Flood mapping using satellite SAR data

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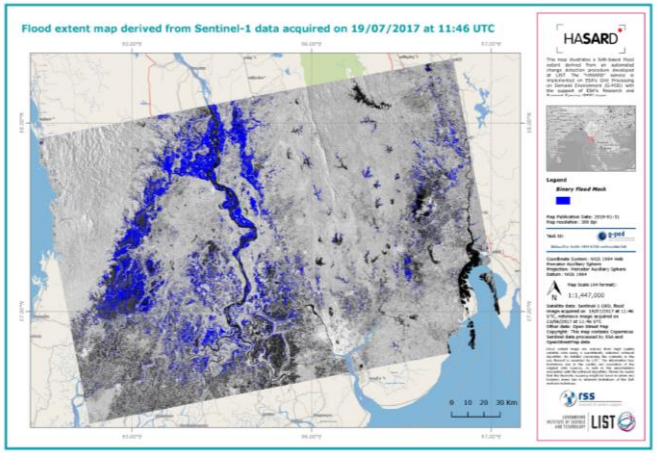
Background



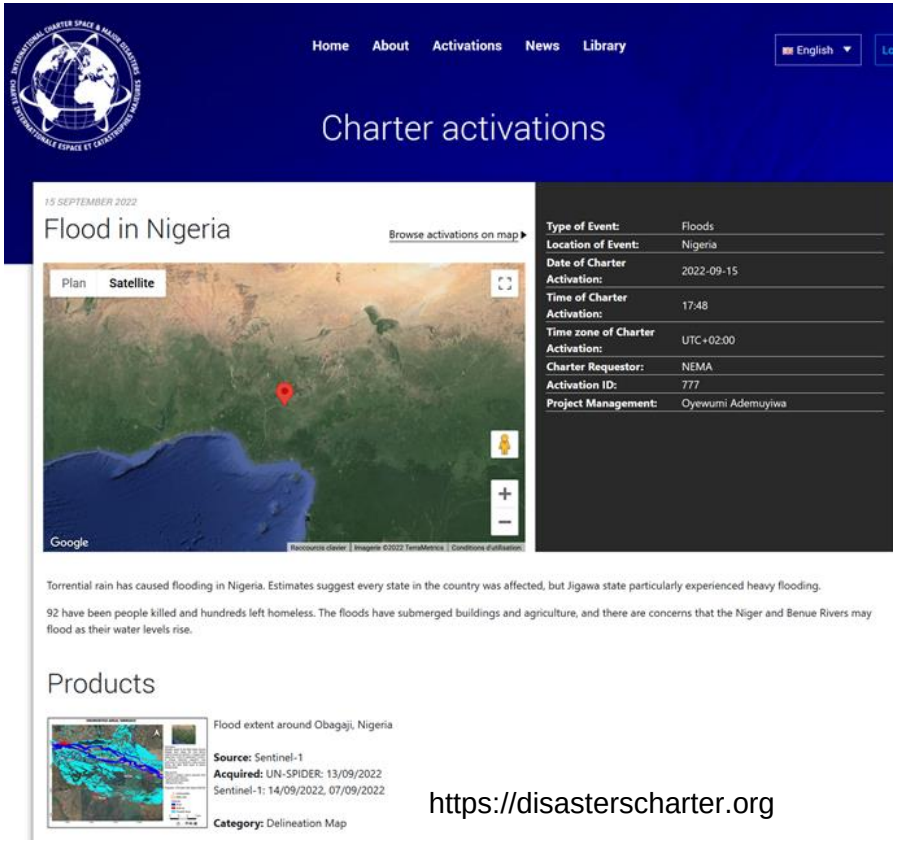
Flood hazard is one of the most disastrous (frequency and damages)

Need for observations to understand, anticipate and protect populations:

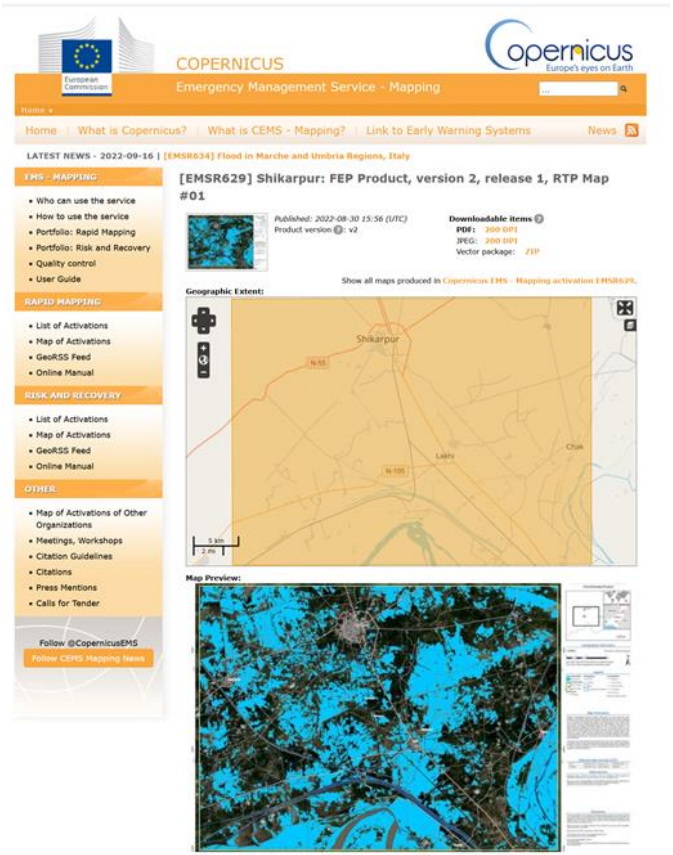
- Traditional observations are punctual (pb of representativeness).
- Ground observations are scarcely distributed and observation networks tend to be further reduced (e.g. stream gauges)
- Ground observations not always reliable during flood events.

