

# Use case of GSMap and GSMap-IF for Flood Management

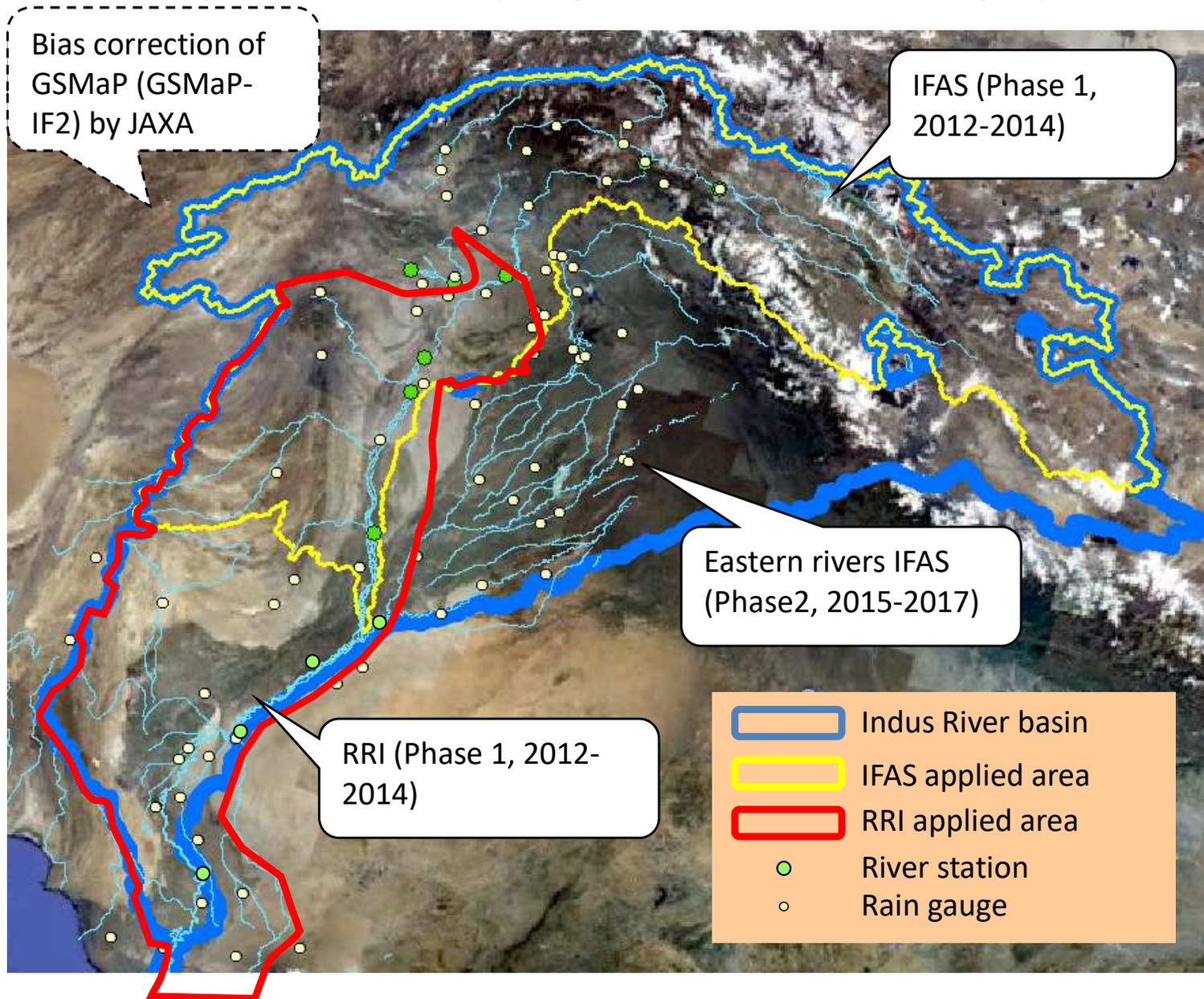


11 February 2026 Millennium Airport Hotel Dubai, UAE

TSUDA Morimasa

 **Japan Water Agency** (JWA)

# Challenges in developing Flood forecasting system (Indus River basin)



Phase 1  
(2012-2014) :

Model in main river  
(Indus-IFAS)  
GSMaP-IF2 (by JAXA)  
Capacity building

Phase 2  
(2015-2017) :

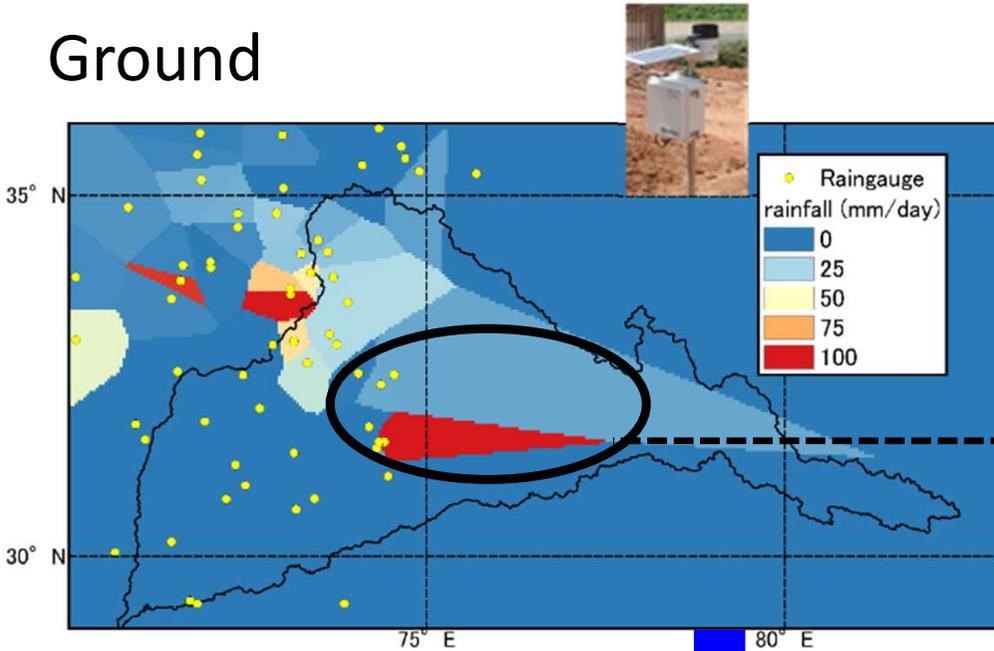
Eastern rivers model,  
snowmelt model,  
Integrated interface,  
ADCP observation  
Capacity building

**Rainfall uncertainty:** Insufficient rain gauge network

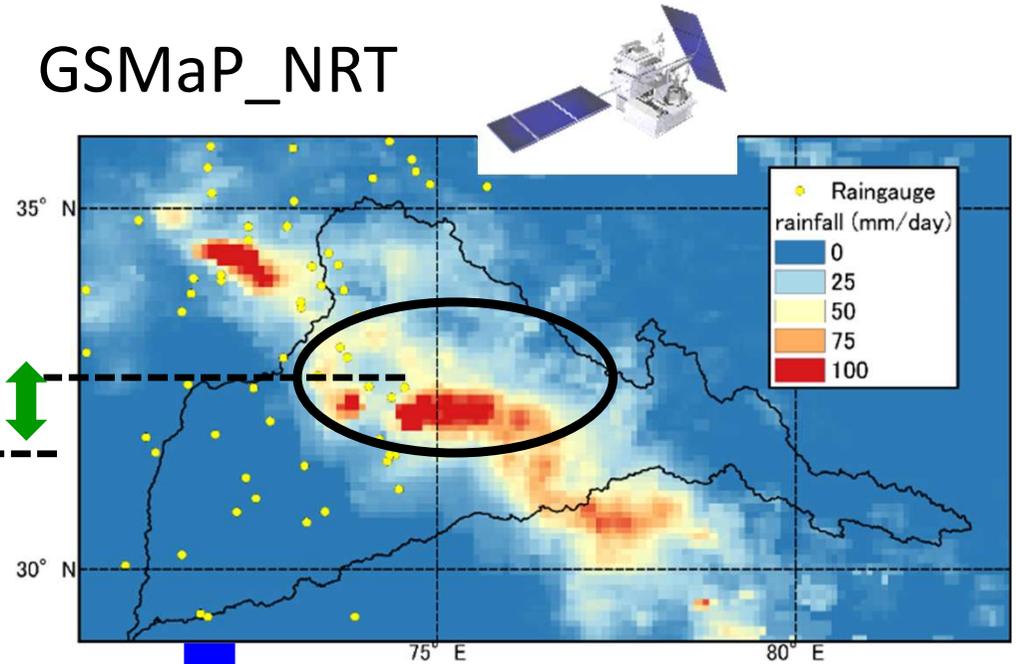
**Hydrological Modeling:** Snow/glacier melt, Insufficient Information(Cross section, soil data)

