Assessment of water resources for improved water governance under climate change:

Case in Stung Chreybak catchment of Tonle Sap Great Lake Basin in Cambodia

an on-going research

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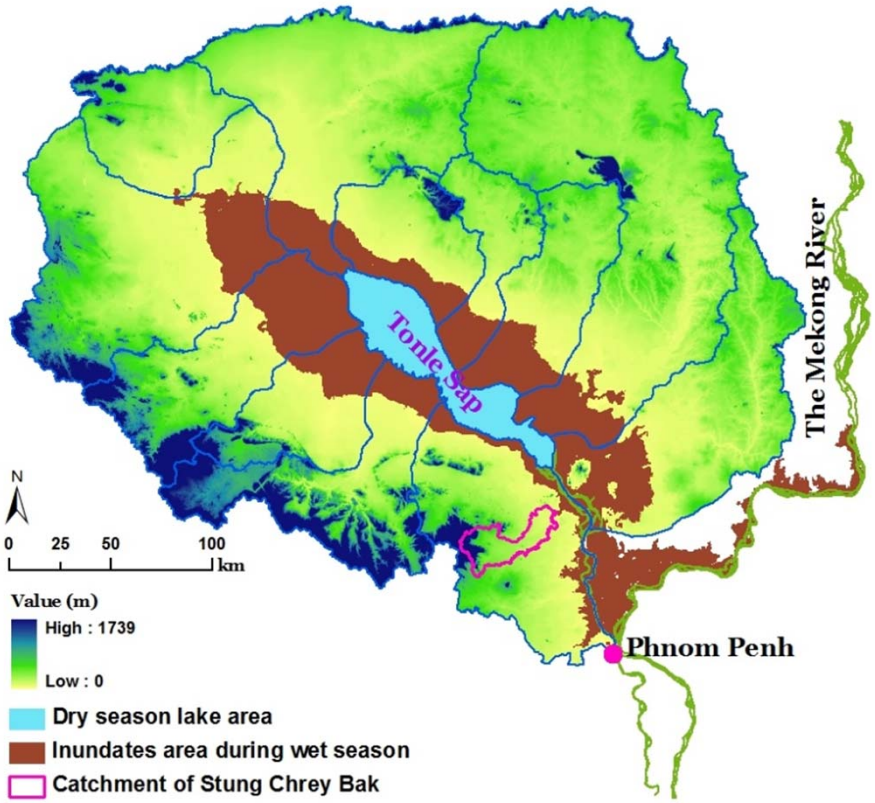
WATER RESOURCES | MODELLING|CLIMATE CHANGE | GIS-REMOTE SENSING | WATER & SANITATION

វិទ្យាស្ថានបច្ចេកវិទ្យាកម្ពុជា

INSTITUT DE TECHNOLOGIE DU CAMBODGE

Introduction & Objective

- Cambodia is one of the most disaster-prone countries in South East Asia, with its vulnerability to annual floods and droughts
- Without having an efficient water resources management system, it would be difficult to talk about food security, environment and safe future of man kind
- Understanding water availability of catchment is important for improving water resources allocation to adapt with climate change
- Strengthening the resilience of communities to help them to cope with existing challenges to their livelihoods is a must

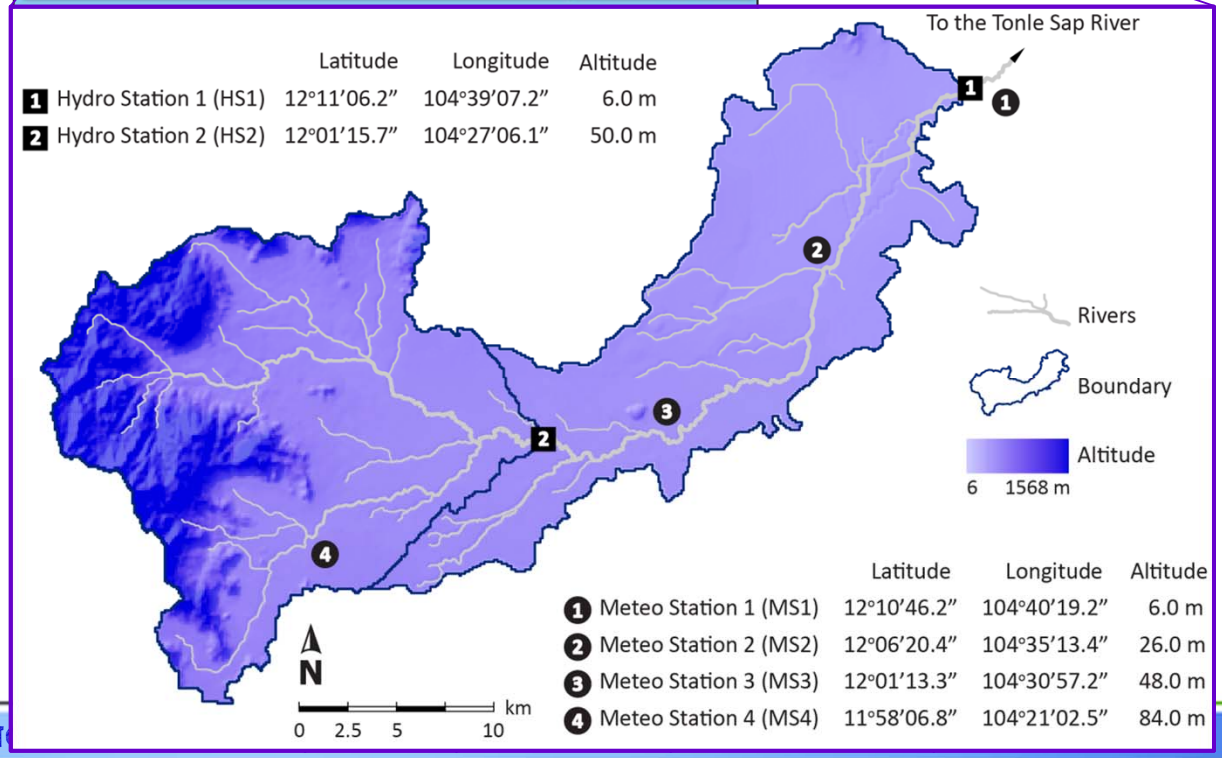


The main objective is to assess water resources and water use in Chreybak catchment: present and future

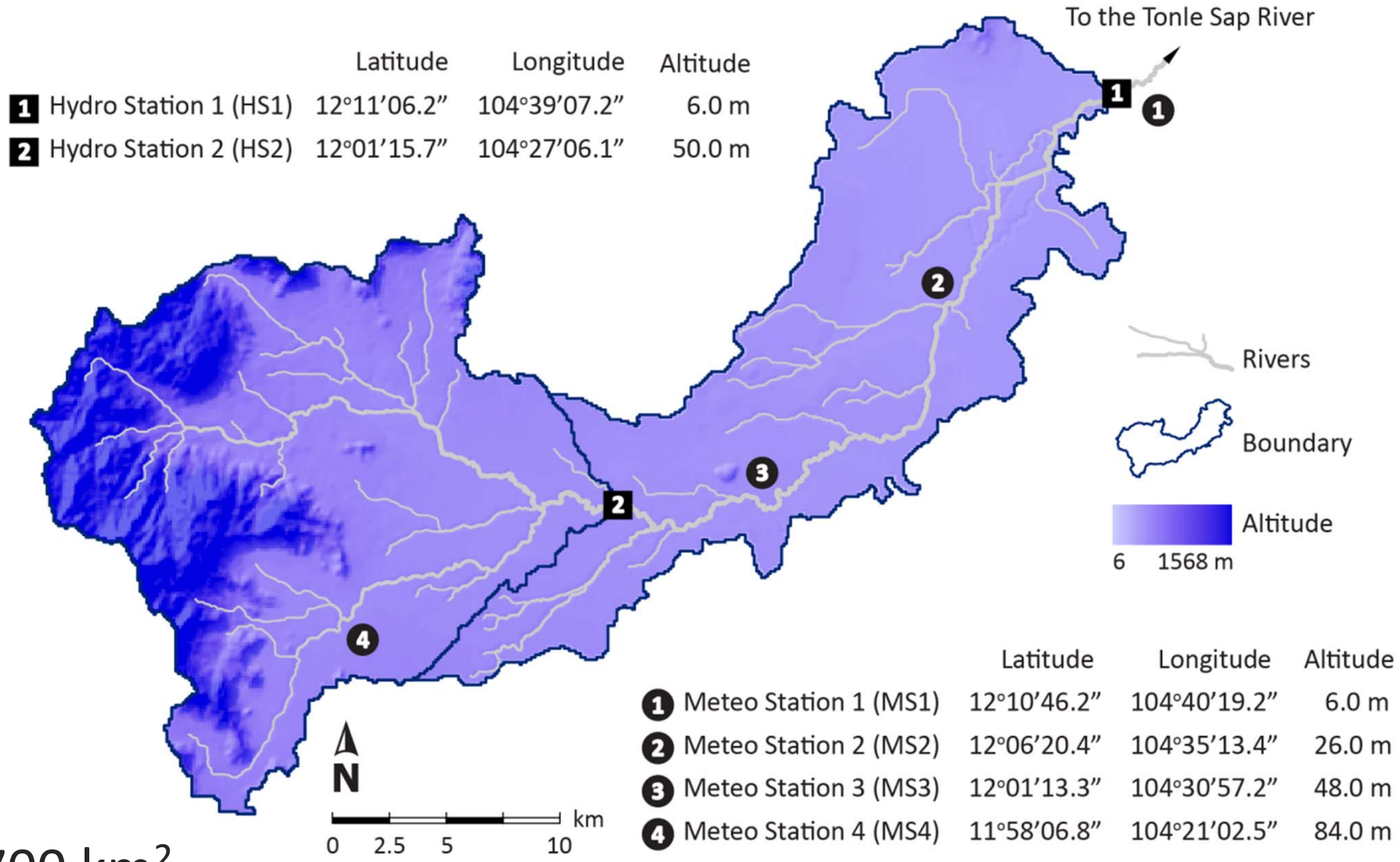
Study Area

The main **geology** dominated by ancient alluvial at the upstream and recent alluvial at the downstream with elevation ranges from **5 to 1568** meters

The **hydrology** of the catchment is governed by two contrasted patterns with water discharge starting to increase in early July and peaking in September/October. Low flows occurred from November to May.



