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Meteorological
Department

AOMSUC-15 FYSUC-2025

FIFTEENTH ASIA-OCEANIA METEOROLOGICAL SATELLITE USERS' CONFERENCE
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Evaluating Satellite-Based Quantitative Precipitation Estimates for Enhanced Early Warning of Heavy Rainfall Events in Brunei Darussalam

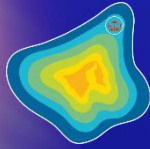
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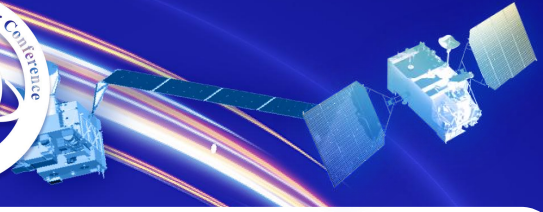




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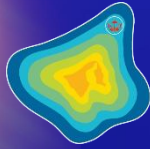
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Objective

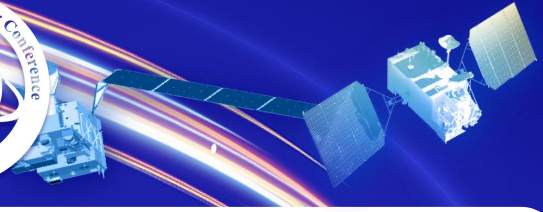
- Evaluate performance of different satellite Quantitative Precipitation Estimates (QPE) products
 1. Self-Calibrating Multivariate Precipitation Retrieval (**SCaMPR**) – Used operationally within BDMD as part of the Flash Flood Guidance System (FFGS)
 2. **Fengyun 4B** AGRI L2 QPE – Widely used in research
 3. **GSMAP**_v8_GC JAXA – Widely used in research
- Assessment of individual strength and weaknesses in capturing heavy rainfall events
- Identify which product can be used for operational early warning support as well for research studies



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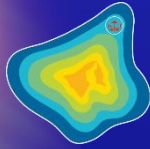
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Self-Calibrating Multivariate Precipitation Retrieval (SCaMPR)

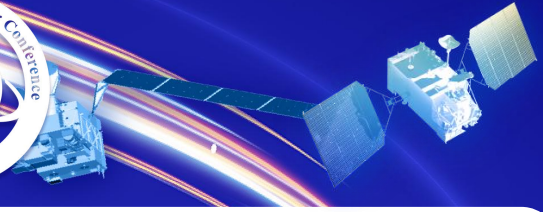
- Also known as NOAA's Enterprise Rainfall Rate (ERR)
- The algorithm combines relative strengths of infrared (IR)- based and microwave (MW)-based estimates of precipitation
- Resolution: 2km
- Frequency: 10 minutes
- Latency: 30 minutes
- Coverage: Global
- Used operationally as the precipitation input to the Flash Flood Guidance System (FFGS)



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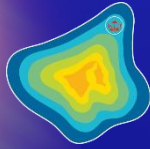
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Fengyun 4B Advanced Geostationary Radiation Imager (AGRI) L2 QPE

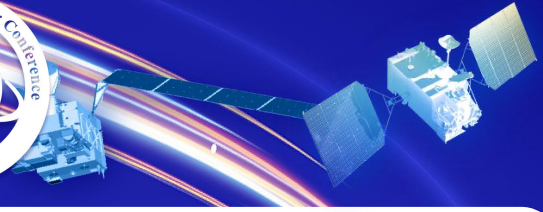
- National Satellite Meteorological Center, CMA's latest and advanced Geostationary satellite
- The algorithm computes real-time FY-4B AGRI Infrared data which is then combined with surface-observed rain gauge data
- Resolution: 4km
- Frequency: 15 minutes, then aggregated to 1/3/6/24 hourly QPE
- Latency: 15 minutes
- Coverage: ~ 80°S to 80°N / ~25°E to 175°W
- Data retrieval: <https://satellite.nsmc.org.cn/dataportal>