# Bias correction of Satellite Precipitation(GSMaP)

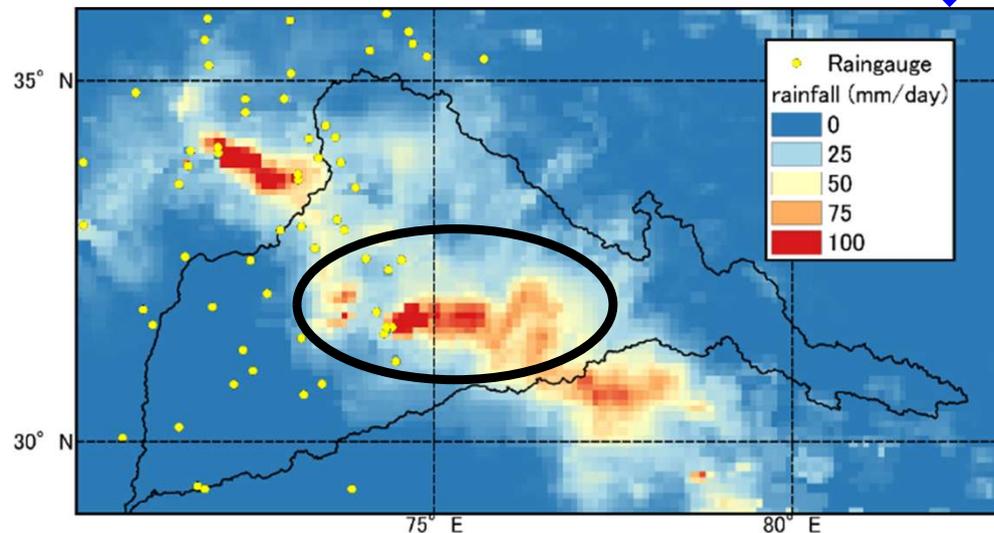
Ground



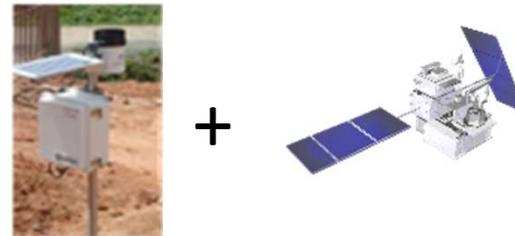
GSMaP\_NRT



Corrected GSMaP (GSMaP-IF)

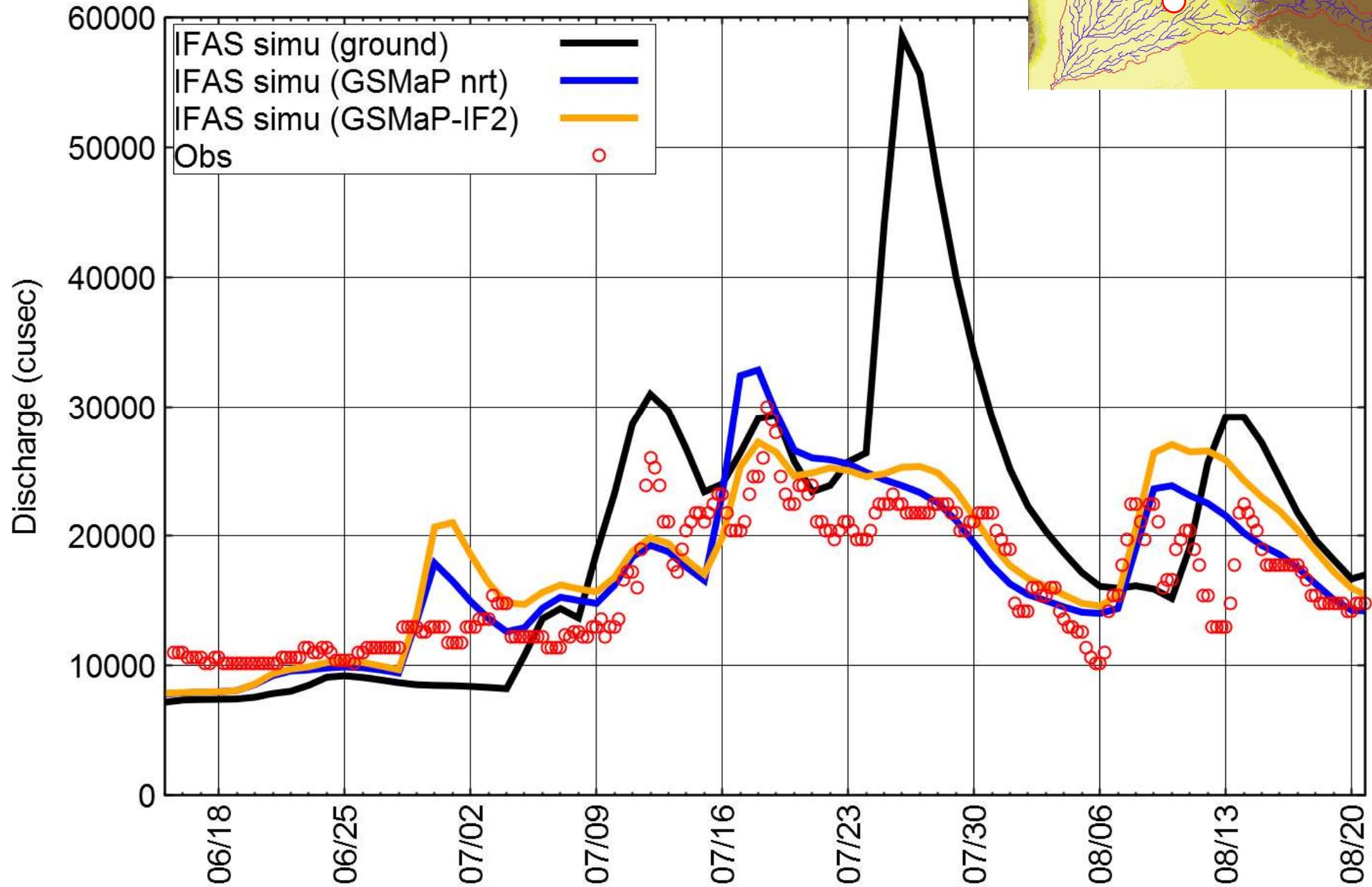


Bias correction (GSMaP-IF)



