MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

VIETNAM INSTITUTE OF METEOROLOGY, HYDROLOGY AND CLIMATE CHANGE

Some features of research and application of climate, hydrology models at IMHEN

BANGKOK, 3/2018

APPLICATION CLIMATE MODELS IN IMHEN

1. • HUMAN RESOURCES
2. • HARDWARE
3. • SOFTWARE
4. • RESEARCH ACTIVITIES

HUMAN RESOURCES

HUMANS

Viet Nam Institute of Meteorology, Hydrology and Climate Change (IMHEN)

Total: 257 person

Prof., Assoc. Prof.: 8

PhD: 26

MSc.: 44

BSc., Engineers: 150

HARDWARE

HARDWARE

IMHEN's HPC Overview

8/2012

HPC configurations

Hardware:

- 1 Master nodes: Dell R720
- 20 computing nodes:
  + 16 nodes: Dell PowerEdge M620
  + 4 nodes: Dell R720
- Hitachi HUS 110: ~ 100TB
- UPS smart: turn off HPC when the electric suddenly cut off
- Precision cooling system
- 42U Rack

OS:

- Rock 6.1
- HPC PBS pro: jobs management
- Relevant libs

~ 350 CPUs (1CPU ~3.0Ghz)

HARDWARE

Present

Computer Name	Computer Model	OS Installed	CPU	System Memory (MB)	Internal Storage (DISK,RAID)
IMHEN-HEADNODE01	Dell PowerEdge R730	Red Hat® Enterprise Linux 7.3	2 x Intel Xeon E5-2690 v4 2.6GHz,35M Cache,9.60GT/s QPI,Turbo,HT,14C/28T (135W) Max Mem 2400MHz	256GB (16 x 16GB)	2 x 300GB SAS
IMHEN-COMPUTE01	Dell PowerEdge M630 Server	Red Hat® Enterprise Linux 7.3	2 x Intel Xeon E5-2680 v4 2.4GHz,35M Cache,9.60GT/s QPI, Turbo,HT,14C/28T (120W) Max Mem 2400MHz	32GB (4x8 GB)	2 x 300GB SAS
IMHEN-SW-01	Dell Switch N2048	Dell			
IMHEN-SAN-CTL	Dell MD3460, MD3060f	Dell Storage OS			180 x 2TB SAS

SOFTWARE - MODELS

1. NWP (Numerical weather prediction).
2. MM5
3. WRF
4. CCAM, AGCM/MRI, AGCM of Norway, ..
PRECIS, CCAM, WRF, RegCM, …
5. NAM
6. TANK
7. SWAT
8. MIKE NAM
8. DSSAT
10. Agrometshell
11. Cropwat
….

RESERCH ACTIVITIES

CLIMATOLOGY AND CLIMATE CHANGE

HYDROLOGY AND MARINE

ENVIRONMENT

AGRO-METEOROLOGY

CLIMATOLOGY AND CLIMATE CHANGE

- Climatic characteristics/resources;
- Atmospheric circulations and monsoon: onset of wet/dry seasons, heavy rainfalls, dry spells, monsoon oscillation
- Applied climatology (for construction, biology, energy, health and tourism);
- Regional and urban climate;
- Climate variation - ENSO phenomena.
- Tropical meteorology and typhoons;

CLIMATOLOGY AND CLIMATE CHANGE

- Seasonal climate bulletin and outlook
- Climate extreme events
- Study on prevention and mitigation of desertification in the Central Viet Nam
- Drought forecast and warning

Three month seasonal Tem. and rainfall anomaly predictions

Rainfall forecasts

Three months Tem. anomaly prediction

CLIMATOLOGY AND CLIMATE CHANGE

- Research in climatology – meteorology: forecasting models (heavy rainfall, storm…), hydrology (flood, inundation, flash flood) and environment.
- Application of climate information and climate forecasting to serve social – economic sectors and disaster prevention in Viet Nam.
- Research on building and testing the auto - meteorological station system.

CLIMATOLOGY AND CLIMATE CHANGE

Developing the climate and climate change atlas for Vietnam

CLIMATOLOGY AND CLIMATE CHANGE

- Application global climate models (GCM): CCAM, AGCM/MRI, AGCM của Na Uy, ..

- Application of high resolution regional climate models: PRECIS, CCAM, WRF, RegCM, …

- Application of statistical detailing methods: SD_IMHEN

CLIMATOLOGY AND CLIMATE CHANGE

Detailing motivation by model CCAM

GCM (~200 km)

Bias correction

GCM SST/SIC

CCAM (~100 km)

RegCM4, WRF (~20km)

CCAM (~50 km)

CCAM (~10 km)

CLIMATOLOGY AND CLIMATE CHANGE

Developing Climate change Scenarios

- Climate change and sea level rise scenarios were announced in 2009 to promptly serve ministries, sectors and localities to implement the NTP on CC;
- Scenarios were updated in 2012 and 2016, following the roadmap identified in National Strategy on CC and new report of IPCC.

HYDROLOGY AND MARINE

Four main groups of models are used in hydrological studies in Vietnam:

1. Hydrographic model group: MIKE-NAM, HEC-HMS, SWAT, …. These models are used to simulate rain-flow processes for a basin. The results of these models can be used as the boundary input for the hydraulic model group.

HYDROLOGY AND MARINE

2. Hydraulic model group:

One-way hydraulic models such as HEC-RAS, MIKE11, ISIS, …: These models are used to simulate flow (flow, water level) on the river system, providing a boundary for a two-dimensional hydraulic model.