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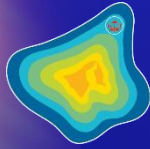
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GSMAP_v8_GC JAXA

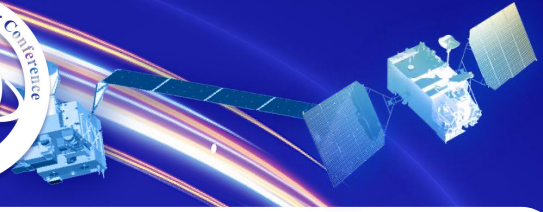
- Global Satellite Mapping of Precipitation (GSMaP) from JAXA/EORC
- The algorithm fuses multi-satellite passive microwave (PMW) retrievals, infrared (IR) morphing, trained with TRMM/PR & GPM/DPR to estimate rain rate
- Gauge Calibration is also applied to reduce regional biases
- Resolution: 10 km
- Frequency: 1-hourly
- Latency: 4 hours
- Coverage: Global
- Data retrieval: <https://sharaku.eorc.jaxa.jp/GSMaP/>



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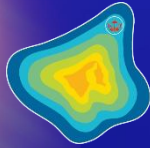
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QPE Product Summary

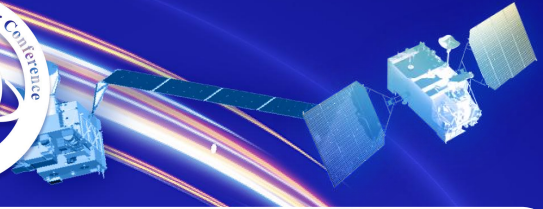
Product	Resolution	Coverage	Frequency of Update	Latency	Organization
SCaMPR	2 km	Global	10 minutes	30 minutes	NOAA/NESDIS
Fengyun 4B QPE	4 km	~ 80°S to 80°N / ~25°E to 175°W	15 minutes	15 minutes	NSMC, CMA
GSMAP	10 km	Global	1 hourly	4 hours	JAXA/EORC



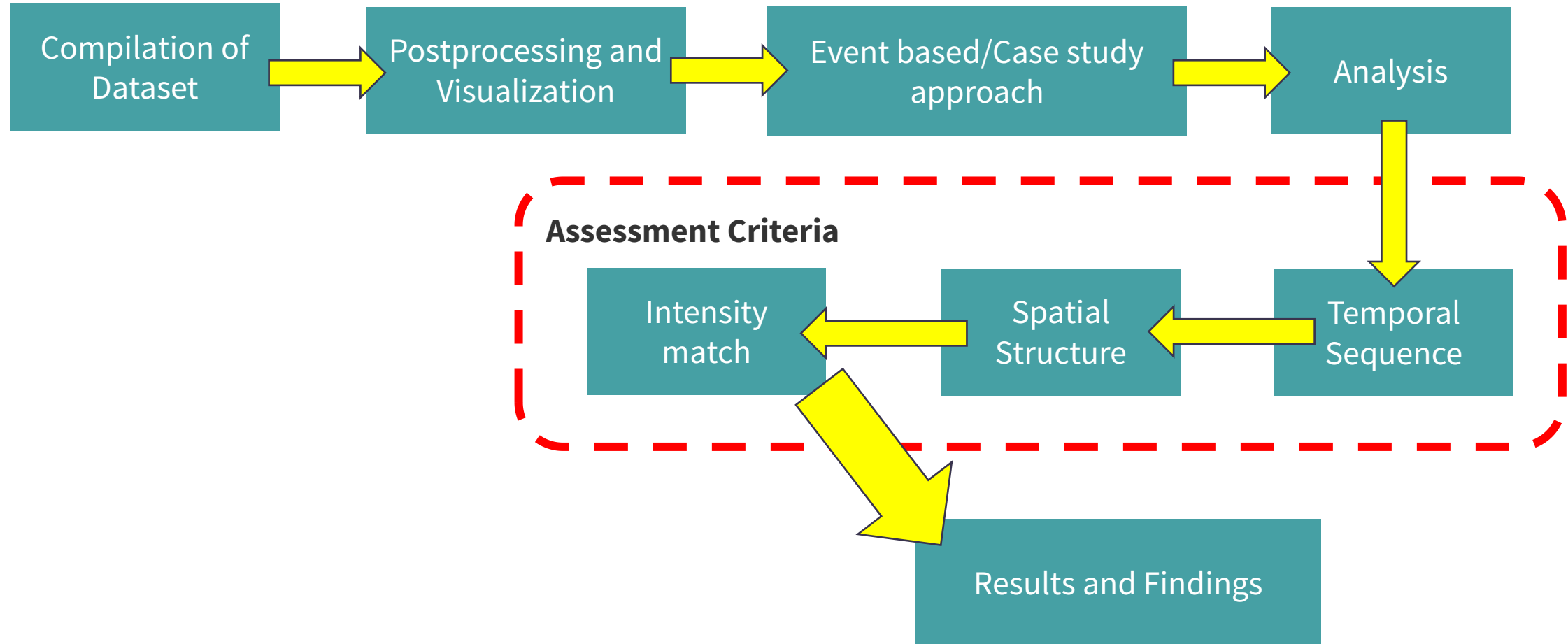
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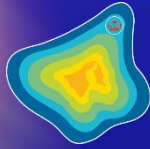
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Workflow

