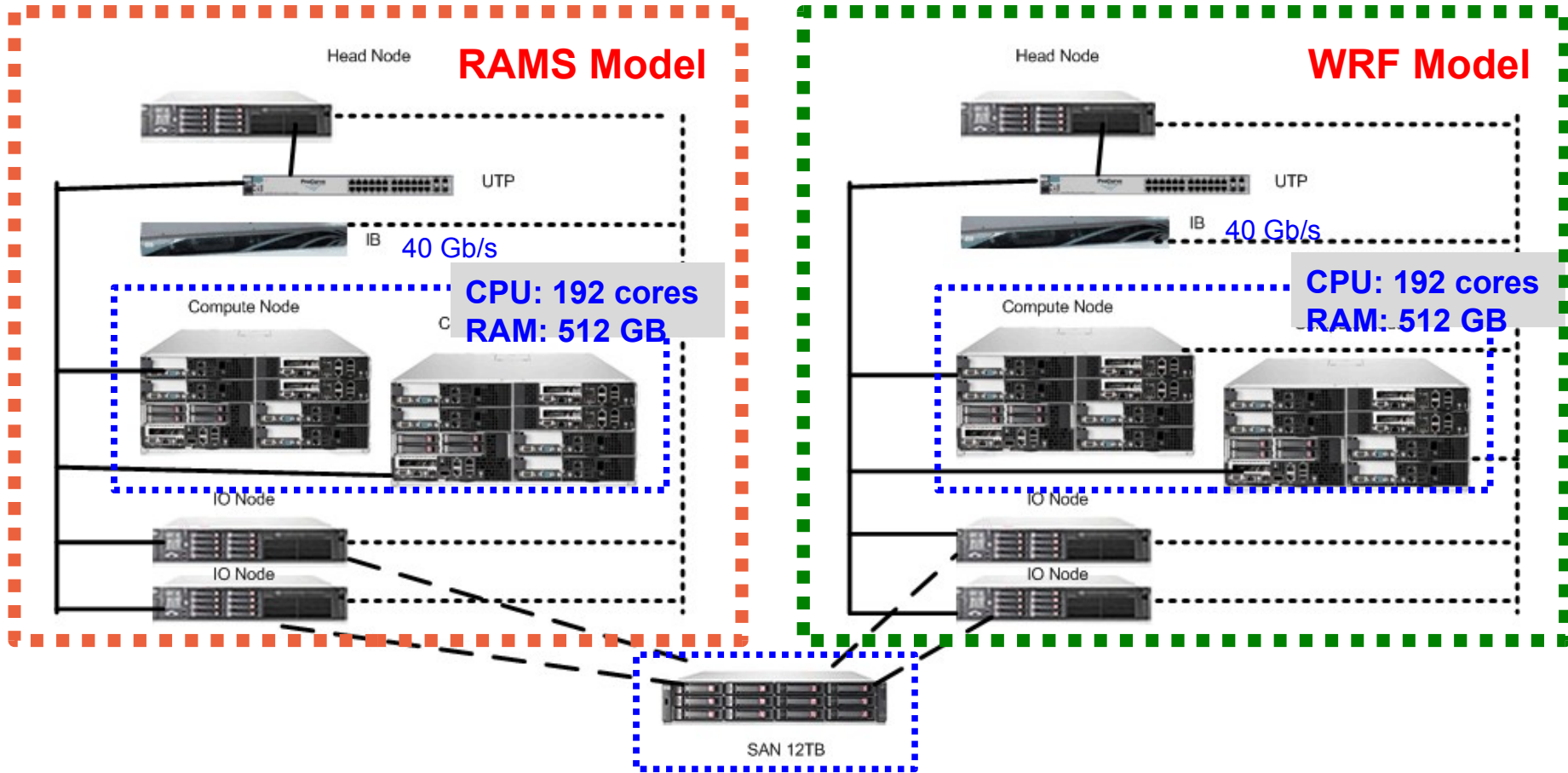
Total Computing Capacity

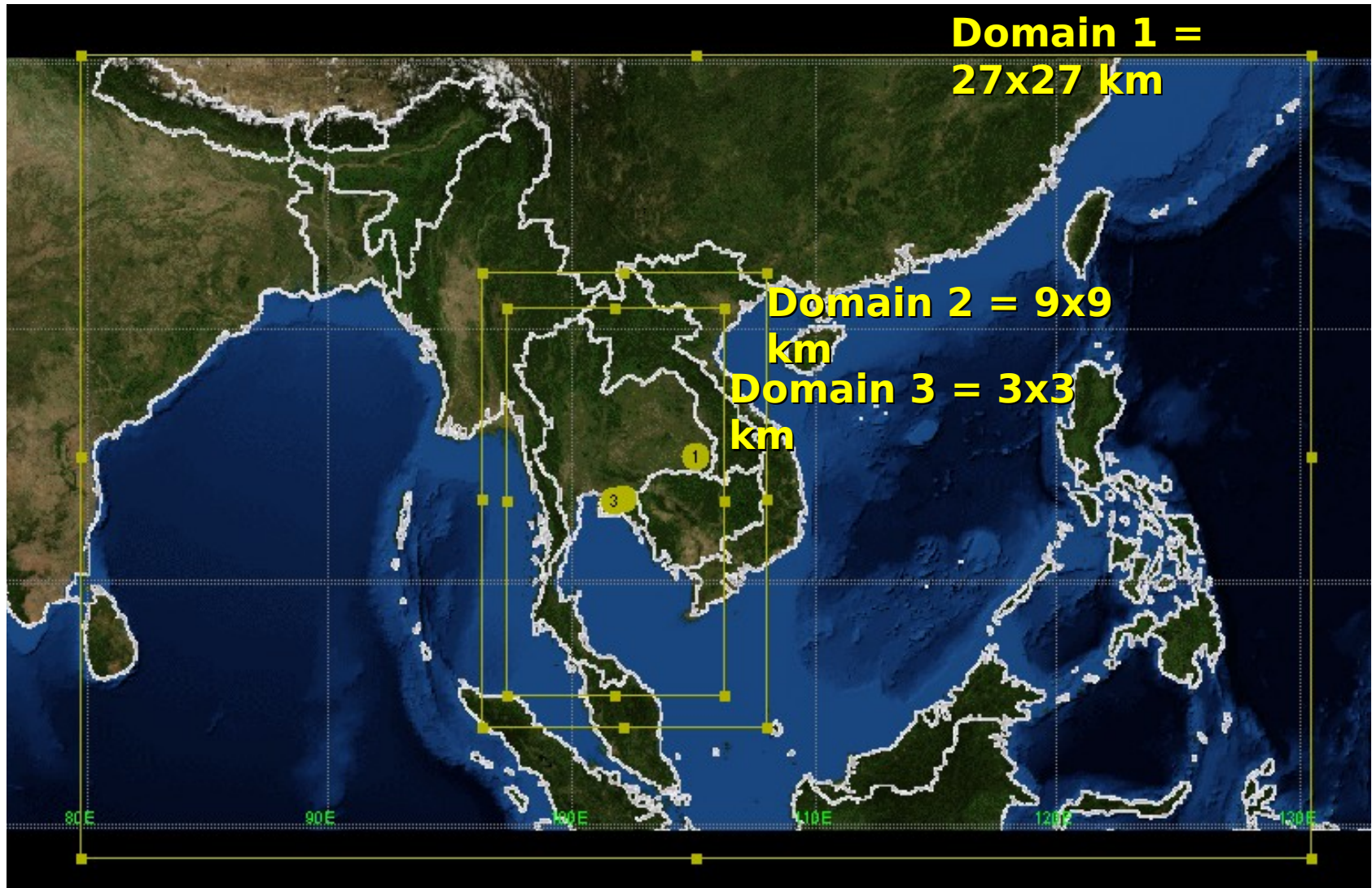CPU: 384 cores (2 Clusters x 16 nodes x 2 CPUs x 6 cores)
RAM: 1 TB (2 Clusters x 16 nodes x 32 GB)
Storage: 12 TB (shared)
File System: Lustre Network Clustering File System, parallel I/O
Throughput: 40Gb/s via Infiniband Switch