Data Collection and Processing



	Latitude	Longitude	Altitude
1 Hydro Station 1 (HS1)	12°11'06.2"	104°39'07.2"	6.0 m
2 Hydro Station 2 (HS2)	12°01'15.7"	104°27'06.1"	50.0 m

	Latitude	Longitude	Altitude
1 Meteo Station 1 (MS1)	12°10'46.2"	104°40'19.2"	6.0 m
2 Meteo Station 2 (MS2)	12°06'20.4"	104°35'13.4"	26.0 m
3 Meteo Station 3 (MS3)	12°01'13.3"	104°30'57.2"	48.0 m
4 Meteo Station 4 (MS4)	11°58'06.8"	104°21'02.5"	84.0 m

700 km^2

Data Collection and Processing

Chrey Bak River

Hydrological station HS2 (Chiprorng)

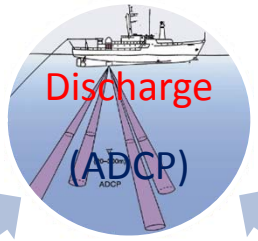
Data Collection and Processing

Acoustic Doppler Current Profiler (ADCP)

Data Collection and Processing

Current Meters

Data Collection and Processing



Flow Velocity

Height

Cross Section

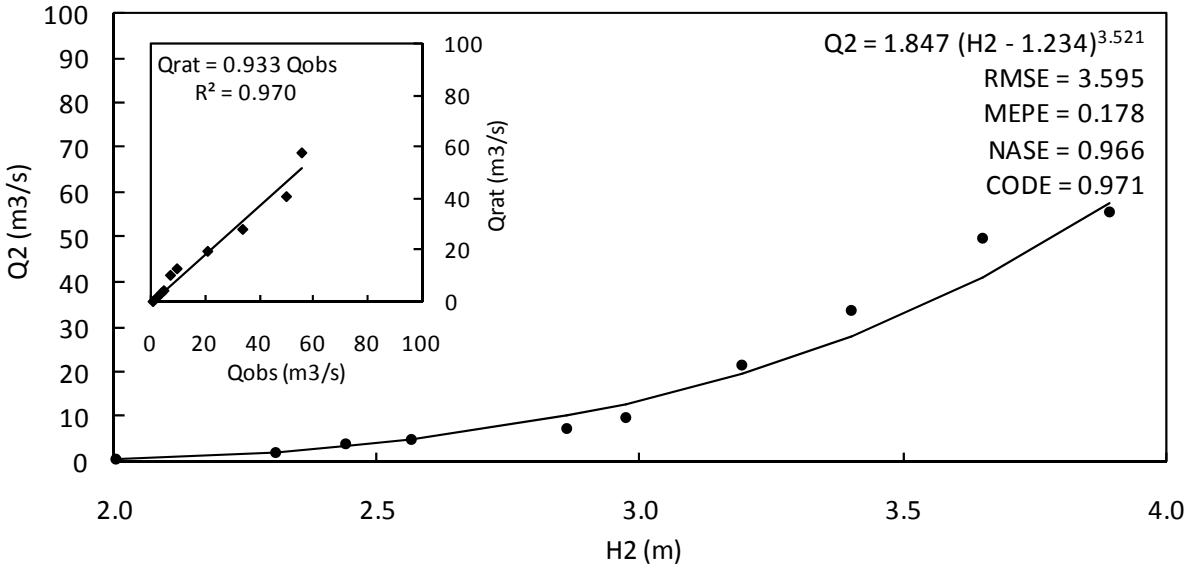
Rating Curve

$$Q_i = a(H_i - H_o)^b$$

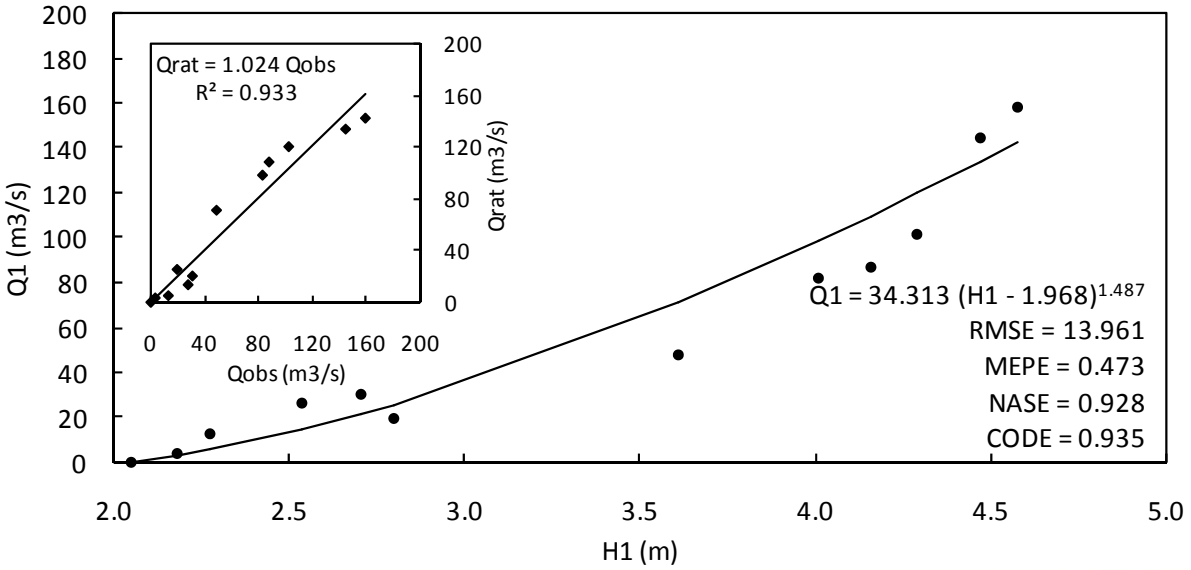
Rating Curve Analysis

Data Collection and Processing

Rating curve for HS2 (upstream station)