=> Need for new observation techniques : satellite SAR flood images offers synoptic views, with rather high revisit and spatial resolution

Background

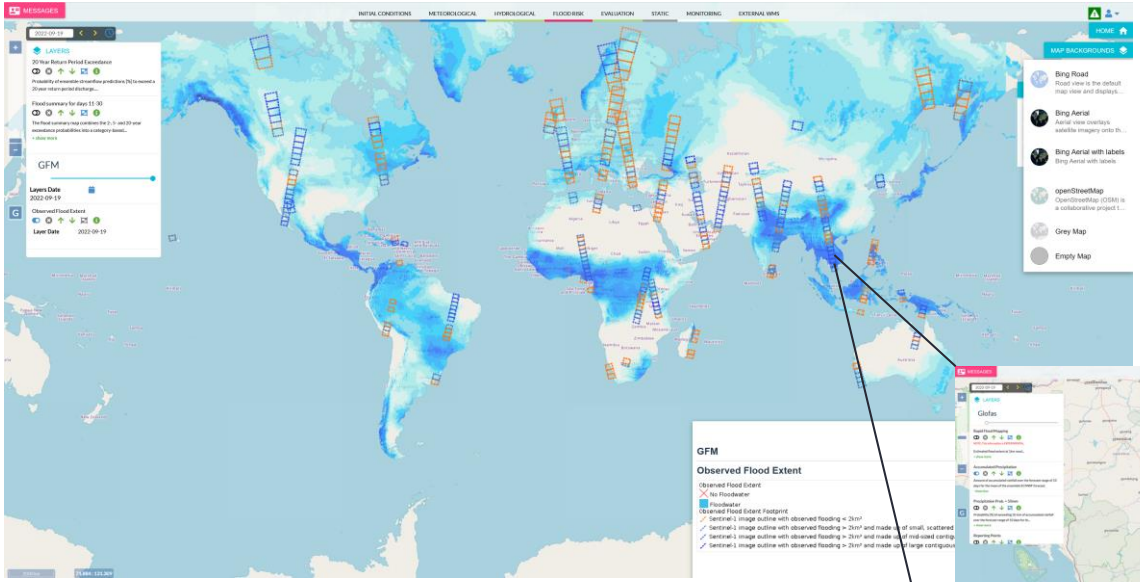


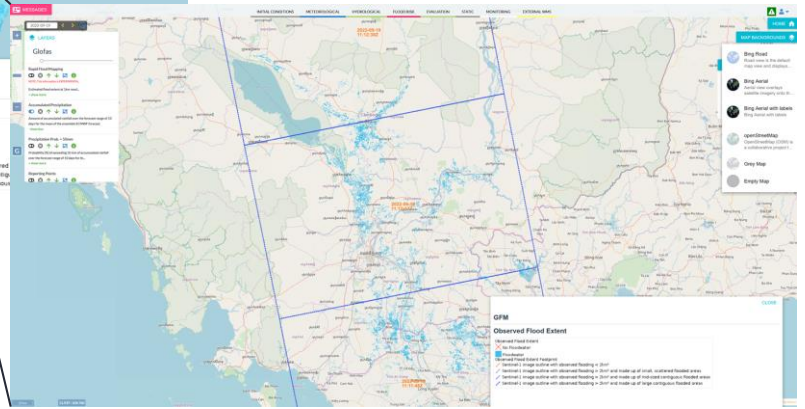