GSMaP: Global Satellite Mapping of Precipitation by JAXA

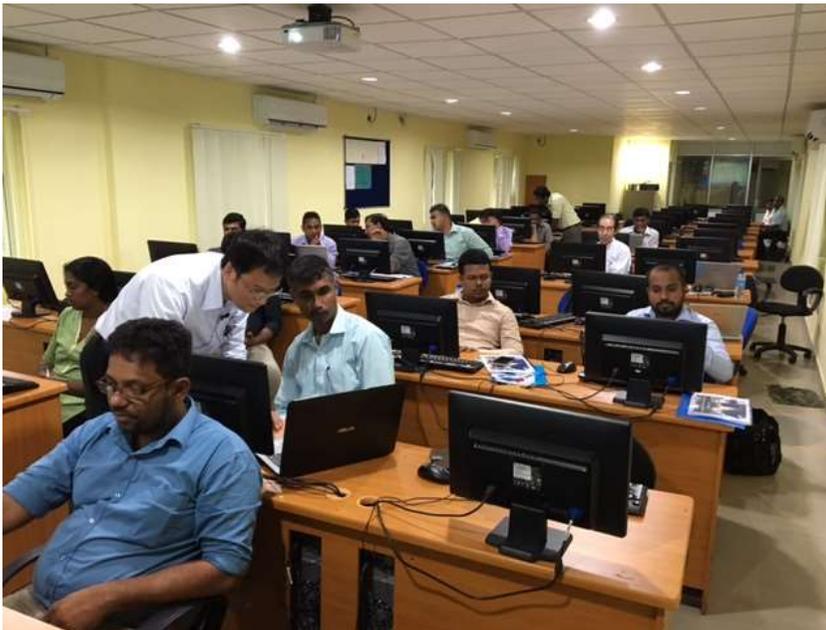
# Simulation result by IFAS with GSMaP-IF2 (2015, Shahdra)



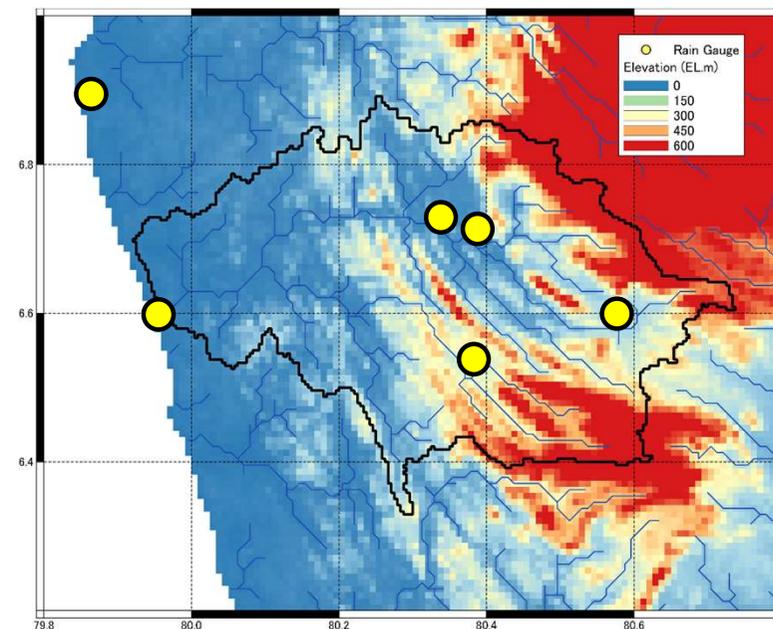
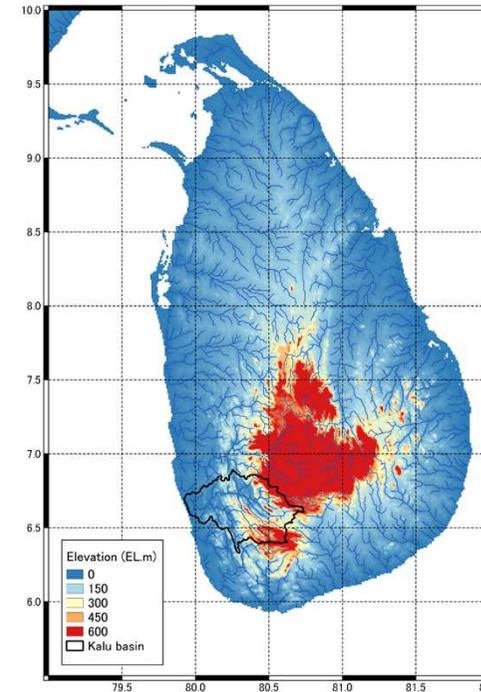
# Application of GSMaP-IF2 in SAFE prototyping project

\* SAFE (Space Applications for Environment)

“Developing and Implementing an Operational Prototype for Advanced Flood Forecasting, Early Warning, and Data Sharing System in the Kalu Ganga Basin, Sri Lanka”  
(2015 Dec – 2017 Dec)



2016 August 22-24, GSMaP bias correction training, Sri Lanka irrigation department



# Prototype of automated bias correction and flood forecasting

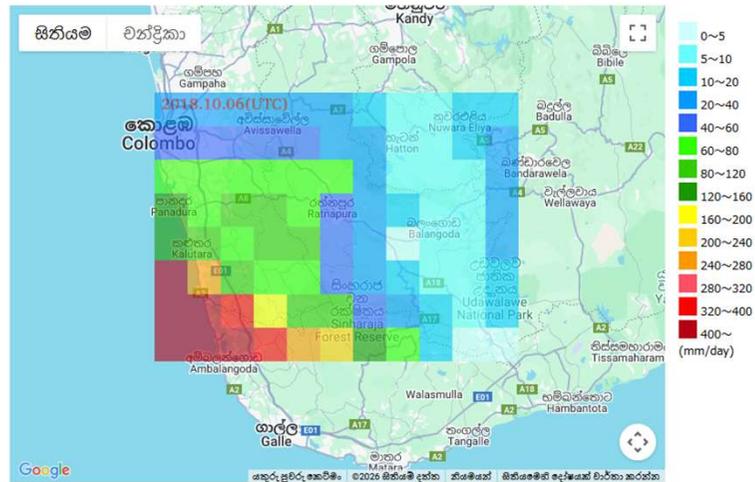
## Flood Forecasting for Sri Lanka



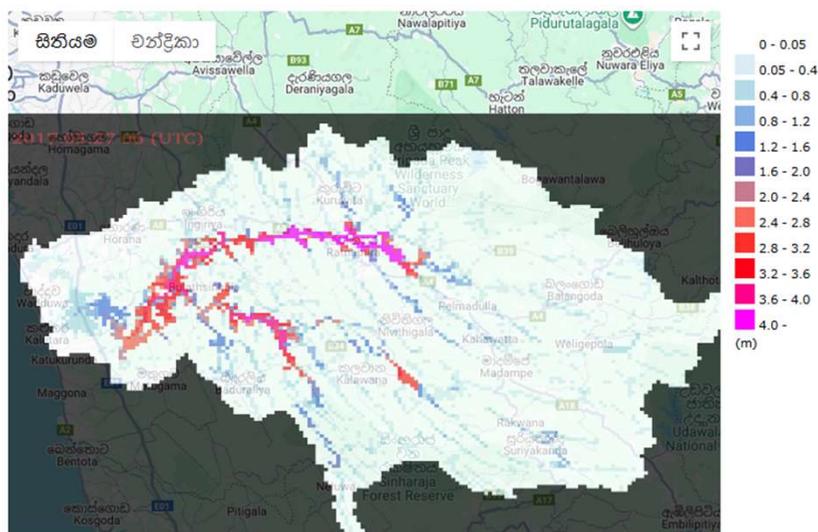
- HOME
- Insitu Data
- Satellite Data
- Corrected Rainfall Map
- Rainfall Prediction
- Flood and Inundation

Home -> Corrected Rainfall Map -> GSMaP Bias Correction (Kalu Basin, From 2017/05/20)