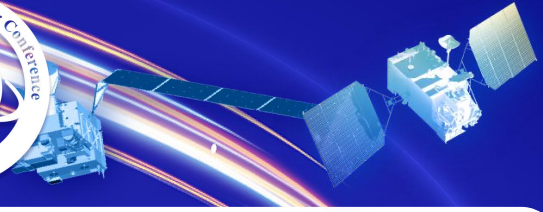




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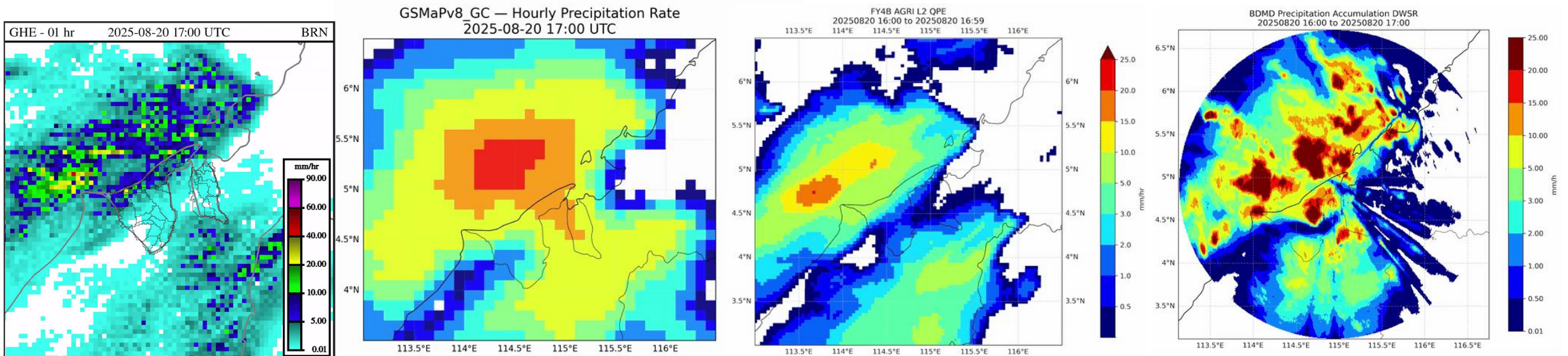
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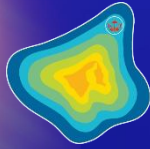
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Case study 1 – 20th August 2025 (16-20 UTC)

- All products capture the propagation sequence
- FY4B has the best spatial match with radar
- GsMAP was the closest in terms of intensity
- SCamPR failed to capture rainfall over land areas