https://disasterscharter.org



https://emergency.copernicus.eu/

Background



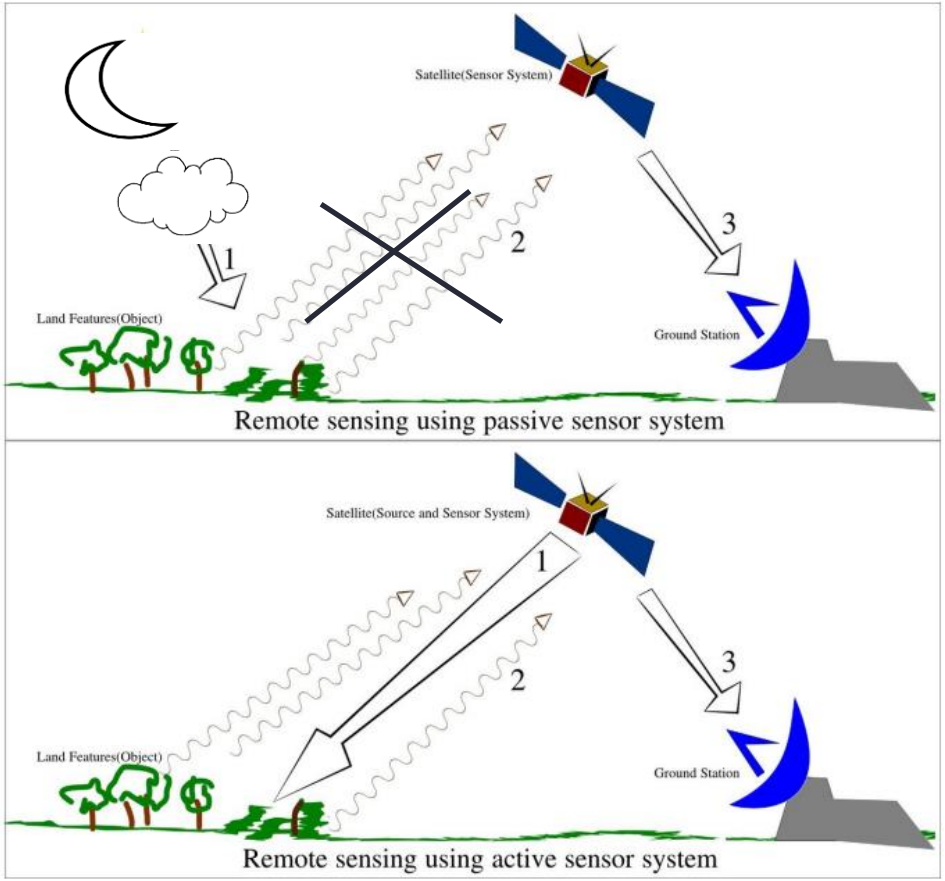


https://www.globalfloods.eu/glofas-forecasting/

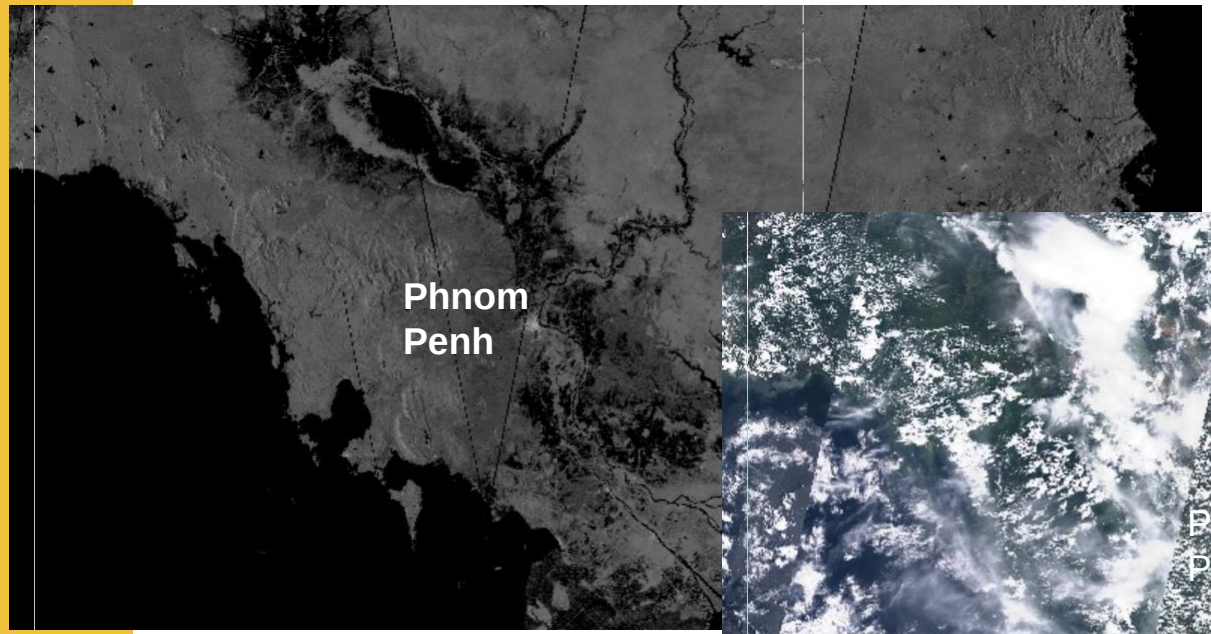
Active and passive sensors for flood monitoring