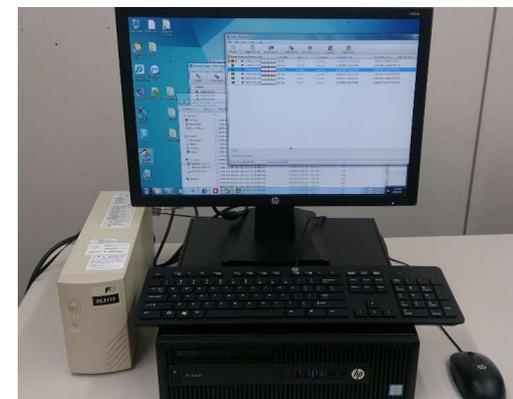
GSMaP Bias Correction (Kalu Basin, From 2017/05/20)



Depth of Inundation (Kalu Basin, 2017/05/22-31)



Real-Time Rainfall Data Receiver at ICHARM (Hourly)



Auto process of GSMaP-IF on Linux base system

# GSMaP Bias correction for MRC (Mekong River Commission)

Project Name : Deploying GSMaP for decision support in transboundary catchment in the Lower Mekong Basin

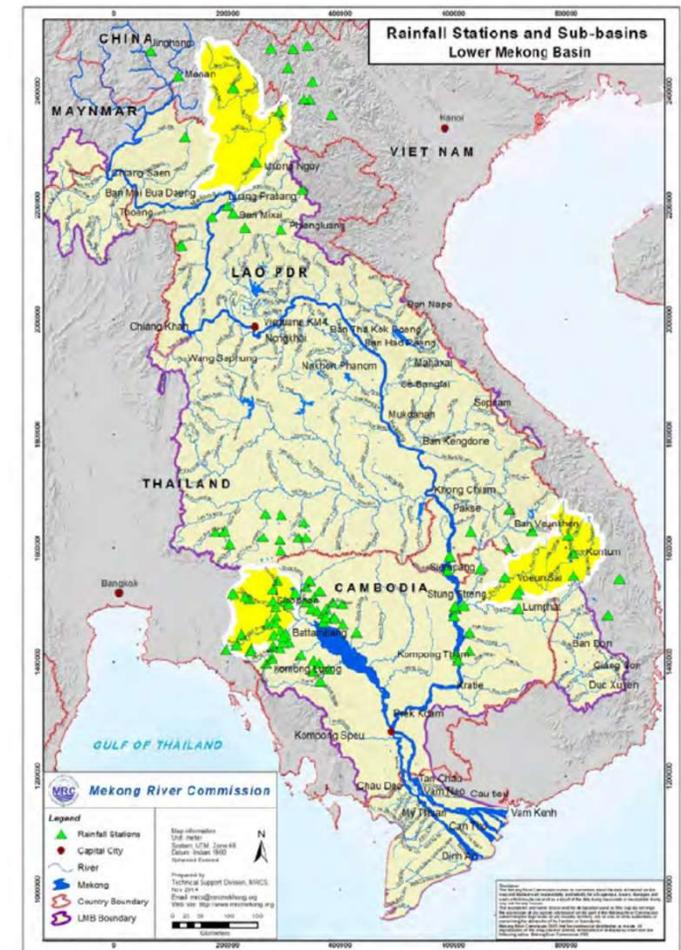
Executor : Mekong River Commission (MRC)

Term : 2014 Sep ~ 2017 May

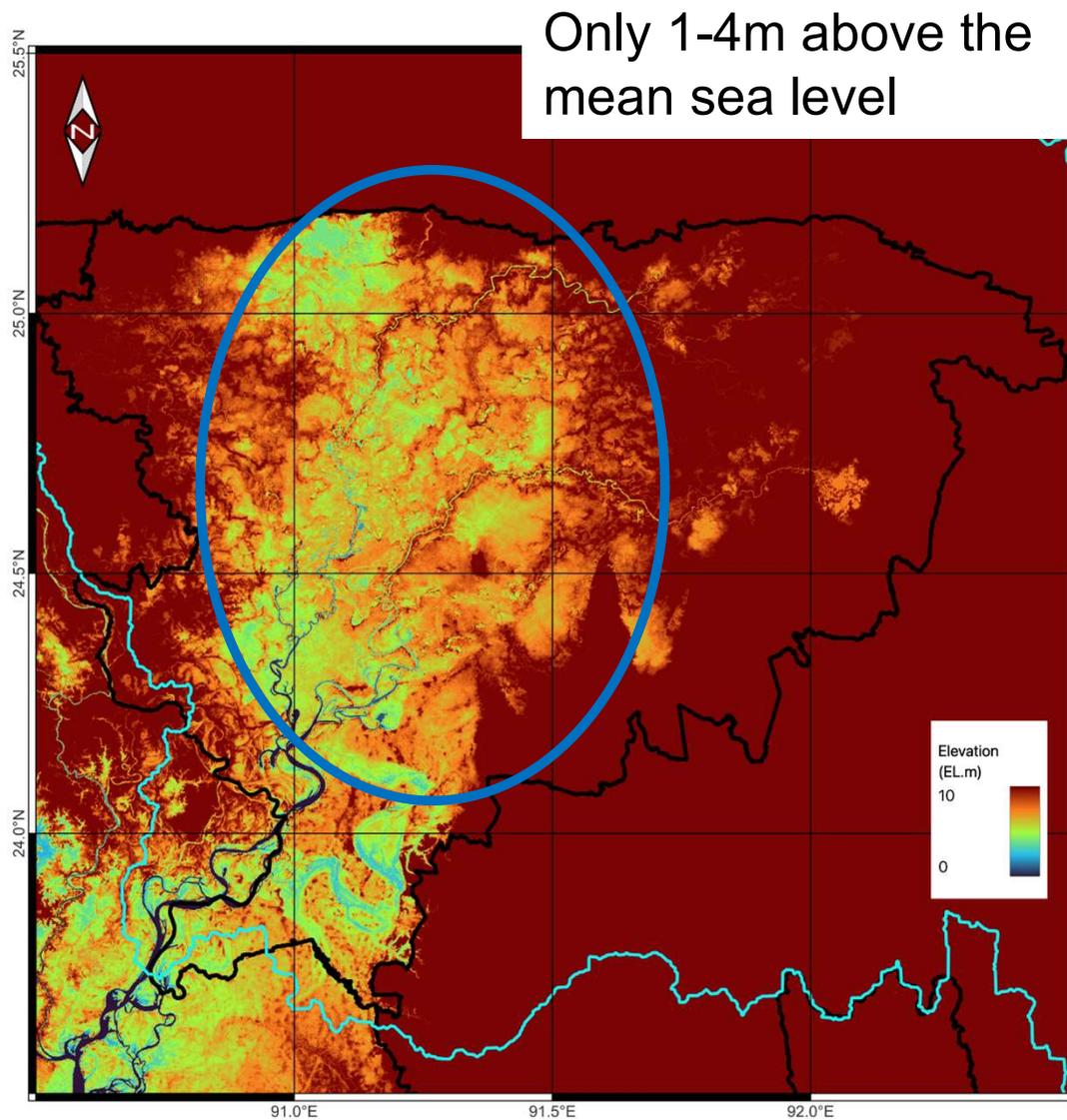
Technical supporters : AIT, ICHARM, FRICS