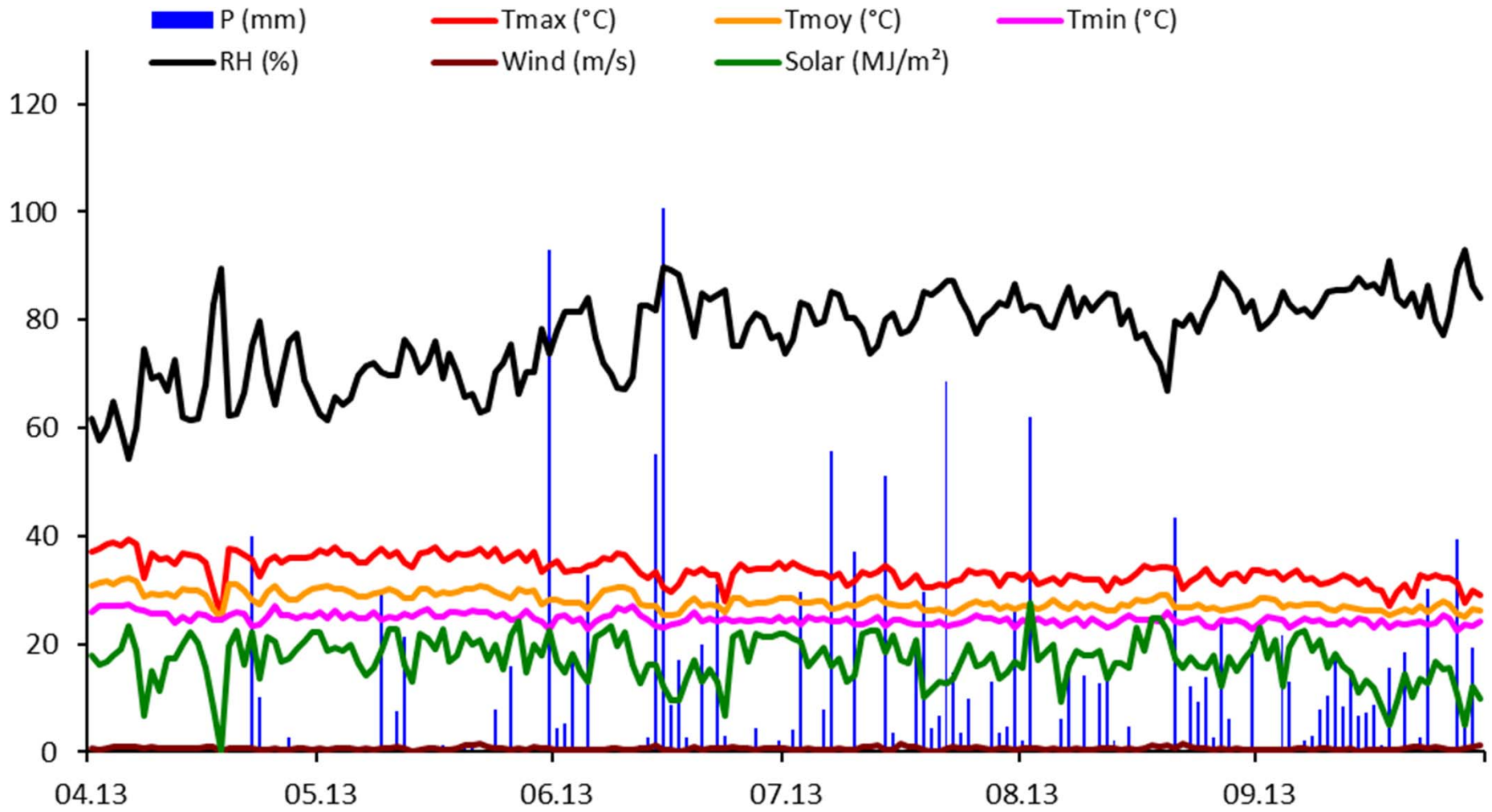


Rating curve for HS1 (downstream station)