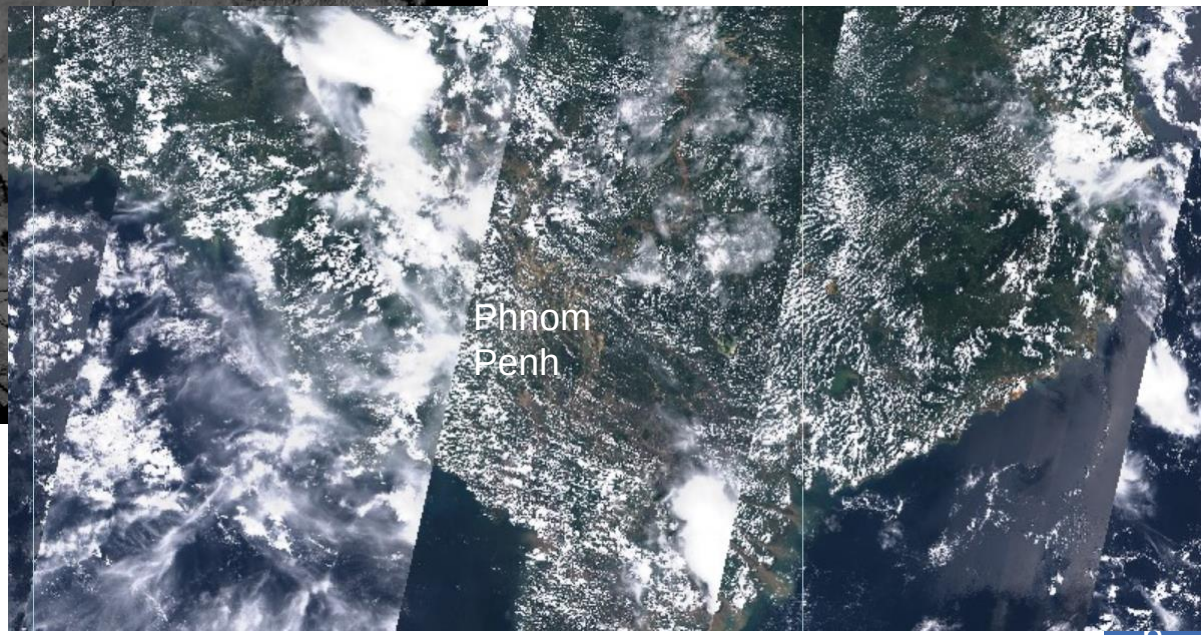
Optical remote sensing

RADAR remote sensing

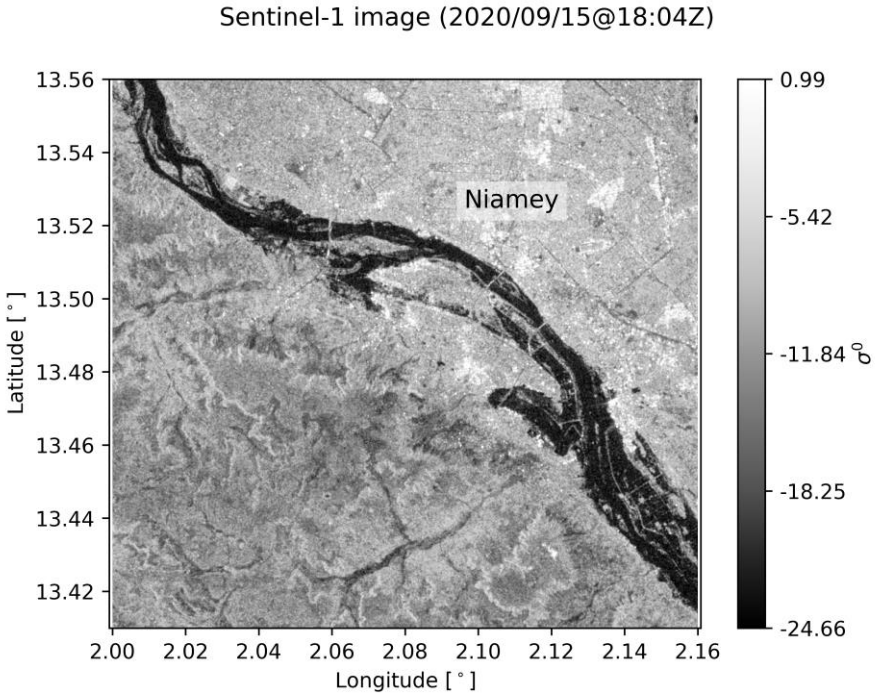


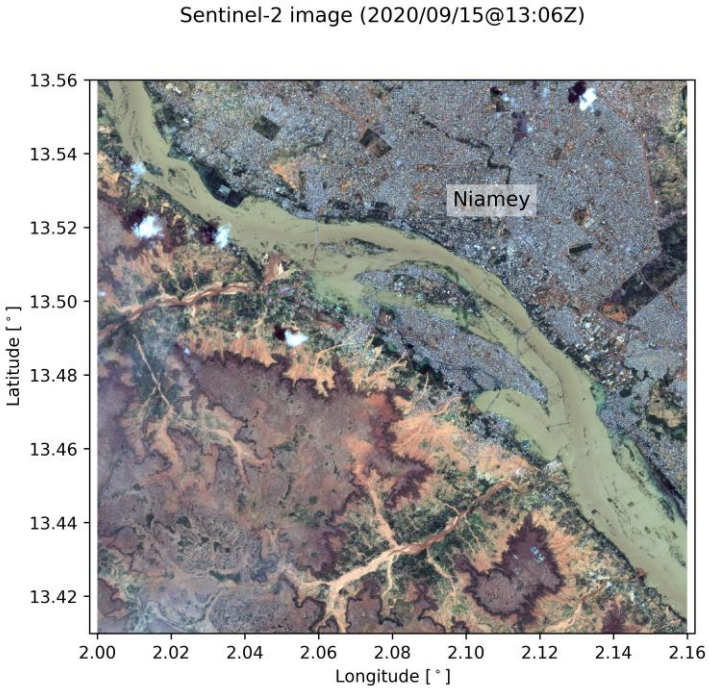
Active and passive sensors for flood monitoring