May 19-20, 2016



# Haor region at North Eastern Bangladesh



Wet Season

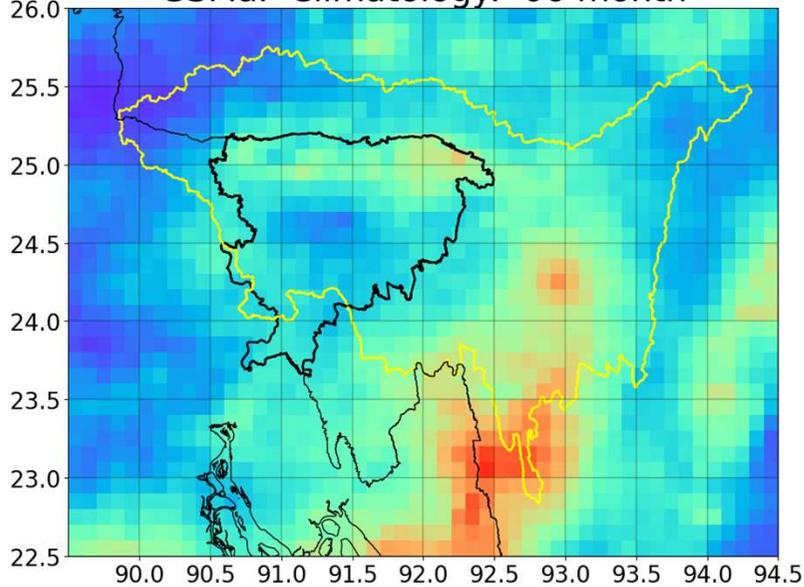


Dry Season

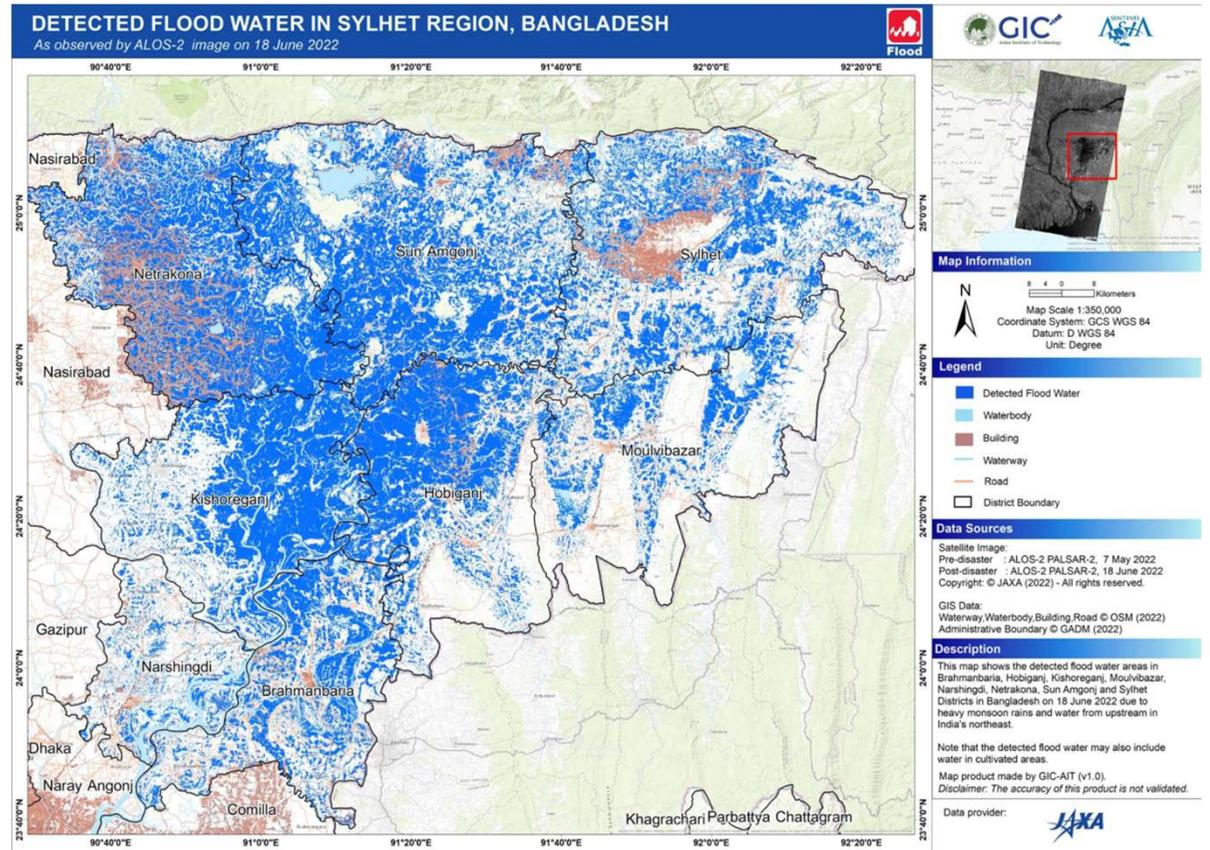
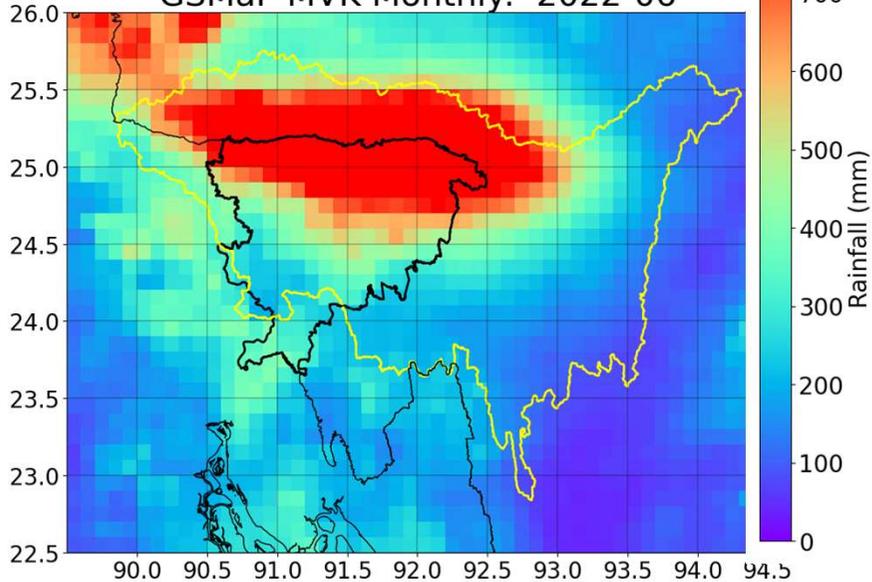


# 2022 Monsoon flood in Haor area

GSMaP Climatology: 06 month



GSMaP MVK Monthly: 2022-06



JAXA ALOS2 image

# Discussion in Bangladesh to use GSMap for flood forecasting

Training session (November 2023)



Discussion with BWDB (May 2025)



Field visit with Kagawa University team

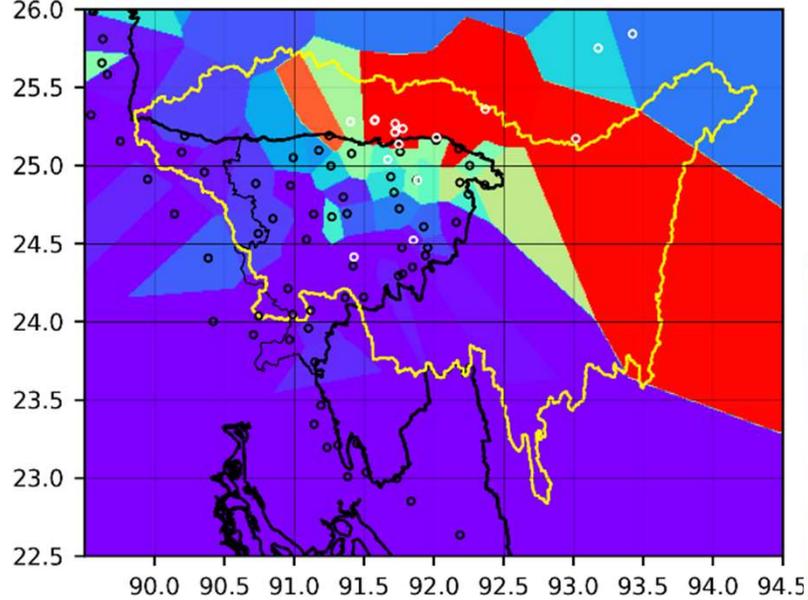
# Cloud object based algorithm (GSMaP-IF4)