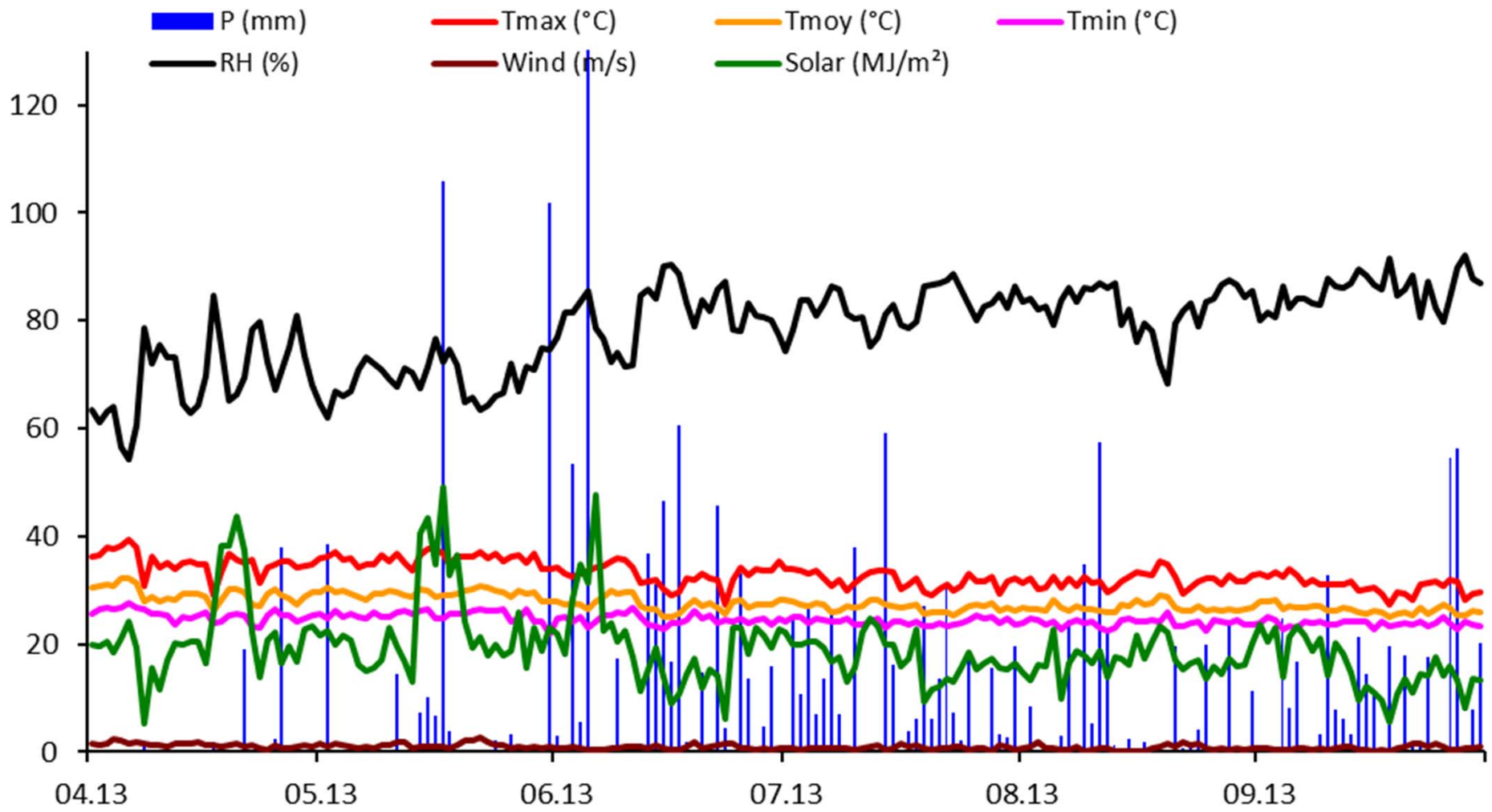
Weather Station

Data Collection and Processing



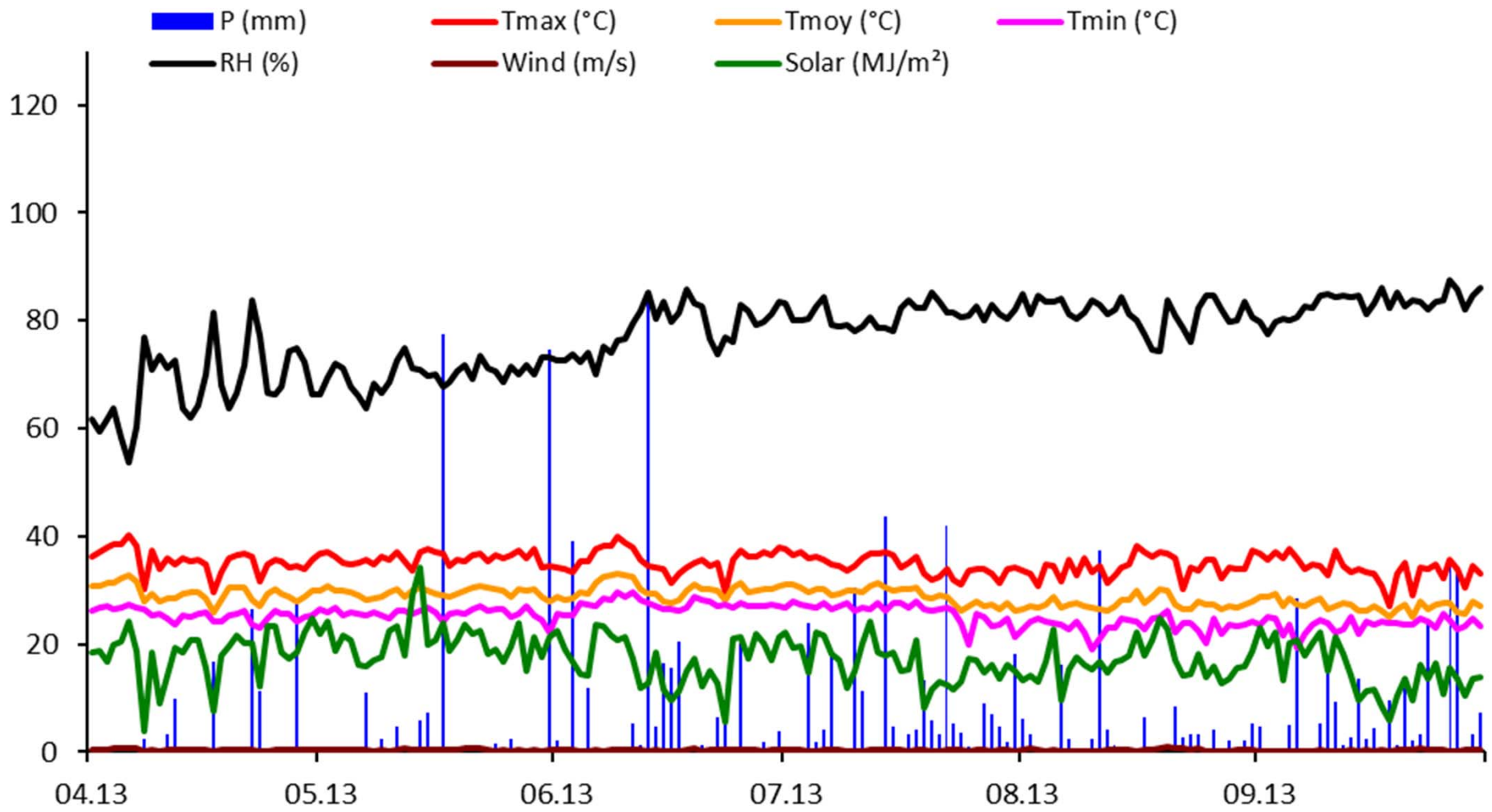
Meteo Station MS1

Data Collection and Processing



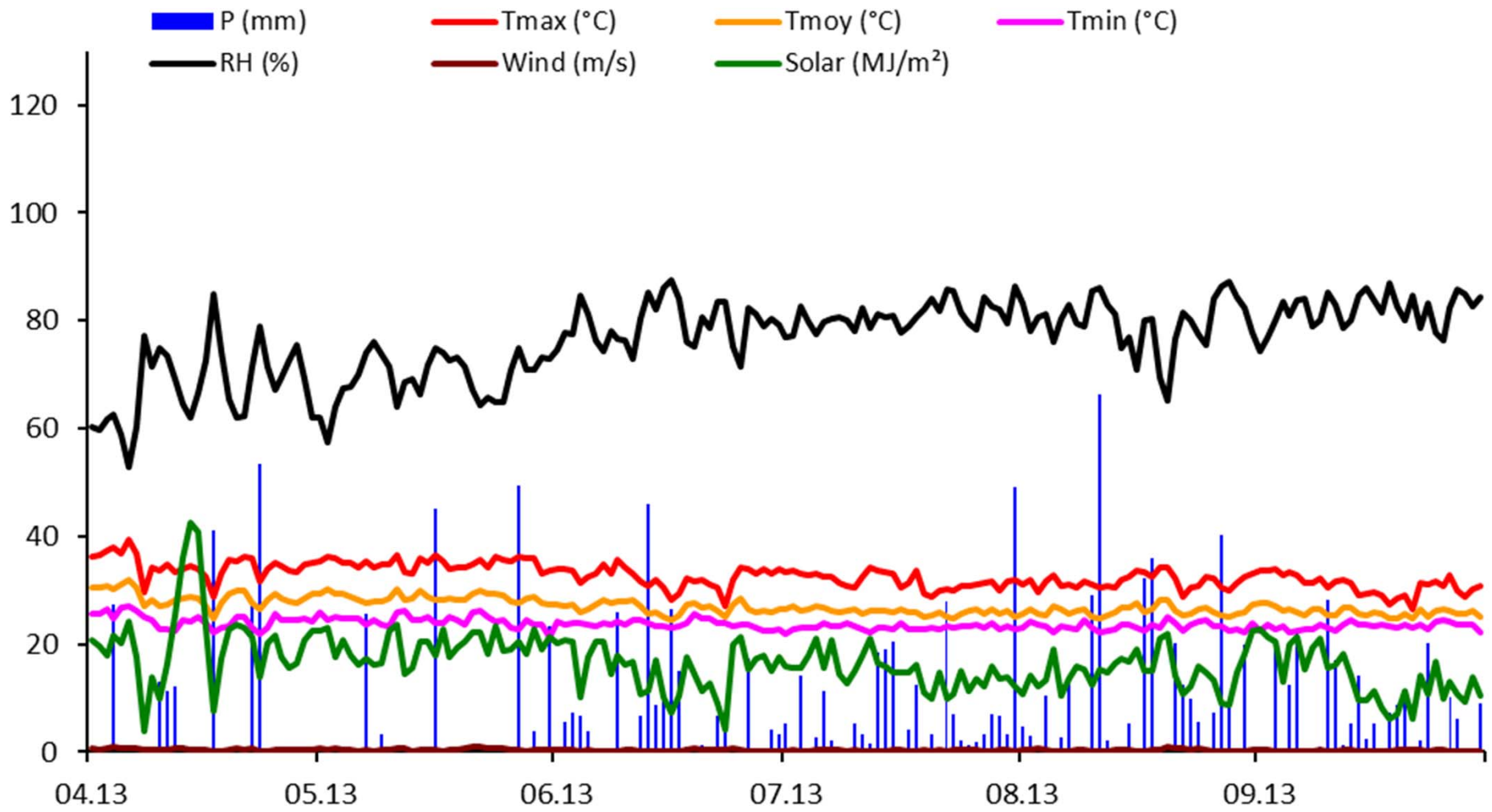
Meteo Station MS2

Data Collection and Processing



Meteo Station MS3

Data Collection and Processing

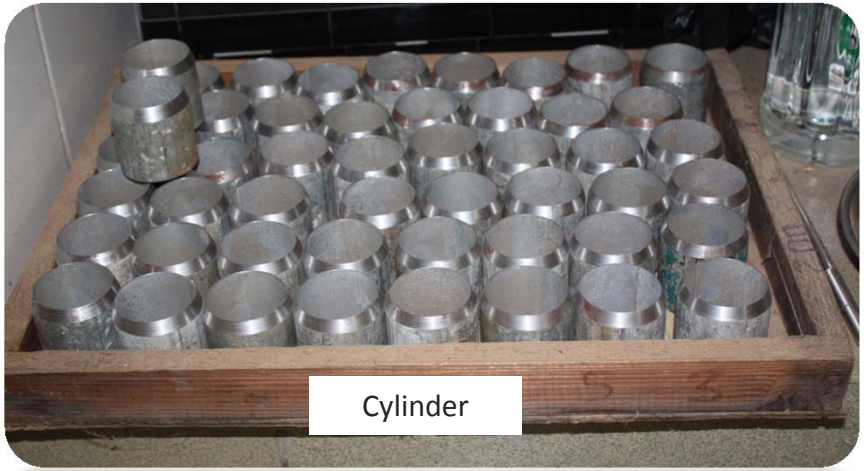


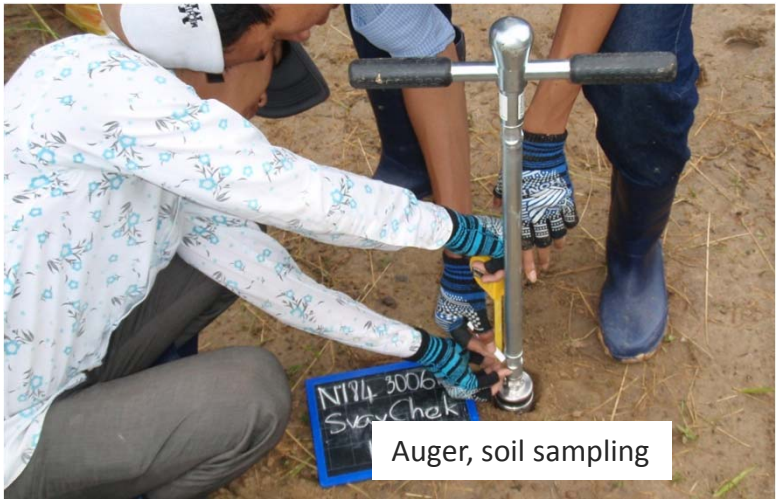
Meteo Station MS4