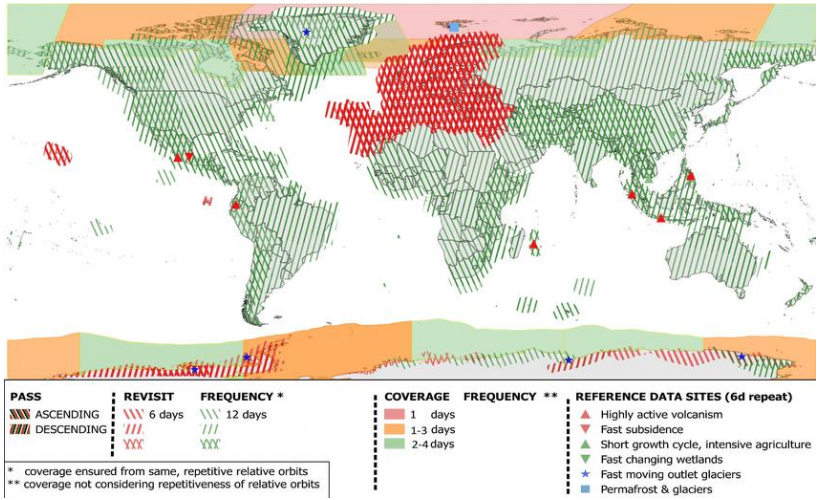


« Bare Soil » floodwater mapping

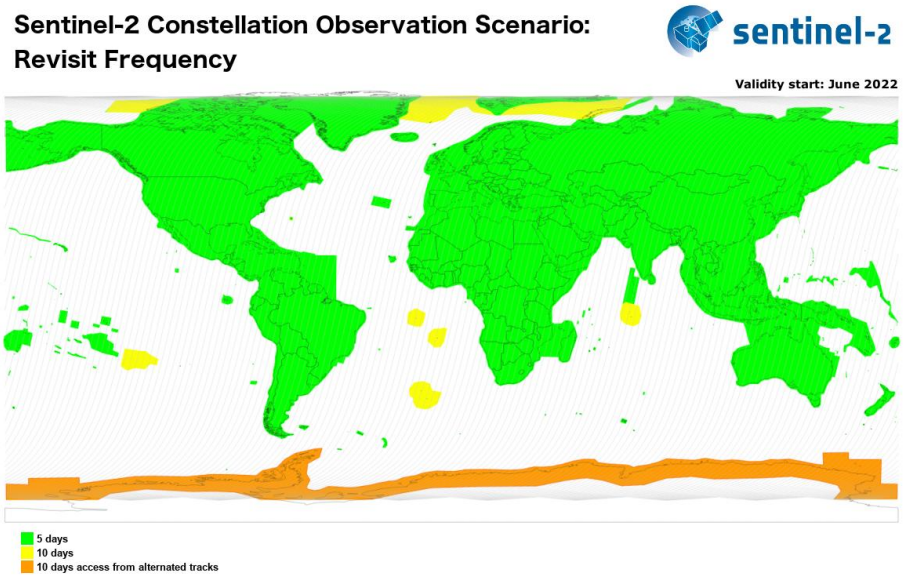




Sentinel -1 revisit time

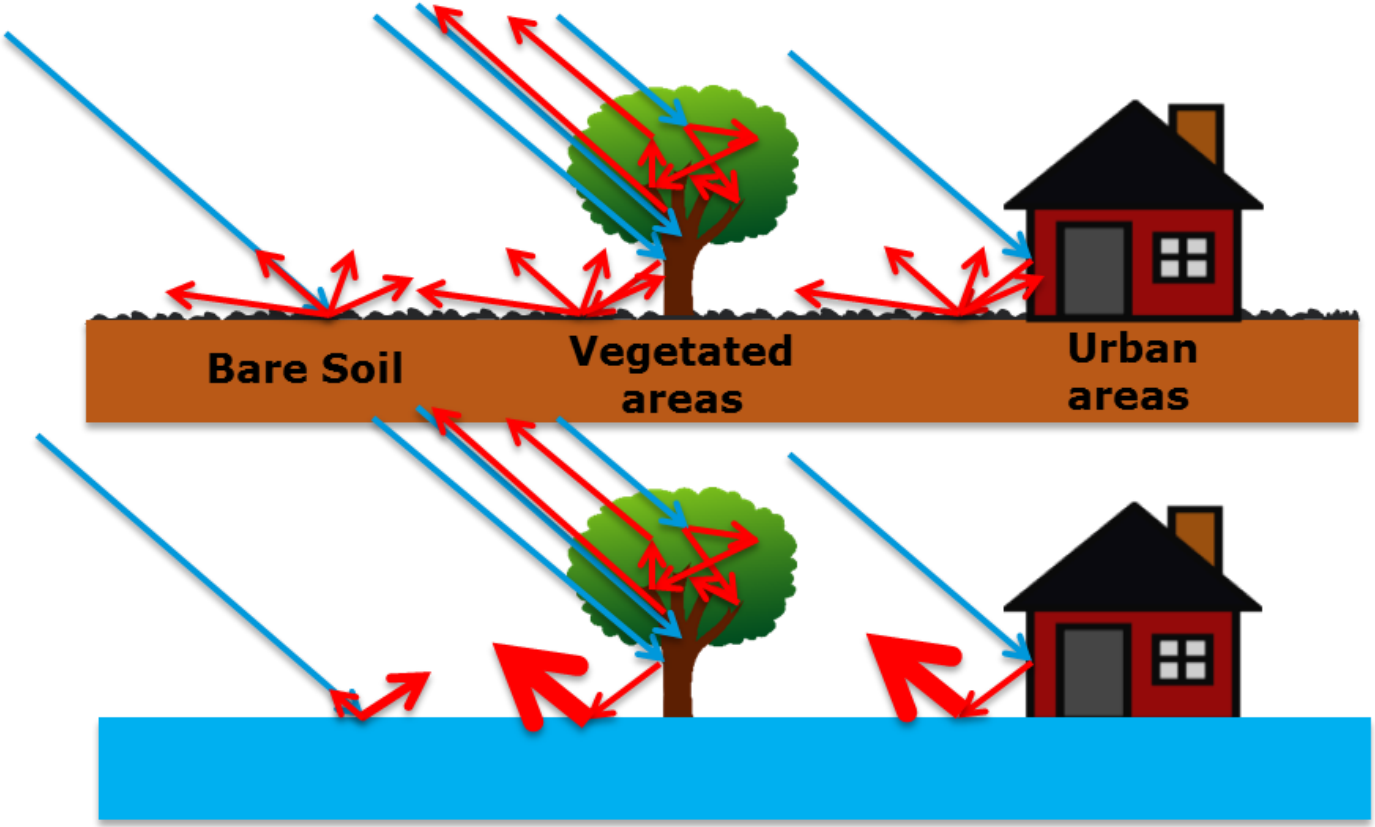


Sentinel-1 constellation observation, revisit and coverage scenario (April 2021), after Mullissa et al (2021)