HYDROLOGY AND MARINE

Two-dimensional hydraulic model such as MIKE21: This model are used to simulate overflow runoff.

Flood simulation model - MIKE FLOOD: Simulating flood spillways, flood levels and floodplains (connecting MIKE11 1-dimensional models, MIKE21 two-dimensional models and MIKE URBAN urban drainage models to simulation of river flow and flood overflow).

3. Flood model

Urban drainage modeling - MIKE URBAN: Modeling the drainage network of urban areas.

Model for calculatin

HYDROLOGY AND MARINE

Viet Nam Operational Flash Flood Guidance System (VNOFFG)

- IMHEN combined with Hydrologic Research Center of American to develop Viet Nam Operational Flash Flood Guidance System

Flash Flood Trend in the period of 1990-2010.

HYDROLOGY AND MARINE

4. Water balance model group

MIKE-BASIN: General structure

HYDROLOGY AND MARINE

- Assessment of water balance and water resources for regions and river basins;
- Inland, urban, and watershed hydrology, river-estuary flows interaction;
- Flood/Flash flood/inundation warning; Flood risk and inundation mapping; Flood alert levels for main rivers.
- Drought maps for the Central Highlands and South Central, salinity intrusion for Mekong River Delta

HYDROLOGY AND MARINE

- Soil erosion and sedimentation and salinity intrusion;
- Dam break analysis and modeling;
- WR management, Irrigation and drainage management;
- Reservoir management.

HYDROLOGY AND MARINE

Contributed to development of Operation Rules for Reservoir Systems

The Operation Rules for Reservoir Systems in dry seasion in large and important river basins were issued by the Prime Minister are the basic legal tools to implement coordination mechanisms, regulatiing, operating reservoir in water supply for downstream in dry season, ensuring to effective and integrated use of water resources in reservois in river basins.

HYDROLOGY AND MARINE

❖ Marine meteorology, hydrology, environment research

- ✓ Marine environment research and the response solutions in Vietnam Sea;
- ✓ Mapping inundation risk caused by super storm surges;
- ✓ Surveys and analysis of depositition and erosion processes in Ca Mau province due to Climate change

HYDROLOGY AND MARINE

❖ Marine meteorology, hydrology forecast

- ✓ Tidal forecast;
- ✓ Storm surge forecast;
- ✓ Wave forecast;
- ✓ Sea level trend
- ✓ Prediction SLR

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HYDROLOGY AND MARINE

❖ Marine disaster research

✓ Constructing tsunami hazard map and planning lookouts station system for tsunami warning at high risk areas;

✓ Establishment of data base for natural hazards with sea origin in the coast of Vietnam;

✓ Reviewing and design details early warning system of multi-disaster

ENVIRONMENT

- Water quality monitoring (rivers, reservoirs)
- Studying on water pollution and proposing mitigation measures.
- Poverty and environmental impact assessment
- Assessing Vulnerability caused by environmental change and climate change
- Study on waste treatment technology

ENVIRONMENT

- Air quality computation and forecast
- Studying on Air pollution and proposing mitigation measures.
- Emission inventory
- Monitoring PM2.5 in Hoa Binh
- Monitoring and Study on acid deposition in Vietnam - Member of East Asia Acid Deposition Network (EANET, 13 countries)

ENVIRONMENT

- Computations of oil spill in the East Sea
- Sediment transport computation for Ha Long bay
- Study on sedimentation in reservoirs (Hoa Binh and Thac Ba)
- Application of high resolution remote sensing to monitor land use planning of Hanoi in 2020

ENVIRONMENT

- Environmental Laboratories: capable of analyzing most parameters of air and water environment, ISO-certified-VILAS

TỔNG CỤC TIÊU CHUẨN ĐO LƯỜNG CHẤT LƯỢNG
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Laboratory:

ENVIRONMENTAL LABORATORY
CENTER FOR ENVIRONMENTAL RESEARCH
NATIONAL INSTITUTE OF METEOROLOGY, HYDROLOGY AND ENVIRONMENT

đã được đánh giá và phù hợp với các yêu cầu của
has been assessed and found to conform with the requirements of

ISO/IEC 17025: 2005

Lĩnh vực công nhận
Field of Accreditation

HÓA HỌC
Chemical

Mã số
Accreditation No

VILAS 255

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VĂN PHÒNG CÔNG NHẬN CHẤT LƯỢNG
(Director of Bureau of Accreditation)

ENVIRONMENT

- Monitoring of PM2.5 in Hoa Binh:

Measurement started from 11th February 2015

- The monitoring data on PM2,5 concentration in HoaBinh station from February to December 2015

ENVIRONMENT

- Study on trans-boundary air pollution
  - ❖ Study was conducted from 2011-2013
  - ❖ Activities of survey, investigation and results of modeling application

AGRO-METEOROLOGY

- Reporting agro-met conditions and forecasting crop yield are regular operational work.
- Bulletins are sent to relevant agencies and posted on the Institute's website: http://www.imh.ac.vn

AGRO-METEOROLOGY

- Research on building frost map for coffee and rubber plantations in Northern mountainous regions using GIS and remote sensing technology
- Developing the salinity forecast program for agriculture and aquaculture in the Red River Delta.
- Rice mapping and monitoring using MODIS data

Mapping of frost safe zoning

Mapping Rice growing areas of Red river delta

AGRO-METEOROLOGY

- Monitoring drought by remote sensing
- Mapping of agro-climatic zoning in Vietnam
- Development of cooperation activities between the Centre and agricultural agencies in the field of applying agro-meteorological information to agricultural production

Drought Index-LSWI from MODIS

THANK YOU
FOR YOUR ATTENTION !