Data Collection and Processing

Soil Sampling

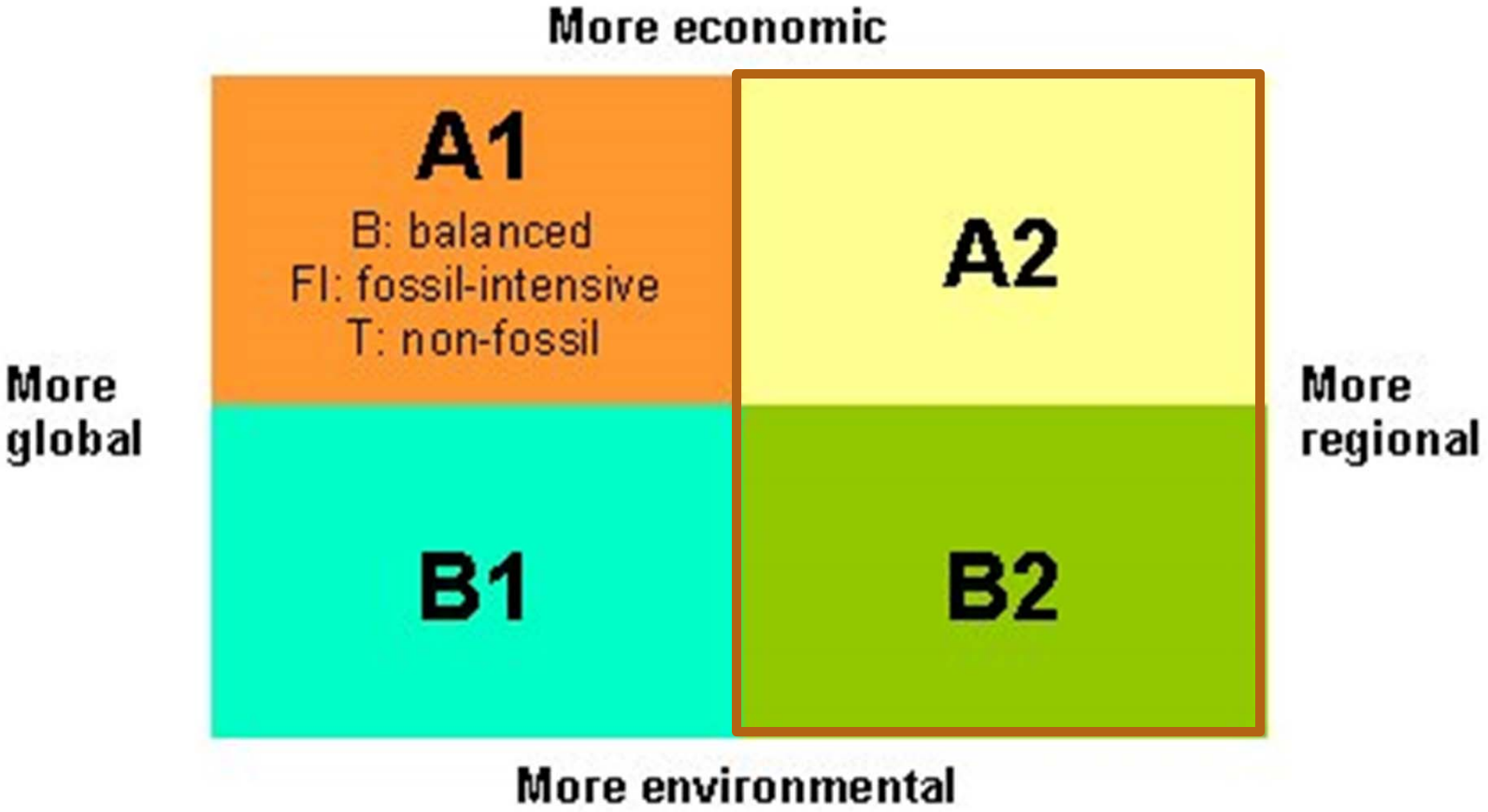

Double Rings


Cylinder

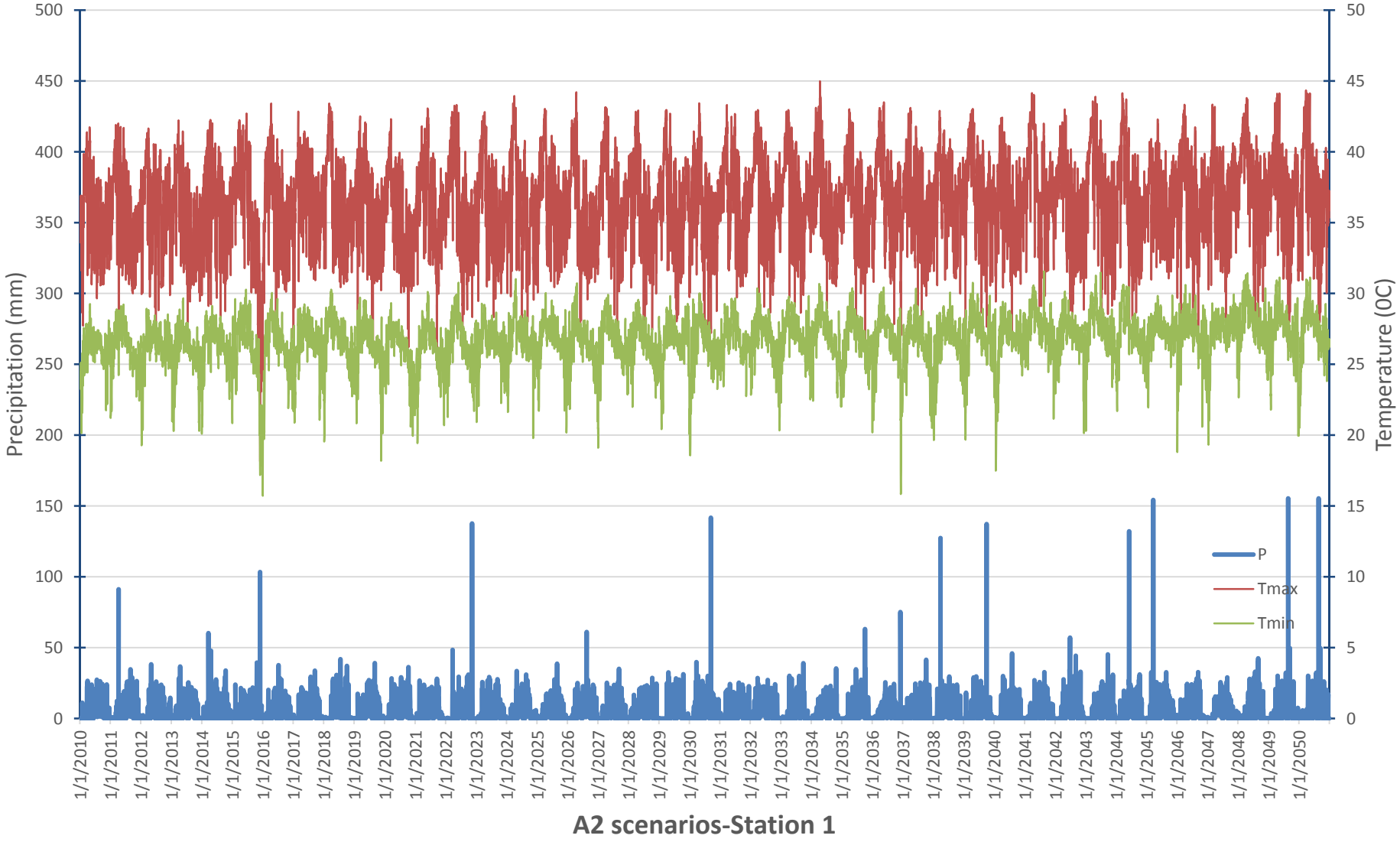

Auger, soil sampling

Climate Scenarios

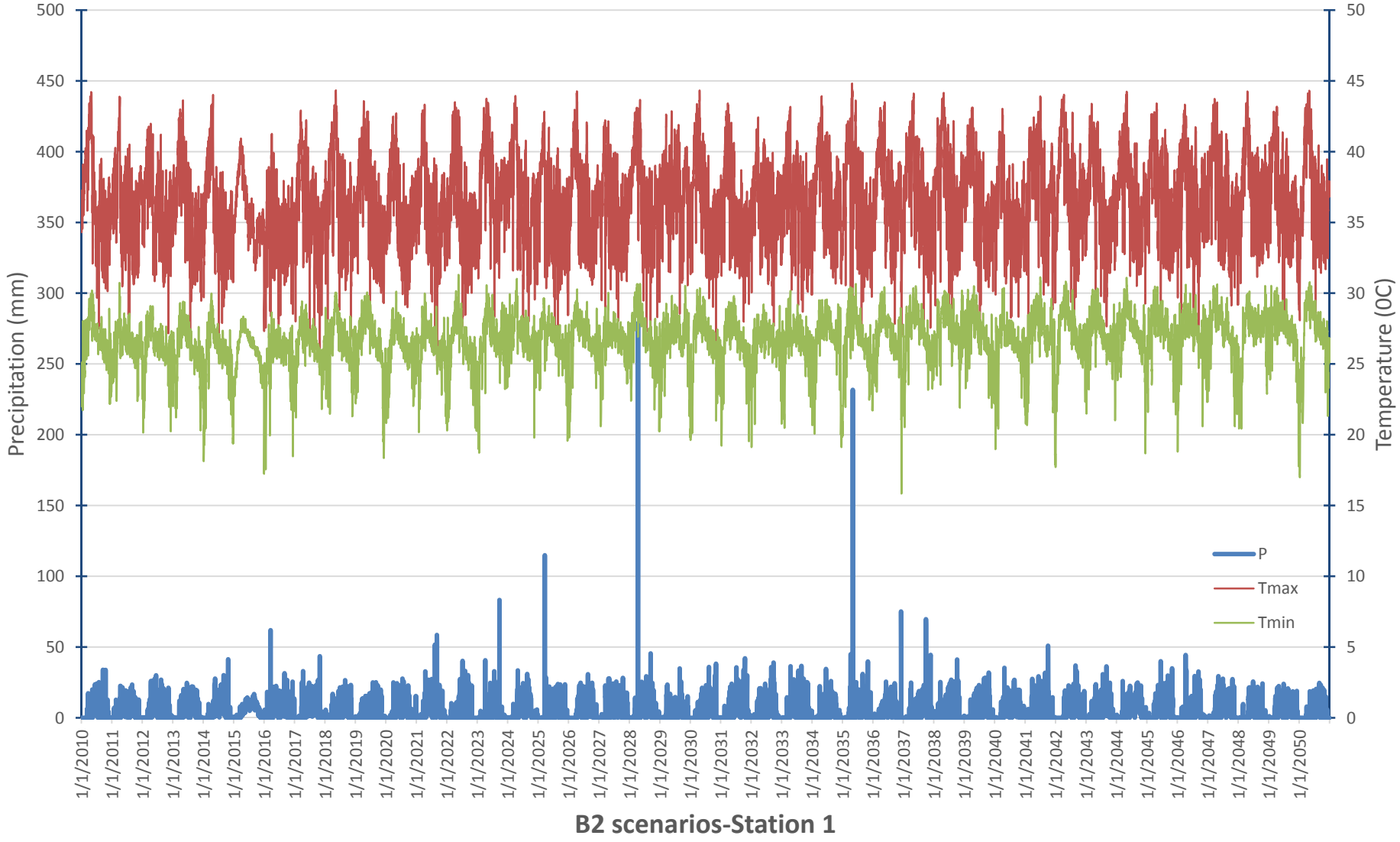
- Six scenarios groups -the three scenario families A2, B1, and B2, plus three groups within the A1 scenario family, A1B, A1FI, and A1T
- *no single most likely, "central", or "best-guess" scenario*