https://www.esa.int/

Detection of water on SAR images



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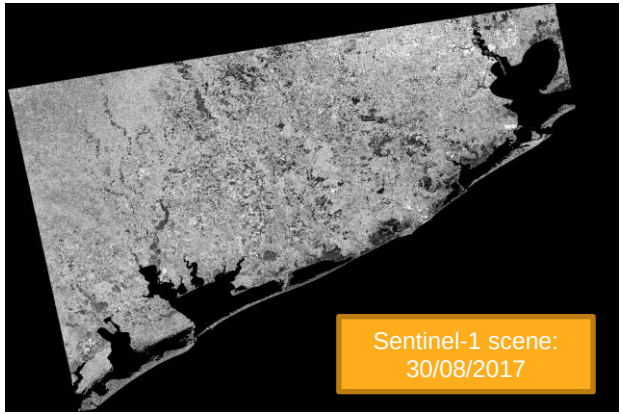
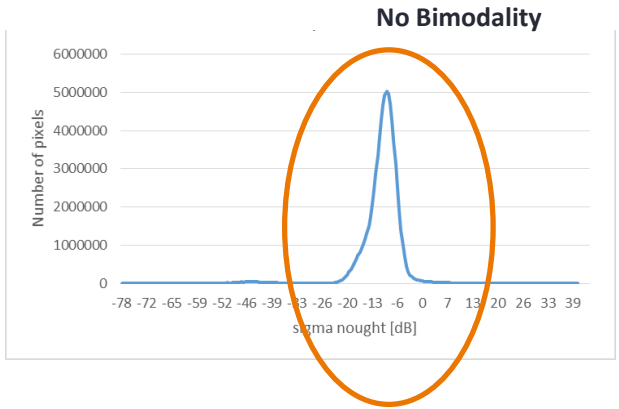
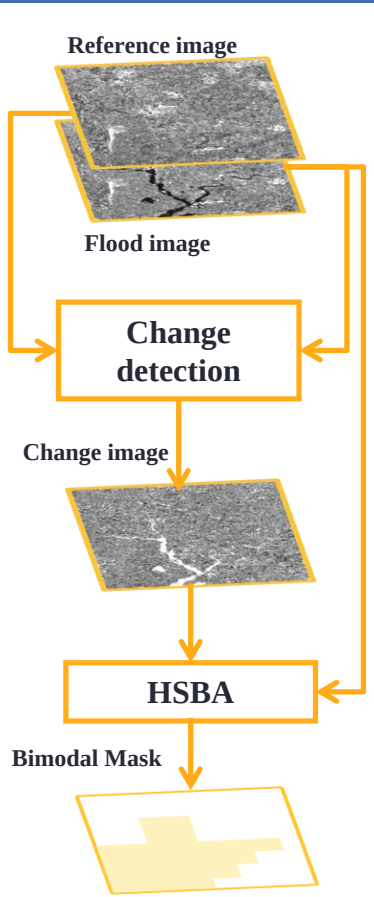
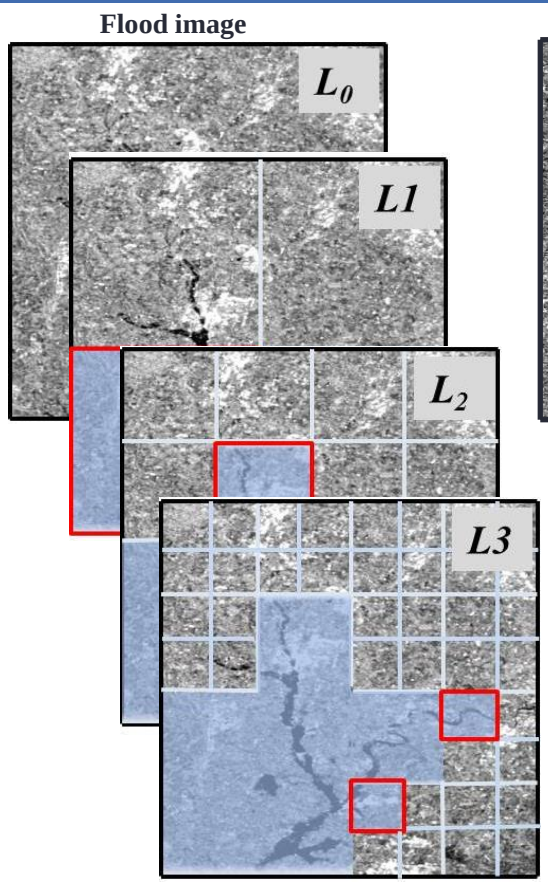
- **Backscatter Statistical modelling :** parameterization of two PDFs for water and non water (resp. Change / No Change)
- **Bottelneck**: floodwater only covers a limited area compared to a Sentinel Scene → very difficult to parameterize the two PDFs