## Appendix 1. Methodology

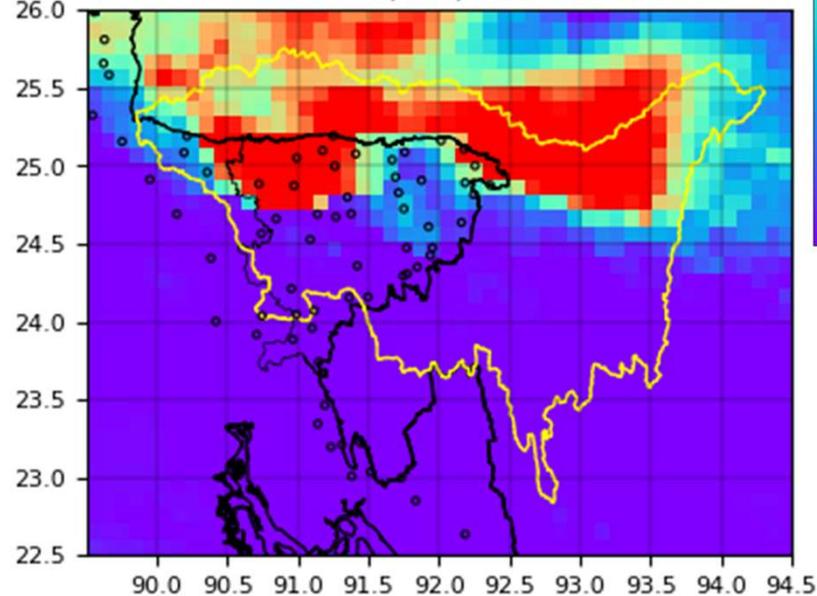
### Cloud object based algorithm

The correction parameters are set for each rain-clouds of GSmAP based on segmentation. The rainfall correction coefficient is calculated for each segmented rain-cloud.

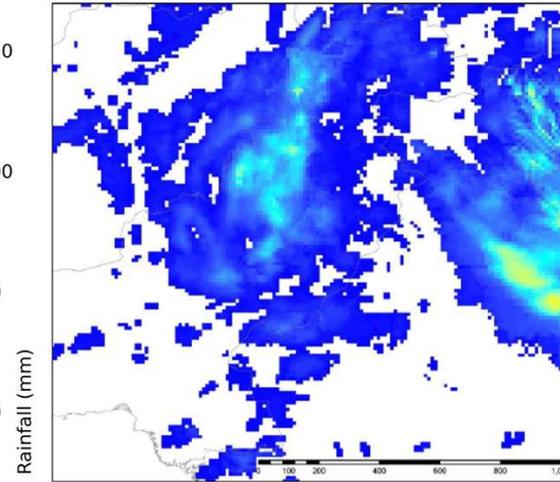
Ground (BWDB + SOHMON): 2022 05/15



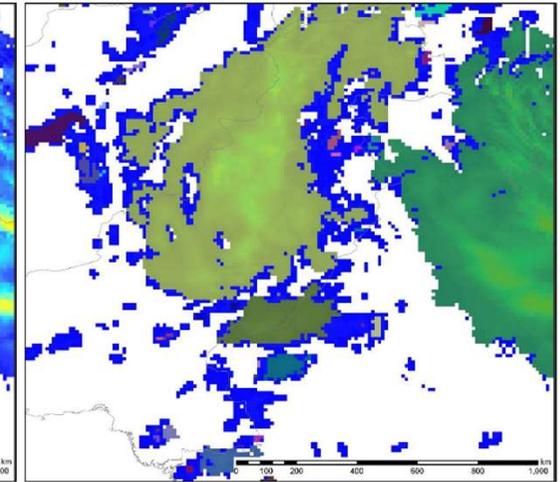
GSMaP-IF4 (Cld): 2022 05/15



Before



Segmentation



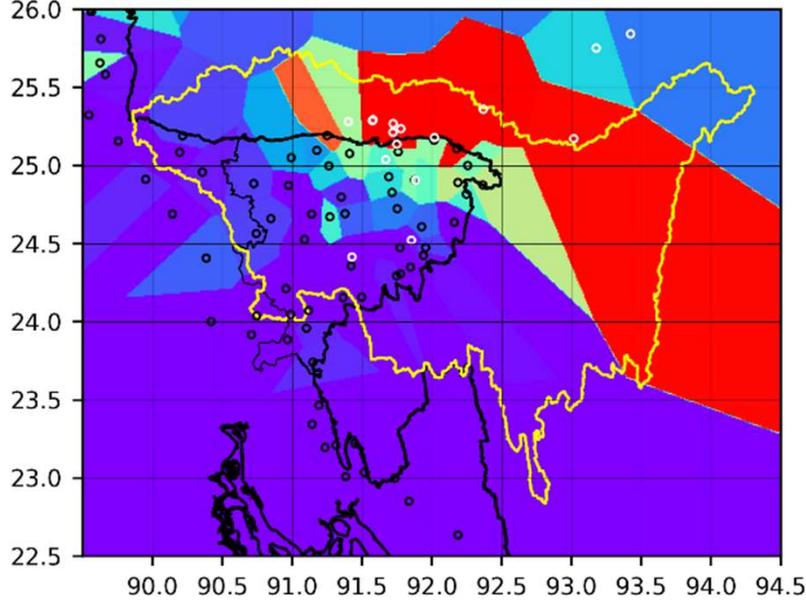
Precipitation value on rain gauges is not same as ground observation

Supported by Prof. Terao of Kagawa Univ. Japan

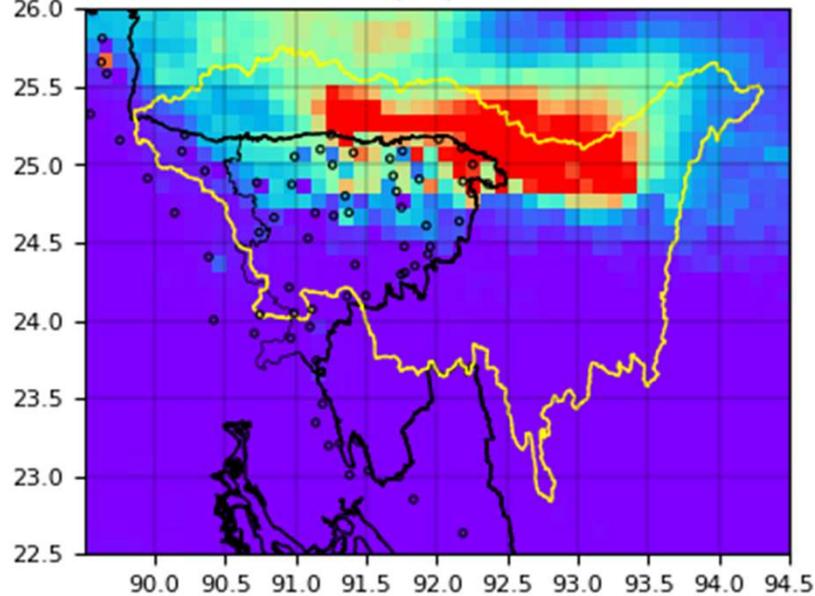
"Data was provided by the Bangladesh / Northeastern India Meteorological Data Archive from the web site at [http://rfweb.ed.kagawa-u.ac.jp/dav/gbm\\_jp/data/DATABASE/](http://rfweb.ed.kagawa-u.ac.jp/dav/gbm_jp/data/DATABASE/)".