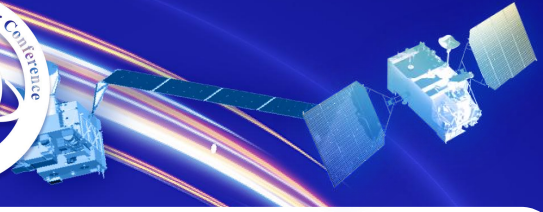




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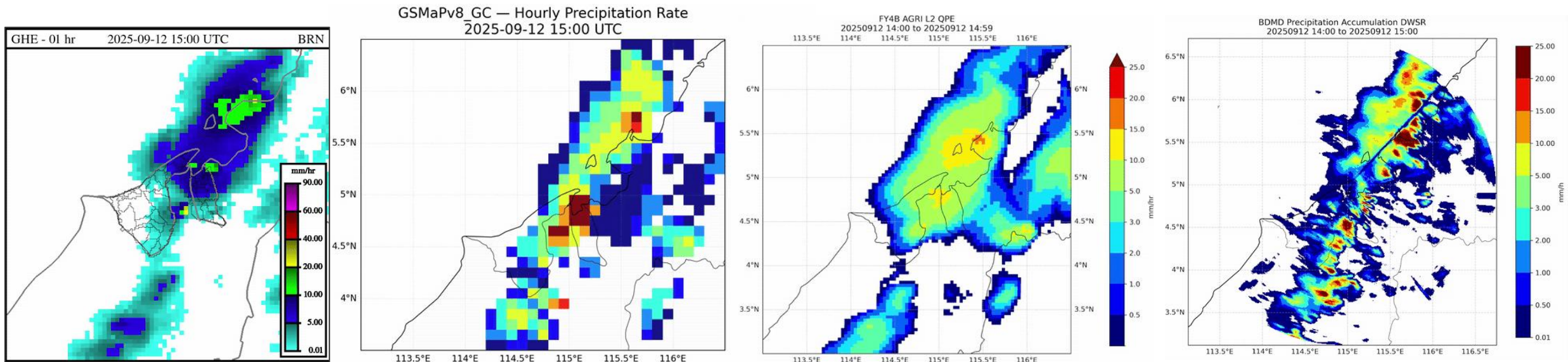
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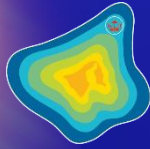
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Case study 2 – 12th September 2025 (14-19 UTC)

- All products capture the propagation sequence
- All products performed well in convective spatial match, FY4B performed the best
- GsMAP was the closest in terms of intensity, but overestimated spatial coverage
- Both SCamPR and FY4B lacked the peak intensity