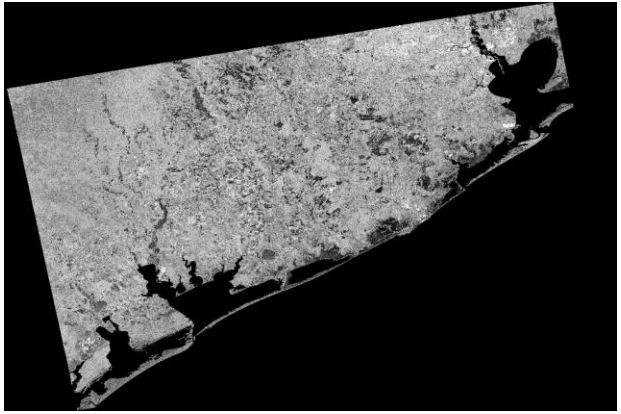
« Bare Soil » floodwater mapping

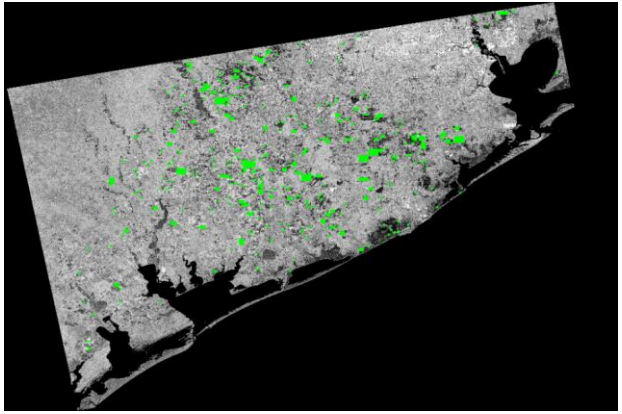


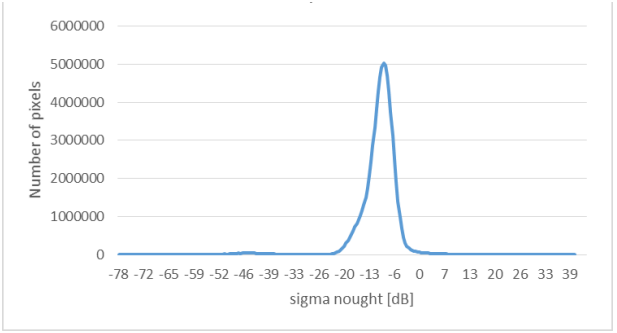


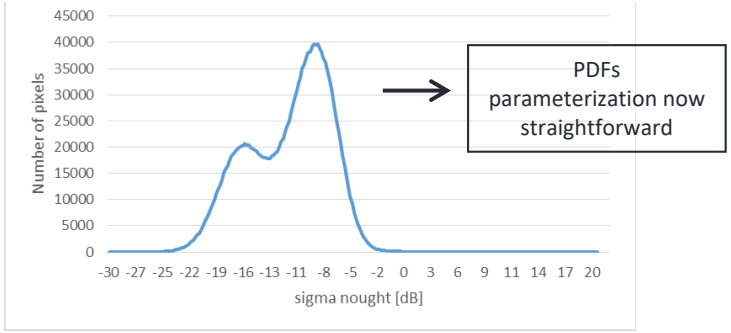
Hostache et al., IEEETGRS, 2009
Matgen et al., PCE, 2011
Hostache et al., JAG 2012
Giustarini et al. IEEE TGRS2013,
Chini et al. , IEEE TGRS, 2017

« Bare Soil » floodwater mapping









Chini et al., TGRS, 2017

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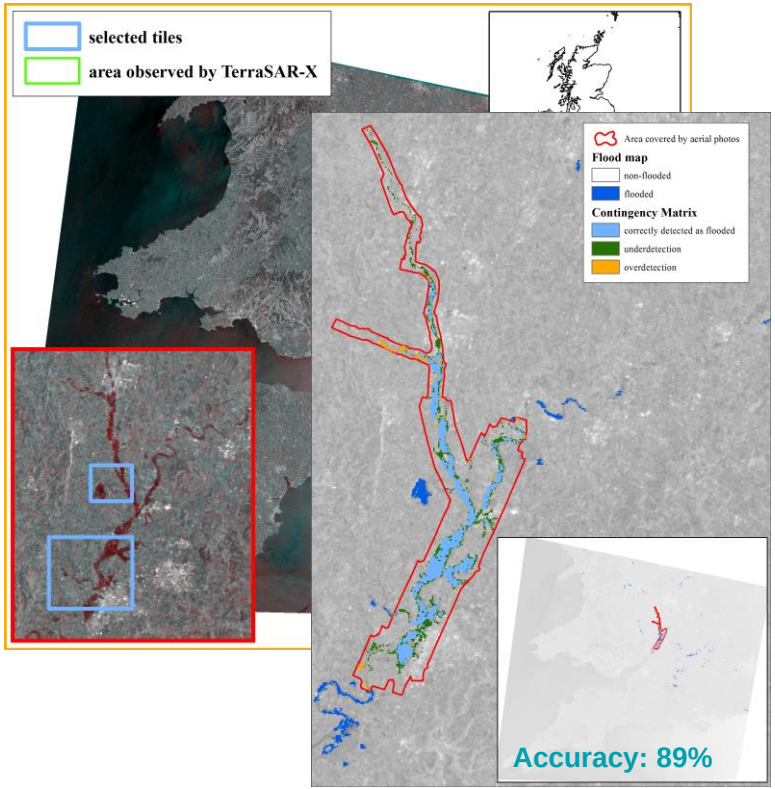
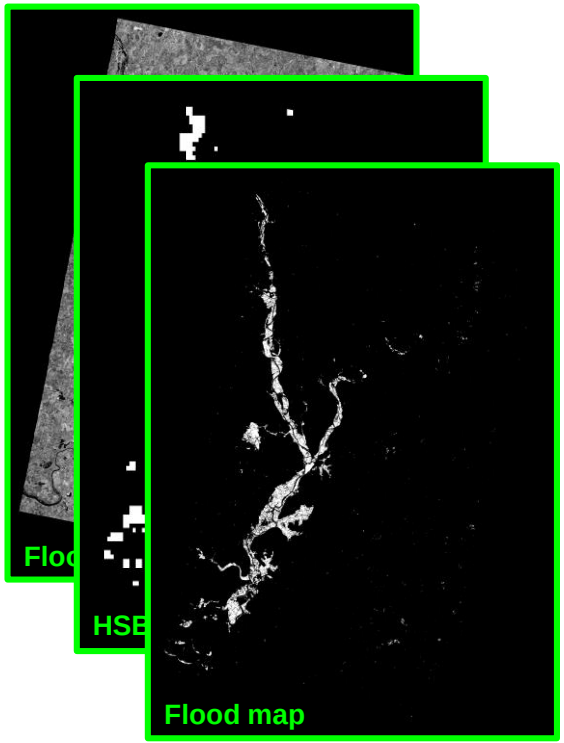
Envisat WSM (150m)



TerraSAR-X Stripmap (3m)