Climate Scenarios



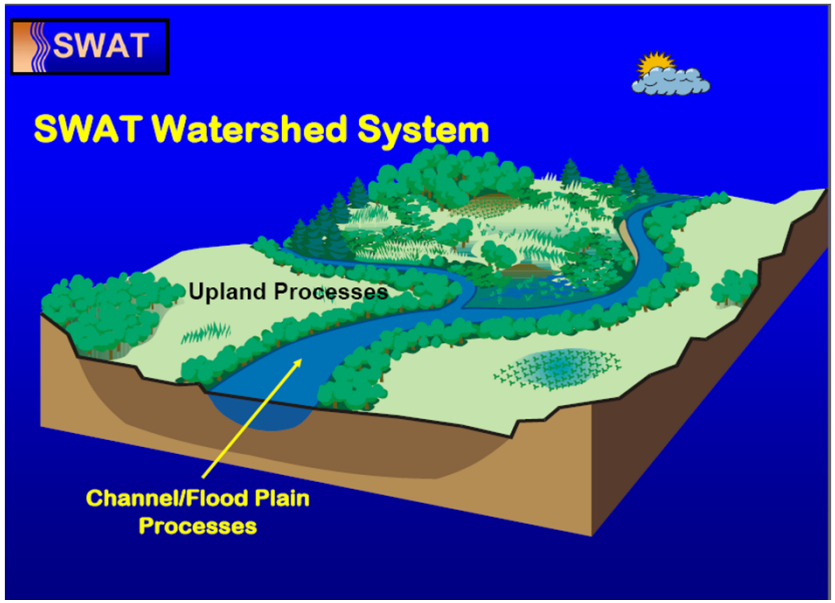
Climate Scenarios

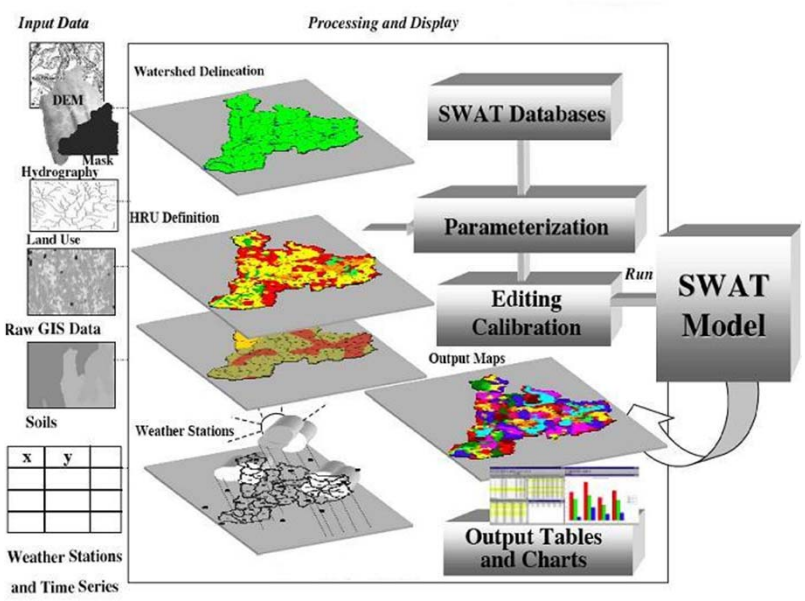


Modelling approach using the SWAT Model

- SWAT (Soil and Water Assessment Tool) by USDA

- SWAT is a physically based model developed to predict the impact of land management practices on water, sediment and agricultural chemical yields, water supply, and climate change on water resources from small to large complex watersheds with varying soils, land use and management conditions.





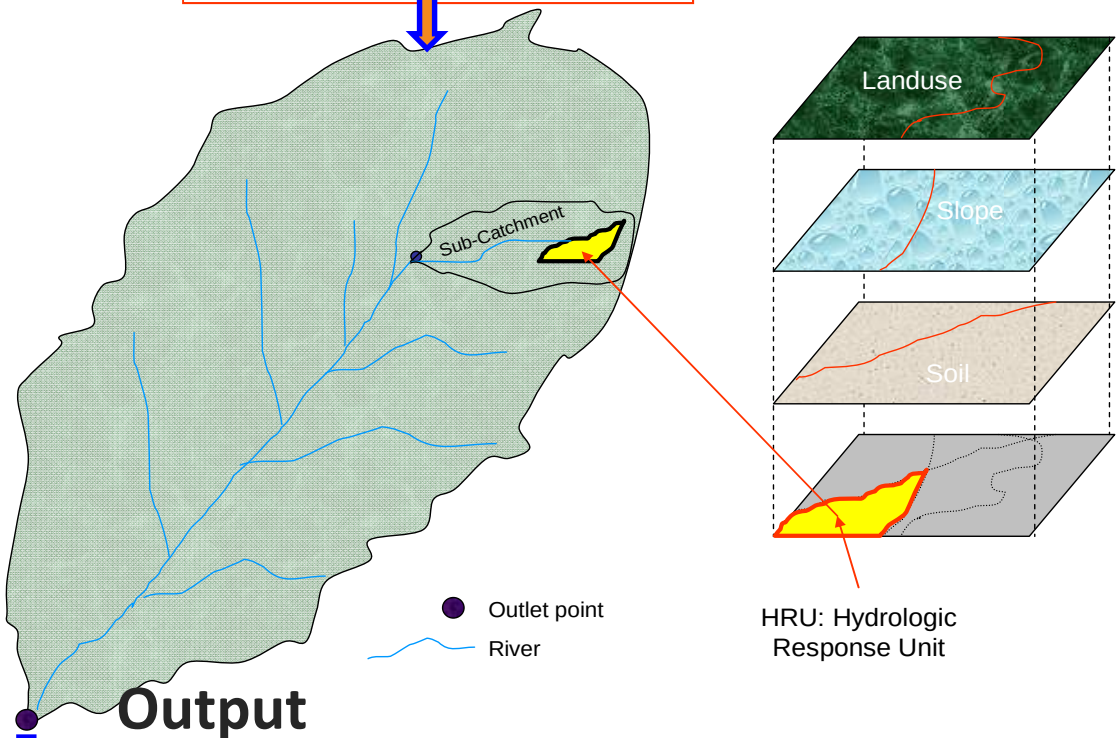
SWAT Model Data Input and Output

Input

Digital Elevation Model

Soil and Landuse data

Meteorological data



Output

Flow, Sediment,

Nutrients , Pesticides,

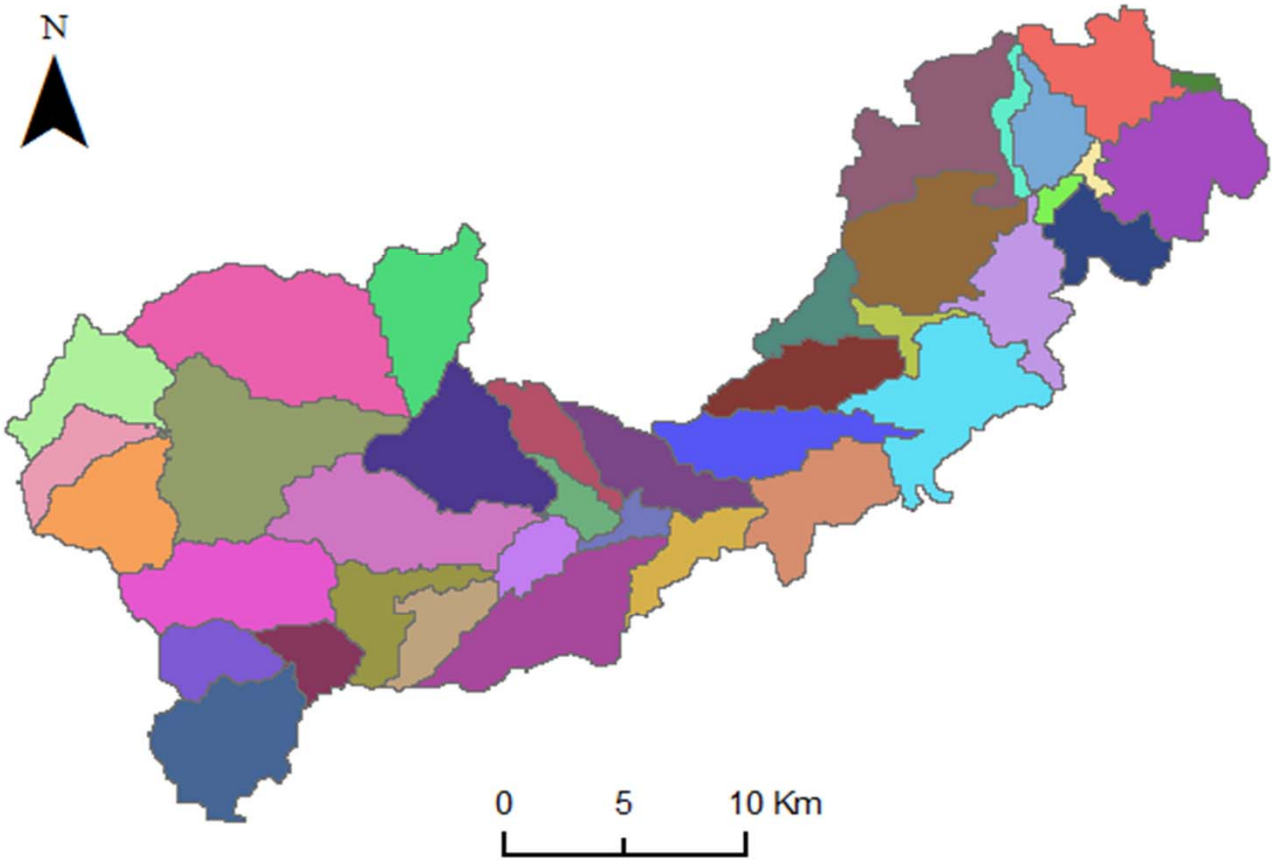
contamination bacteria

(Anual timesteps >> daily)