Computing domains (WRF model)

Domain 1 = 27x27 km

Domain 2 = 9x9 km

Domain 3 = 3x3 km

Uses of wind map

- Rainfall forecasting
- Disaster warning
- Air pollution monitoring
- Coastal erosion analysis
- Royal artificial rainmaking operation
- Wind potential energy
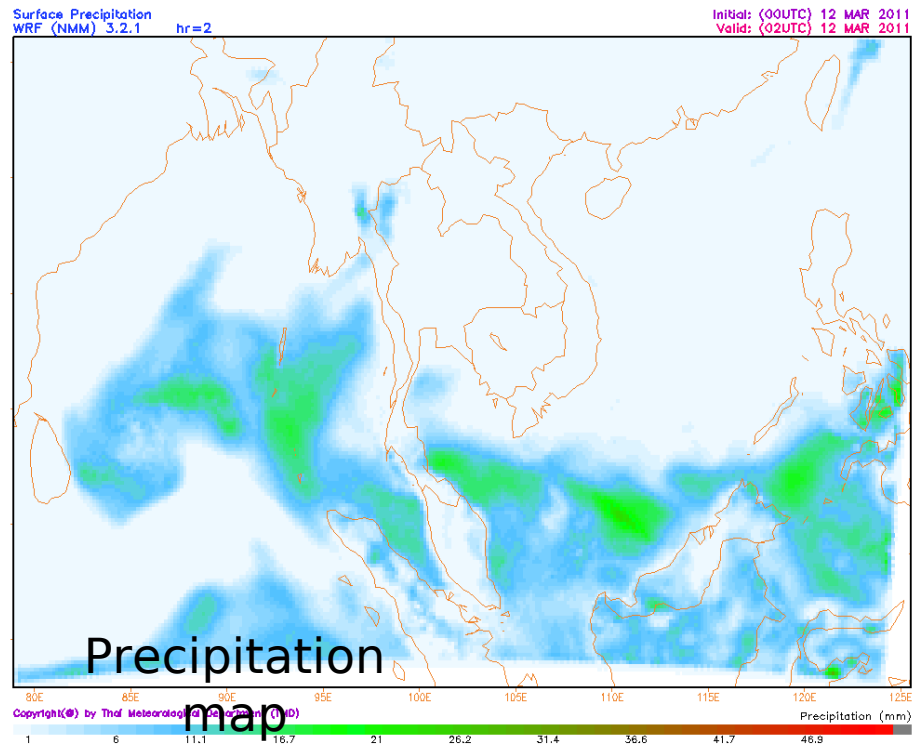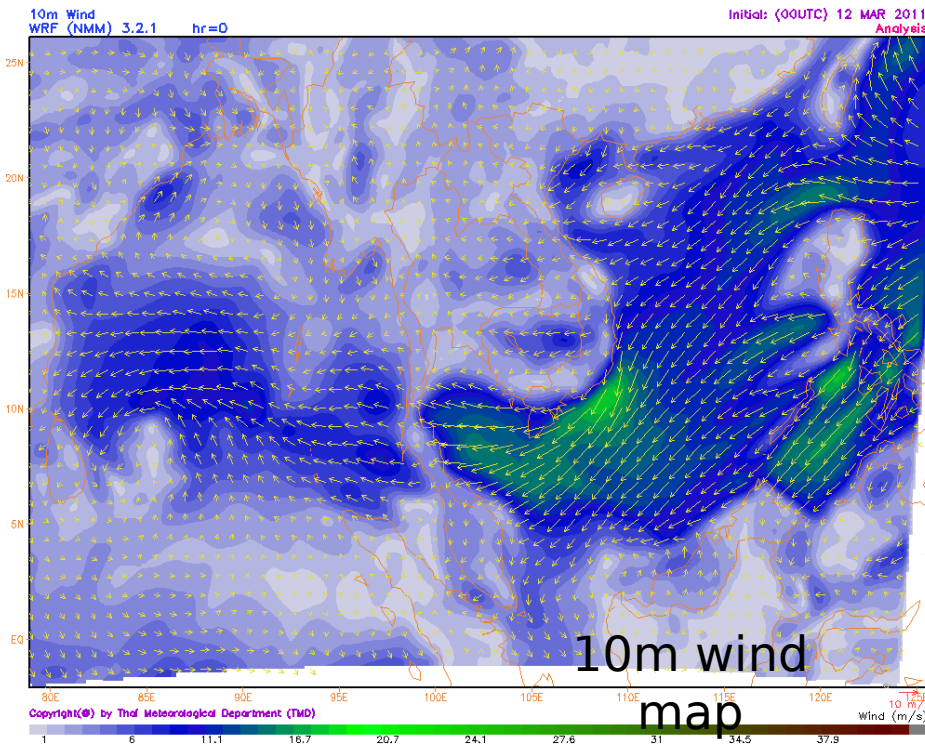- Researches on climate change