# Triangulation based algorithm (GSMaP-IF4)

Ground (BWDB + SOHMON): 2022 05/15



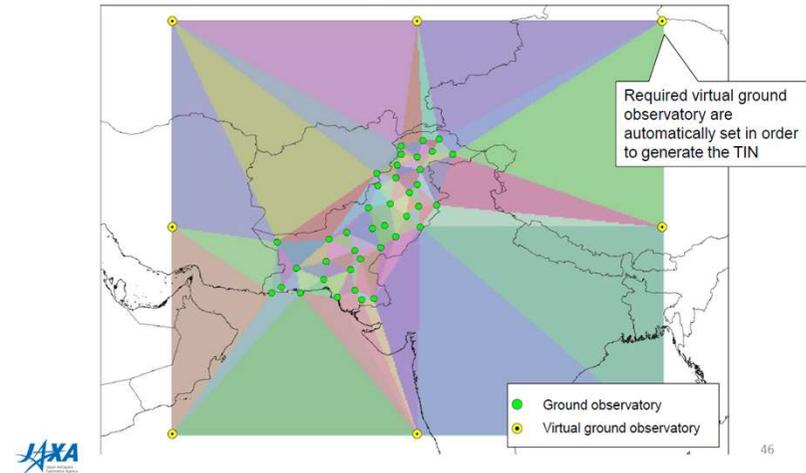
GSMaP-IF4 (Tri): 2022 05/15



## Appendix 1. Methodology

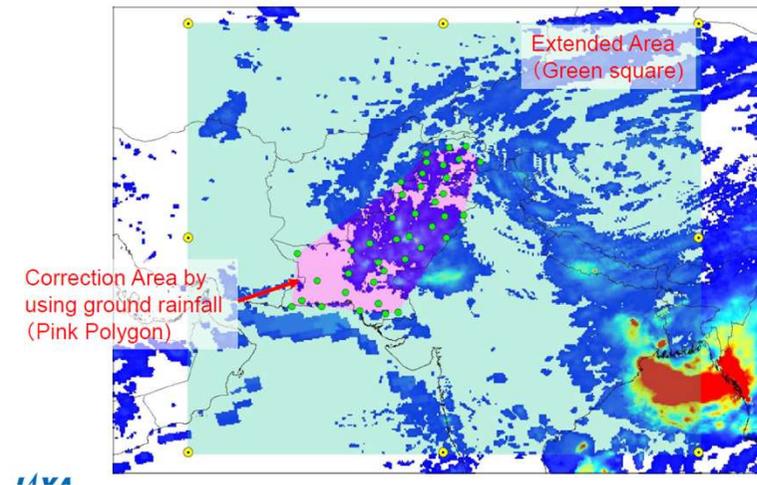
### Weight calculation (Triangulated irregular network)

✓ First, the active area is defined by a triangulated irregular network (TIN) generated from ground observatory, then the weight is calculated accordingly.



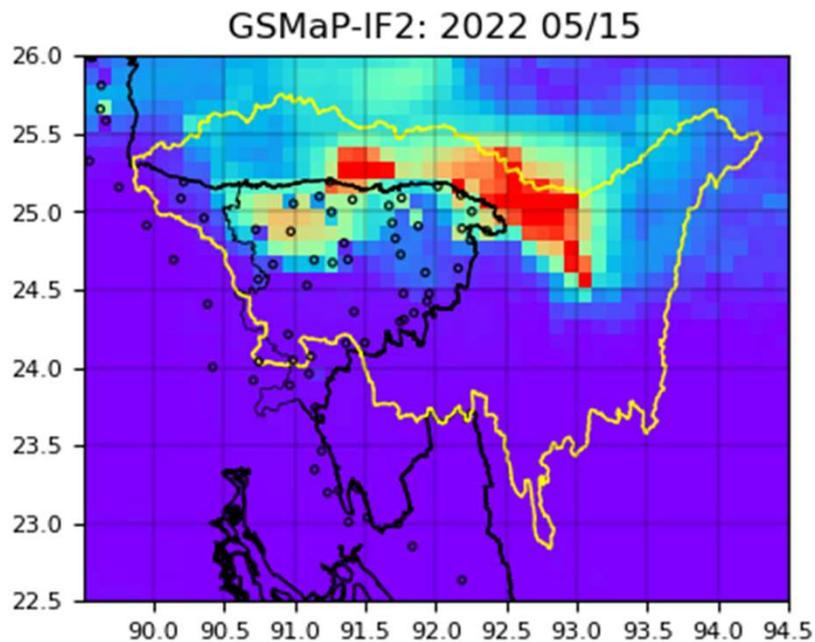
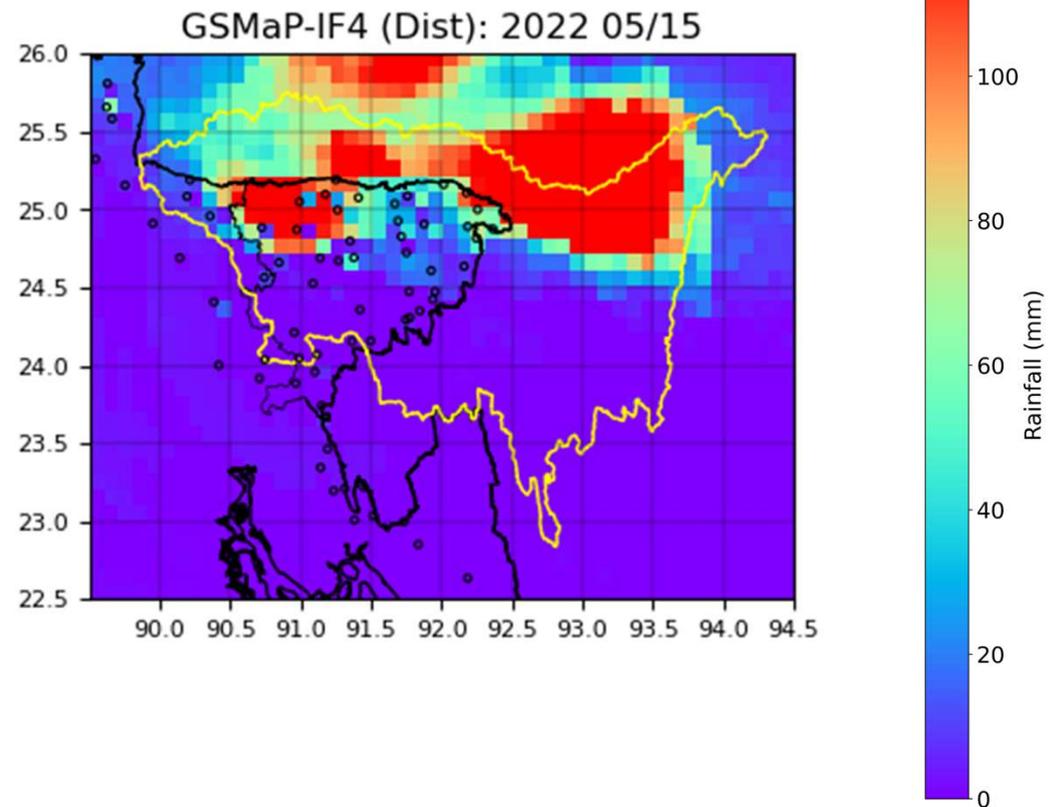
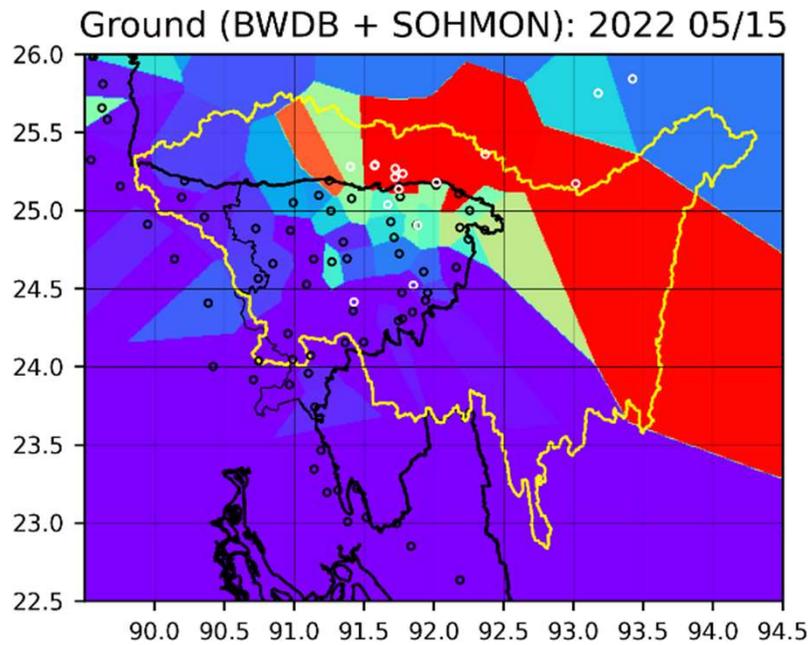
### Triangulation based algorithm (ver. 4.0)