- Digital elevation map (DEM) from the Mekong River Commission (MRC)
- Soil map data from the Mekong River Commission (MRC) & soil properties from Oeurng et al. (2012) for the SWAT soil database.
- Landuse data obtained from Japanese International Cooperation Agency (JICA) and reclassified for SWAT input.
- Meteorological data included 4 rainfall stations which have a complete measurement of daily minimum and maximum air temperature, wind speed, solar radiation and relative humidity (June 2010 to November 2013)

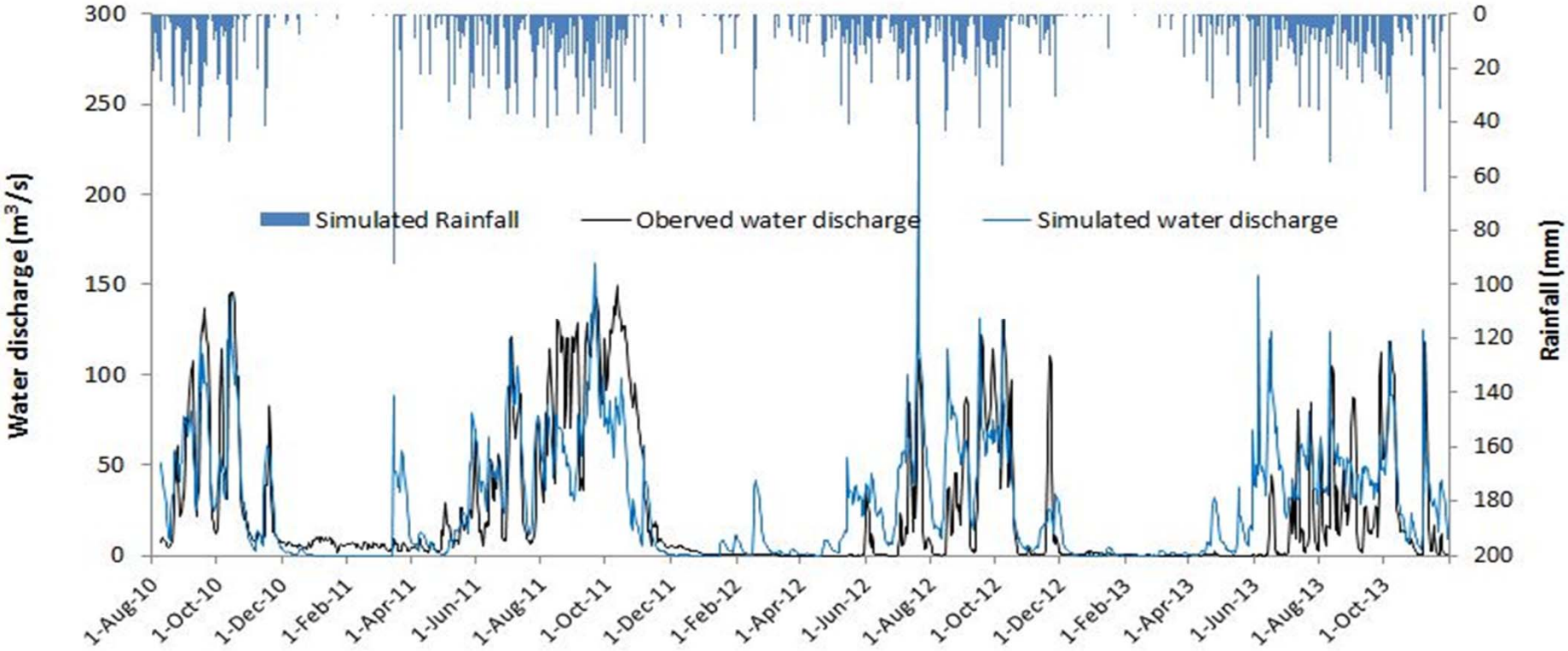
Basin and sub-basins

The catchment was discretised into 40 sub-basins with multiple landuse and soil classification.

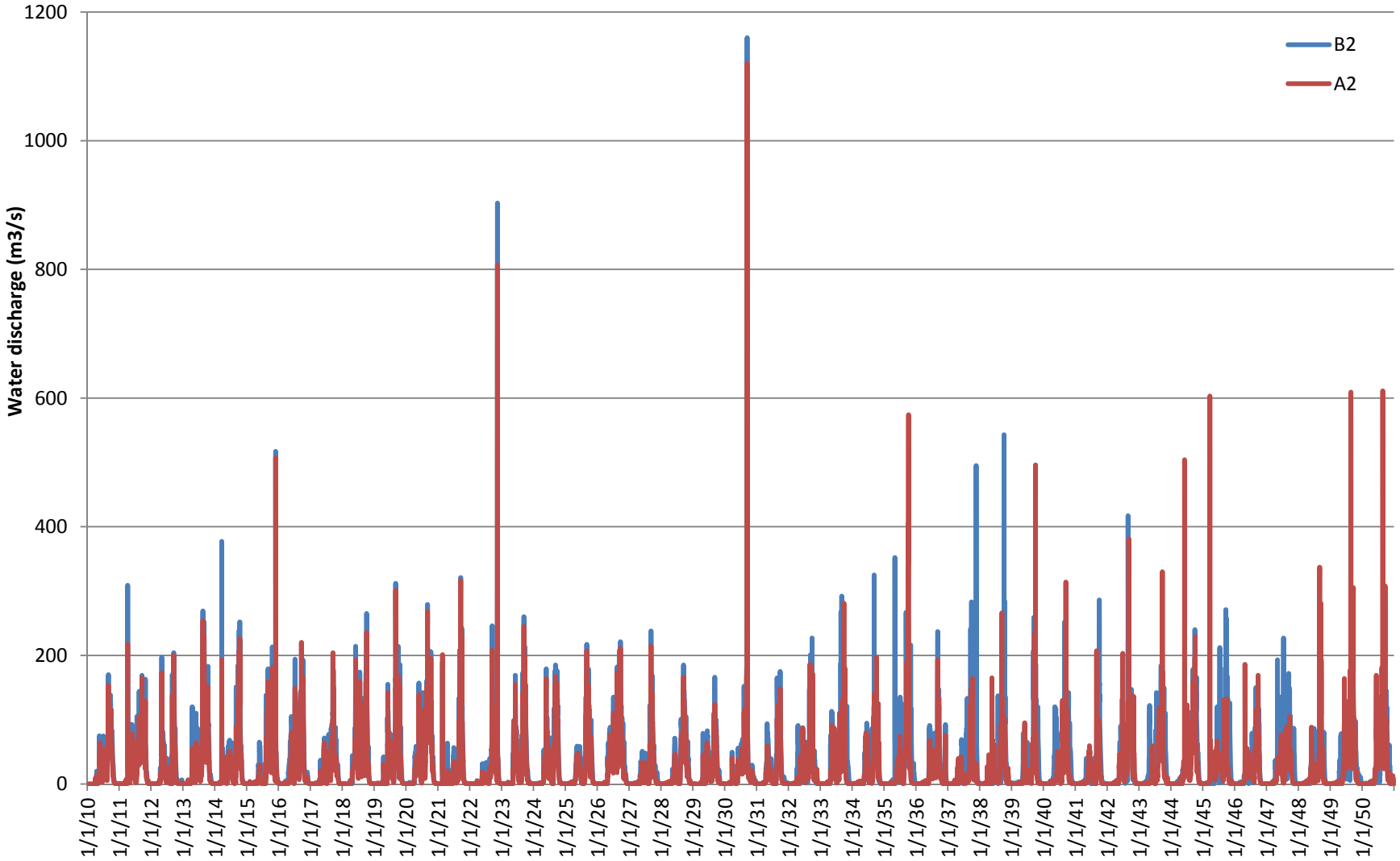


Results

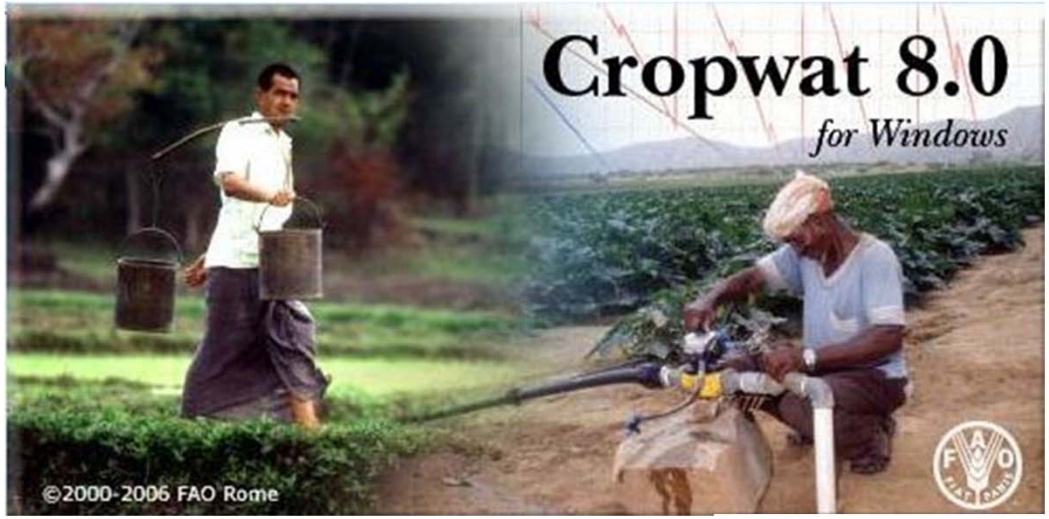
Observed and simulated daily discharge at Chreybak catchment outlet (baseline)