Rainfall forecasting

Source: Kochi University
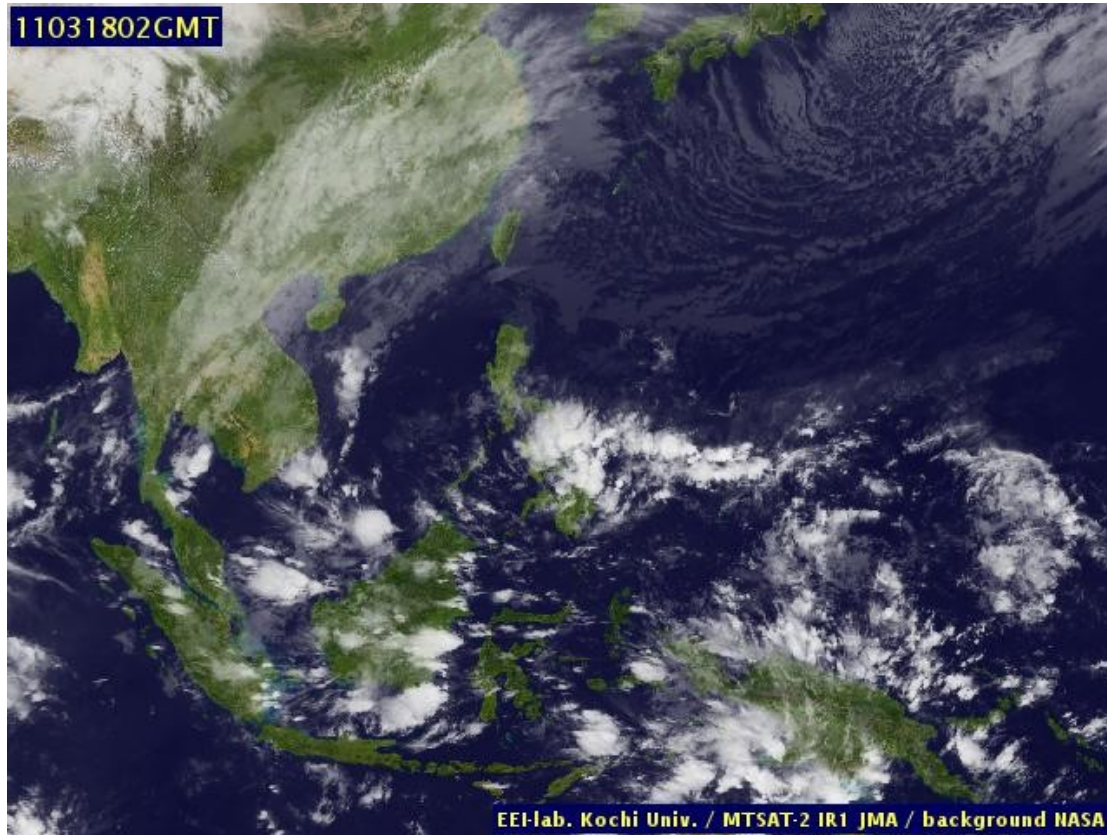
- Weather monitoring
- Reservoir operations
- Water resource management

Disaster warning

- Storms or typhoons
- Floods
- Landslides

10m wind map

Precipitation map

Source: Thai Meteorological Department

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Air pollution monitoring

Pollution Sources:
- Transportations
- Factories
- Smog
- Forest fires

hourly PM2.5 concentration (ug/m3) 1800 19MAR

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Coastal erosion analysis

- Trend analysis of ocean waves and directions

Significant Wave Height with Wave Direction
Valid For Mar-18-2011 06:00 GMT

oceanweather inc.