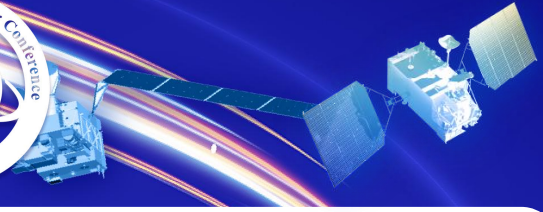




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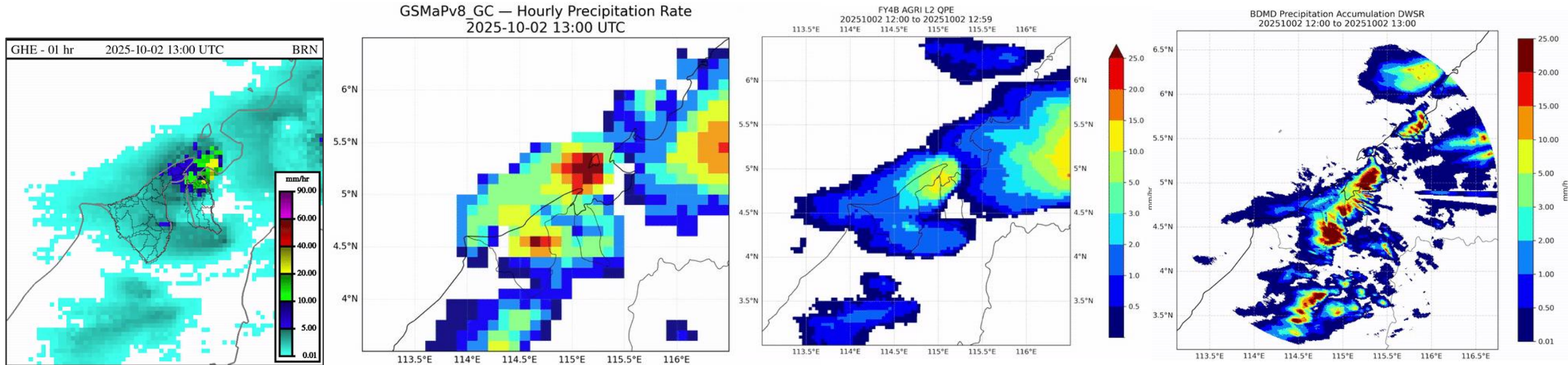
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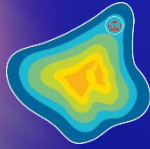
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Case study 3 – 2nd October 2025 (12-16 UTC)

- All products capture the propagation sequence
- All products struggled in identifying isolated convective cell
- Only GSMaP managed to capture rainfall over inland areas
- SCaMPR performed the worst

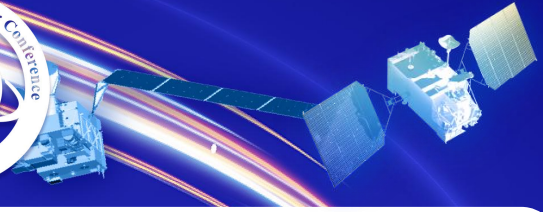




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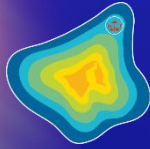
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Summary

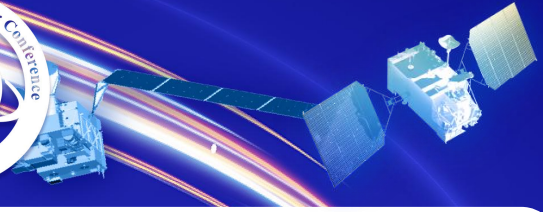
- All three performed well in capturing the temporal sequence of the directional propagation of the heavy rainfall events
- FY-4B QPE has the best structural alignment, reliable for spatial monitoring but underestimates intensity peaks
- GsMAP has the best intensity match but overestimate the spatial extent of rainfall events
- SCaMPR under-performed among the three, struggles with land/sea interface but excelled in off-shore detection



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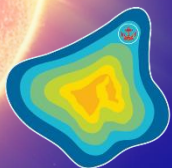
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Conclusion

- FY-4B remains an untapped potential for operational usage in Brunei, especially with FY-4B QPE dataset which looks promising
- Satellite based products can complement radar observations e.g during downtime or maintenance / areas which lacks radar
- Satellite datasets can be used for training AI/ML, particularly for Nowcasting and can play an important role in Early Warning Systems
- Usage not only in terms of operational but there is vast amount of potential for research

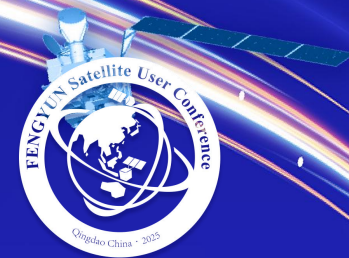


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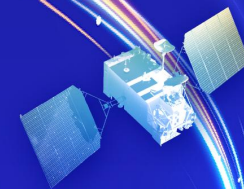
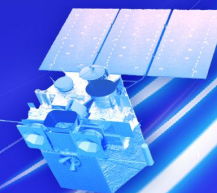
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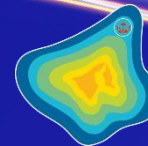
Thank you for your attention





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