Projected water discharge by SWAT

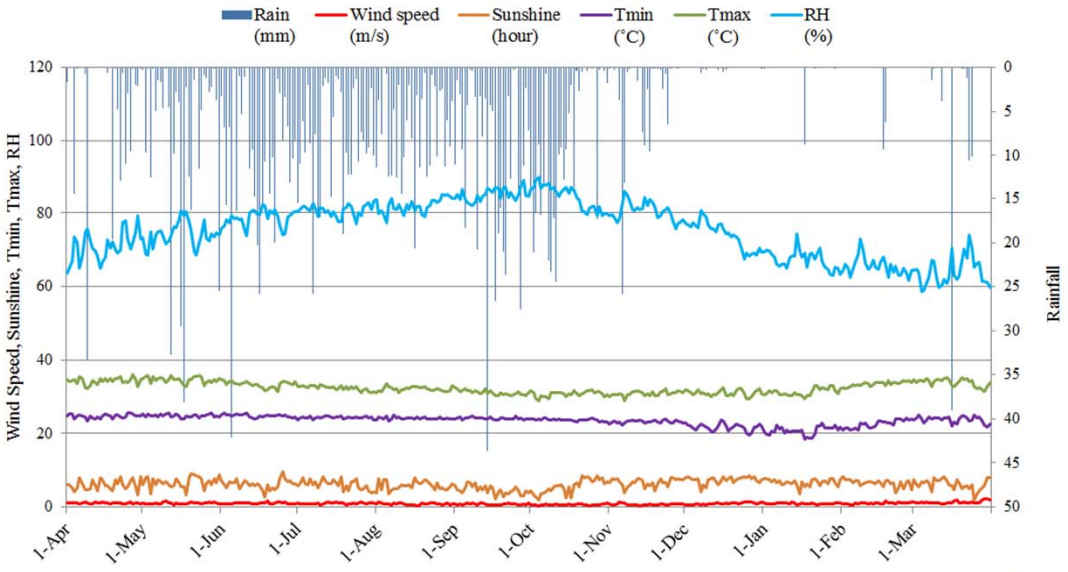


Crop water requirement modelling



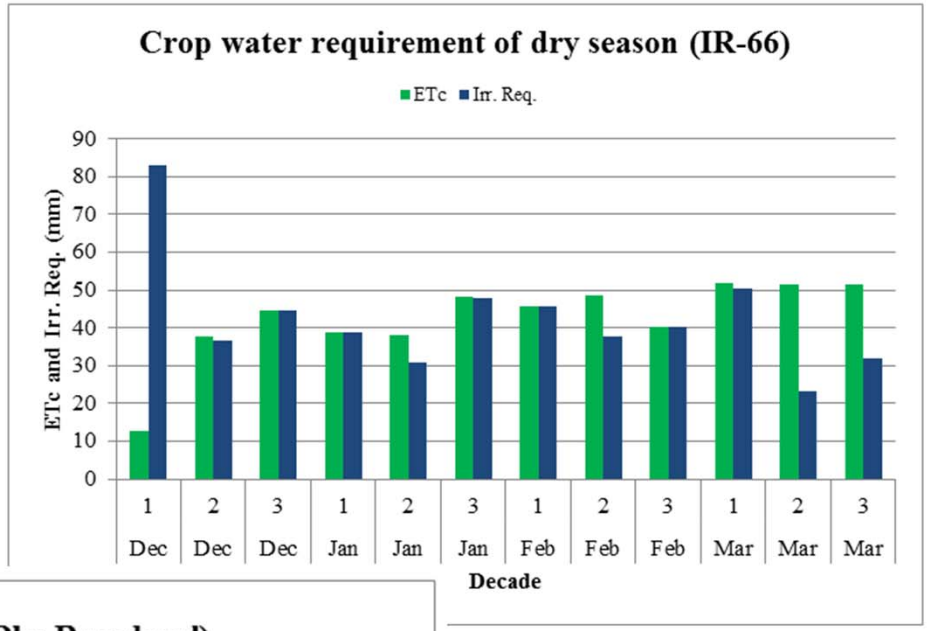
- **Input data**
  - Climate/ETo data
  - Rain data
  - Crop data
  - Soil data
- **Output data**
  - Crop water requirement & Irrigation requirement
  - Irrigation Schedule

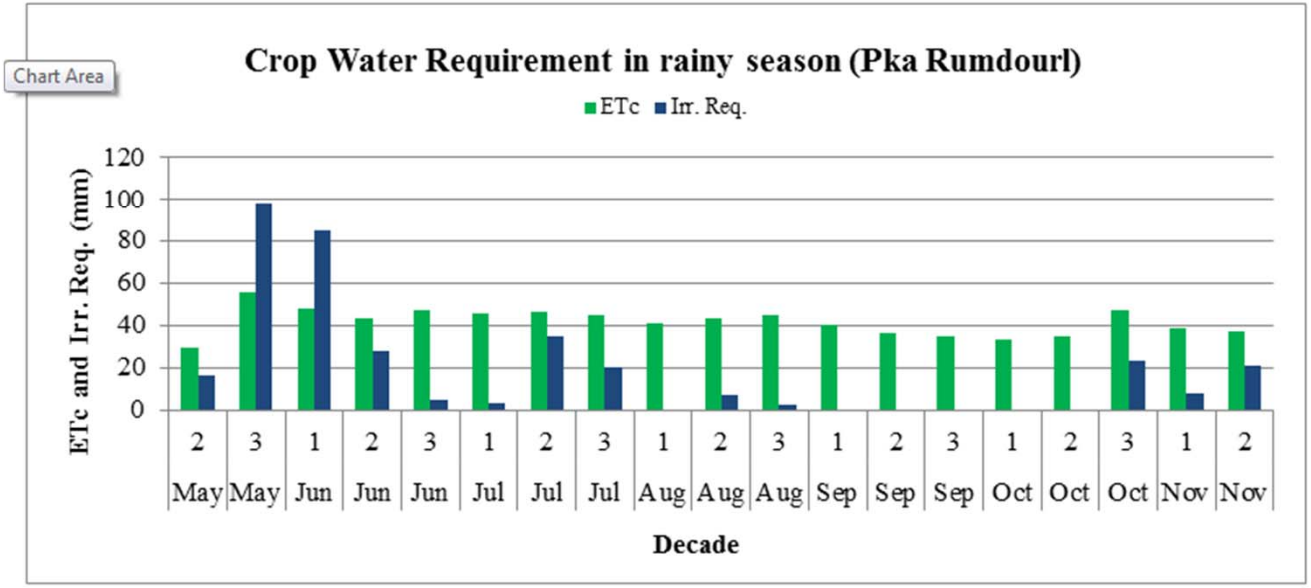
❖Meteorological Data of **WS3**$_{\textbf{average}}$ from 2010-2013 (Ly S., 2013)



Crop water requirement modelling

CropWater Requirement modelled by CROPWAT (baseline)





Next Steps…

- Assessing future water catchment availability for climate change scenarios
- Identification of scheme water use demand for future through existing irrigation scheme

Scheme N⁰	Name of Scheme	Irrigated Area(ha)	Type of Irrigation	Irrigation Structure	Main Crop grown
Scheme 1	Pok Paen	621	Diversion	Weir	Rice
Scheme 2	Antreut	335	Diversion	Weir	Rice
Scheme 3	Trapeang Khlong	926	Diversion	Weir	Rice
Scheme 4	Svay Chek	1800	Diversion	Weir	Rice
Scheme 5	Tang Krasang	5620	Diversion(small reservoir)	Spillway, Weir	Rice
Scheme 6	Chrey Bak	455	Diversion	Weir	Rice
Scheme 7	Trapeang Trabek	610	Diversion	Weir	Rice

Implications

- Improve water use efficiency for irrigation to adapt with climate change
- Develop water use regulations and water governance
- Sustain river flow for ecological functions during dry season
- Manage floods and droughts for livelihood improvement


Thank
You