Plotted at Mar 17, 2011 21:41 GMT

Significant Wave Height (Meters)
0 1 2 3 4 5 6 7 8 9 10 11 12

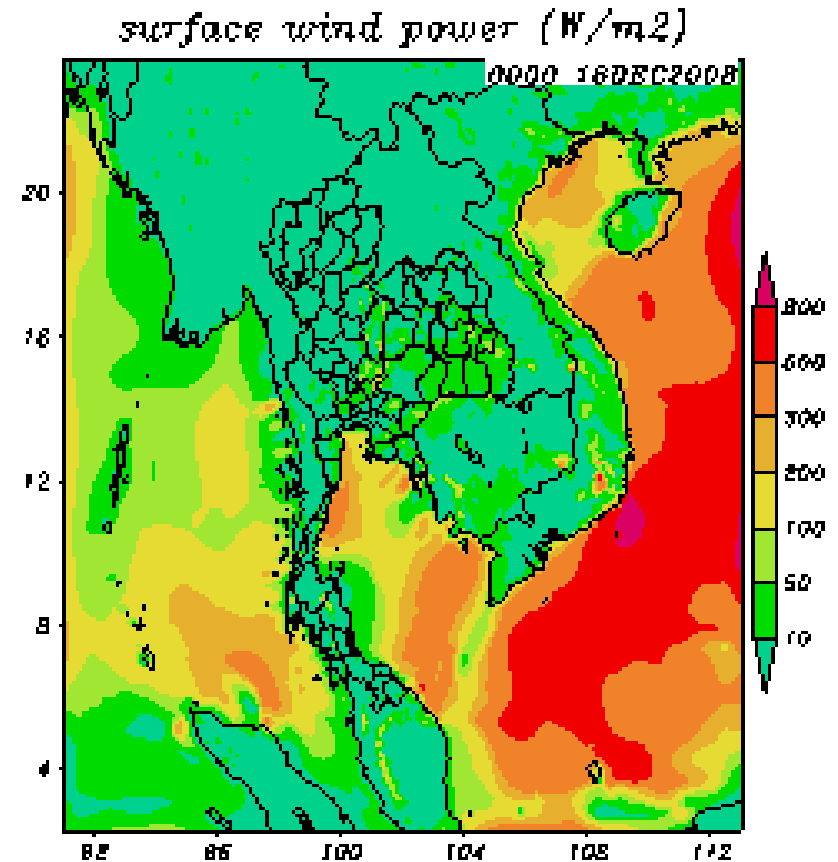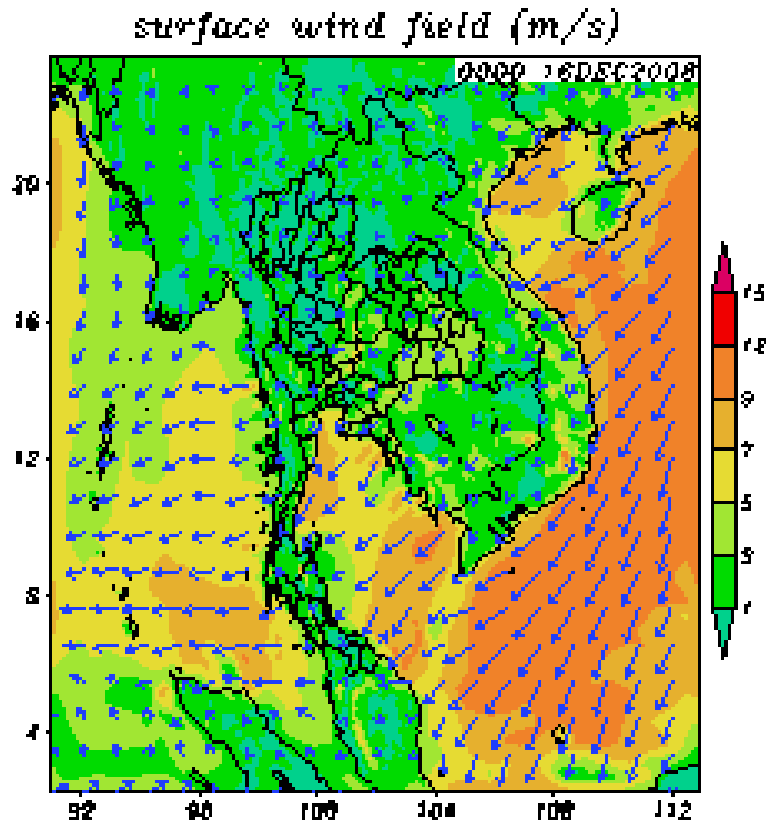0 5 10 15 20 25 30 35 40
Significant Wave Height (Feet)