The extended area can be corrected using two different methods.  
(Triangulation based / Cloud object based)



- Corrected value on rain gauges are similar to observation
- Rainfall in extended area is reasonable

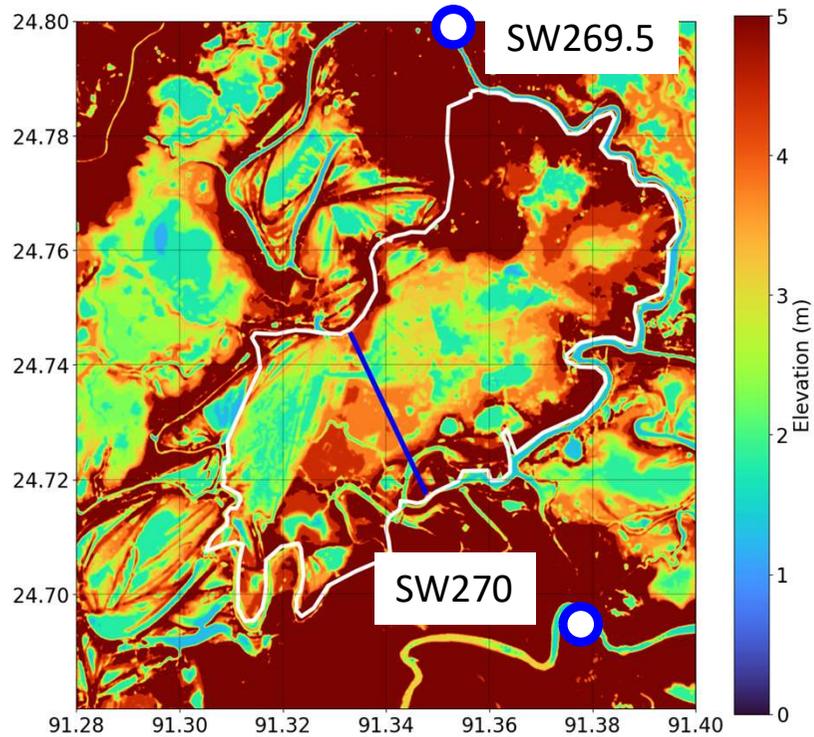
# Distance based algorithm (GSMaP-IF4) and GSMaP-IF2



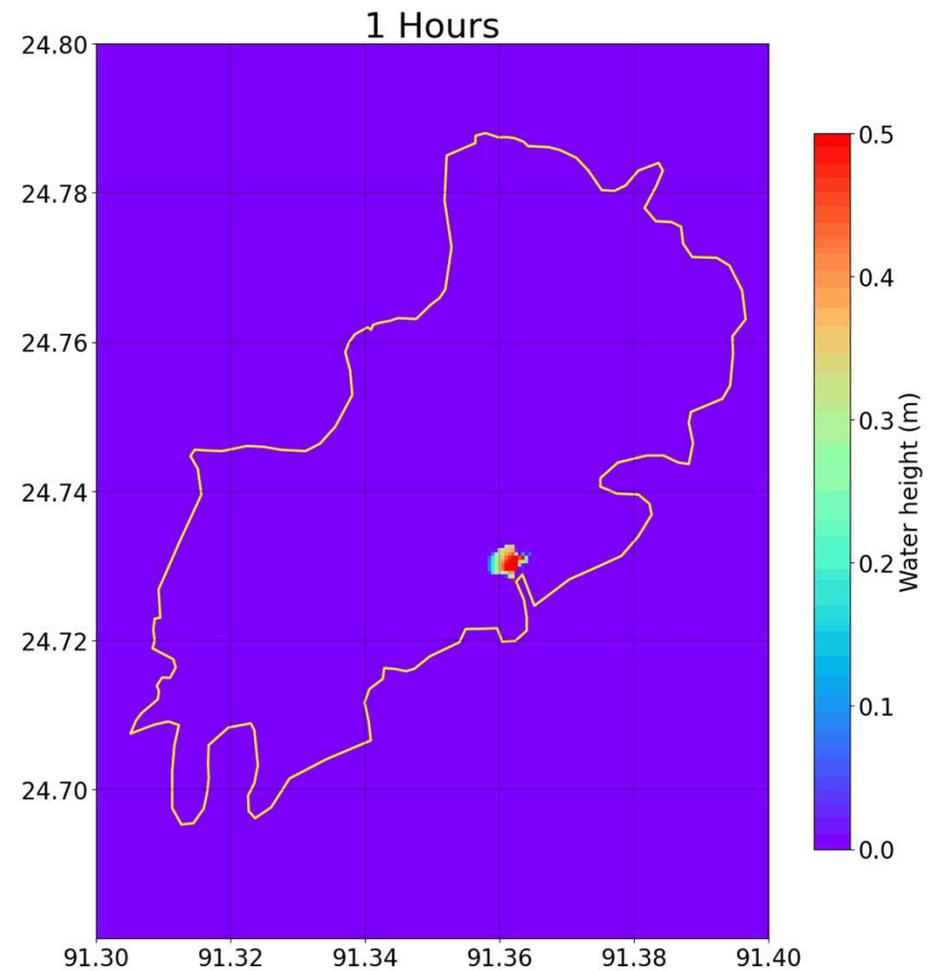
- Corrected rainfall value of GSMaP-IF2 on rain gauges is same as ground observation in Bangladesh
- That of GSMaP-IF4 (Distance based algorithm) is a bit different

# Estimation of elevation combining satellite information and ground observation

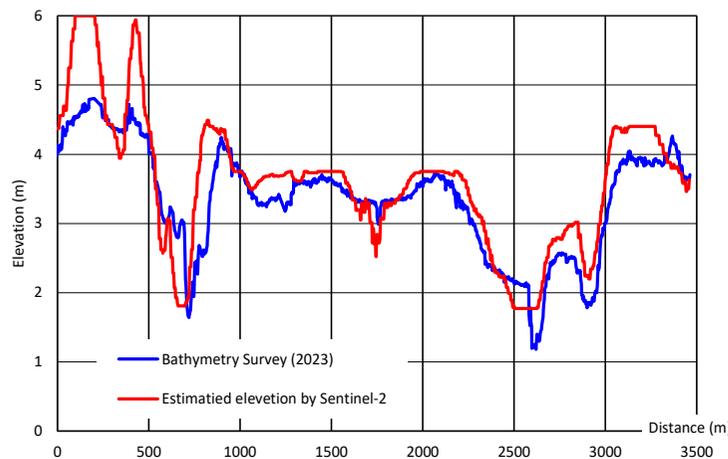
## Estimated elevation



## Flood analysis using estimated elevation



## Comparison with observation



# Summary

- Rainfall information outside of observation network is important for water management in transboundary basin
- GSMap-IF was developed by UNESCO Pakistan project funded by JICA's ODA. Copyright of the GSMap-IF model program is jointly owned by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Japan Aerospace Exploration Agency (JAXA)
- Releasing the source code of GSMap bias correction program from Jaxa is expected as it will improve usability