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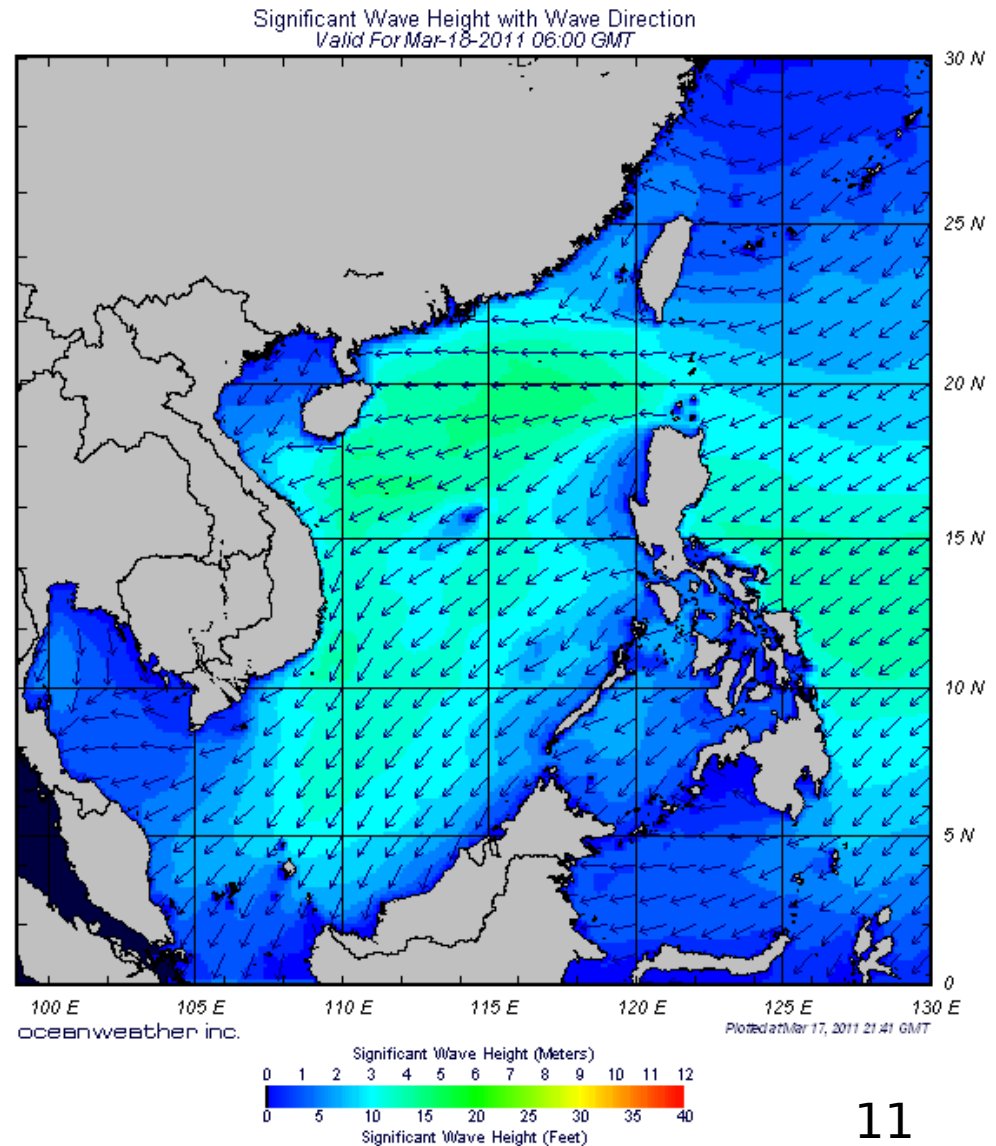
Royal artificial rainmaking operation

- Support artificial rainmaking operations
- Drought alleviation

Wind field and wind power potential

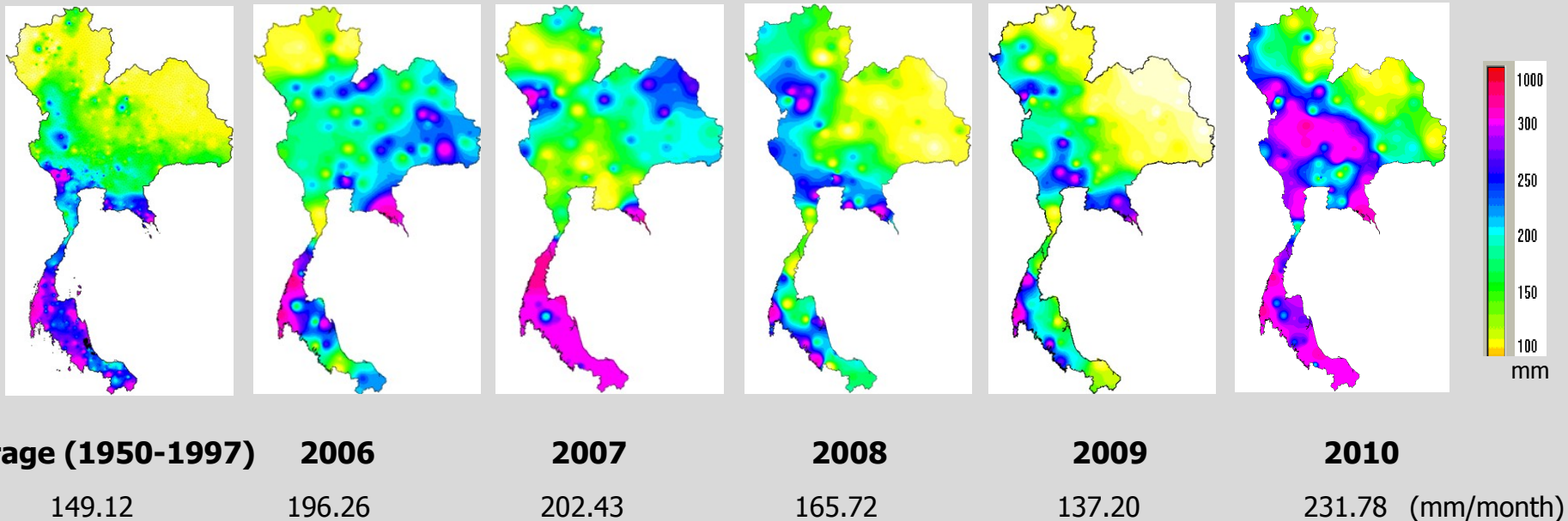
surface wind field (m/s)

horizontal distributions of wind velocity (shaded; m/s) and wind vectors in the surface layer at 0000

surface wind power (W/m2)

horizontal distributions of wind power (W/m2) in the surface layer at 0000

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Researches on climate change

- Spatial and temporal changes of rainfall patterns
- Seasonal changes
- Flood and drought risks management

October rainfall map 2006-2010

Average (1950-1997)	2006	2007	2008	2009	2010	
149.12	196.26	202.43	165.72	137.20	231.78	(mm/month)

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Other benefits in water resource management

- Reservoir inflow estimations
- River flow forecasts
- Runoff calculation and flood peak management

Thank you