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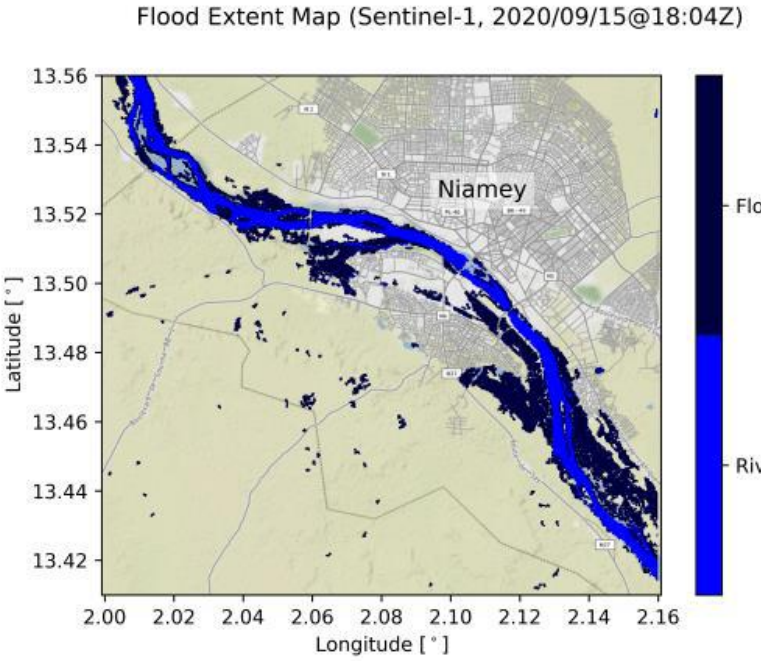
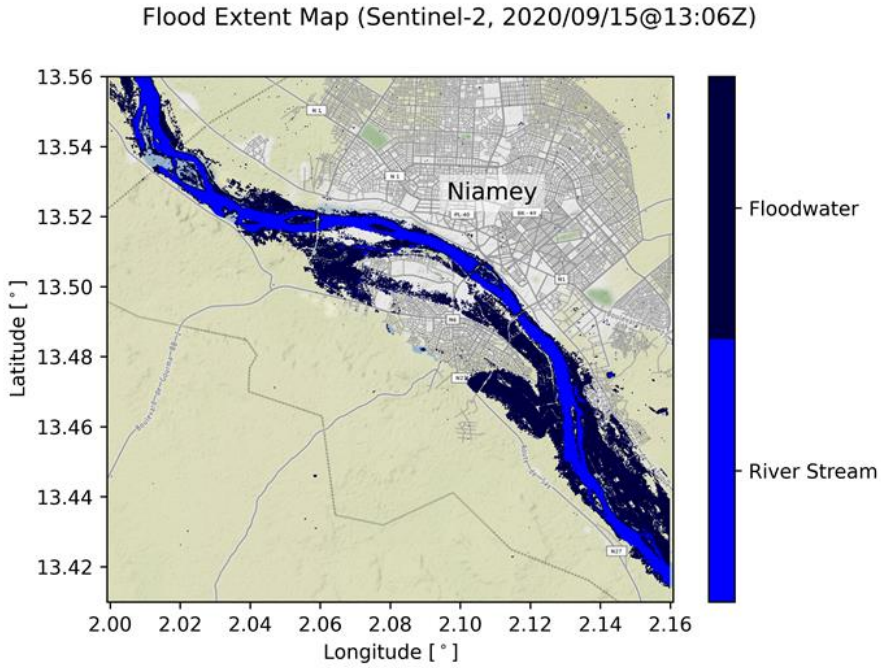
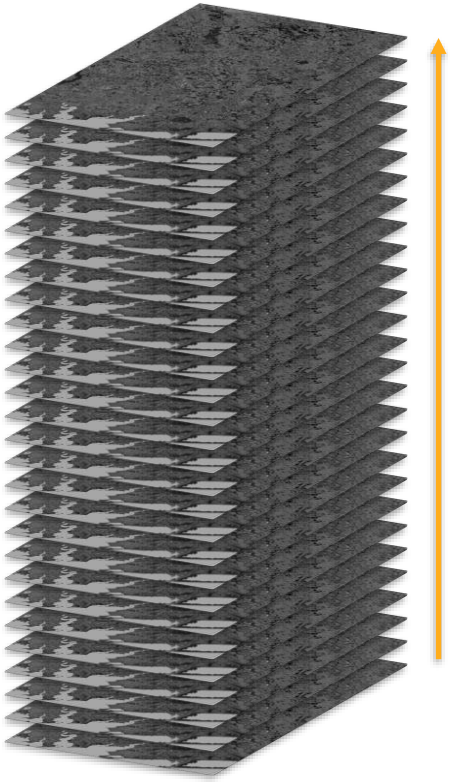
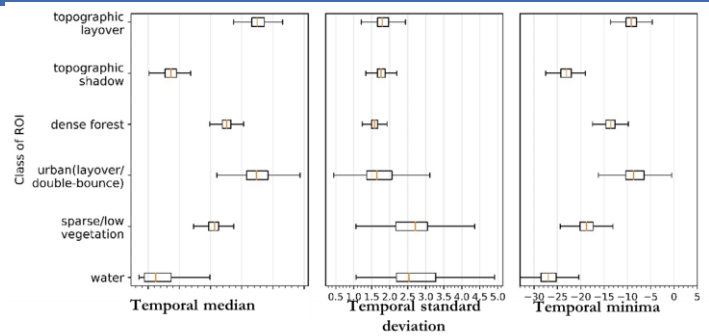
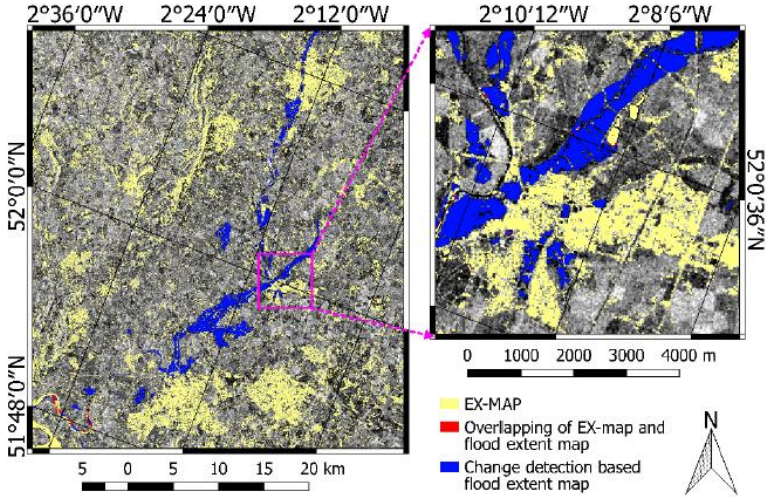




An exclusion layer for identifying areas where floodwater is undetectable

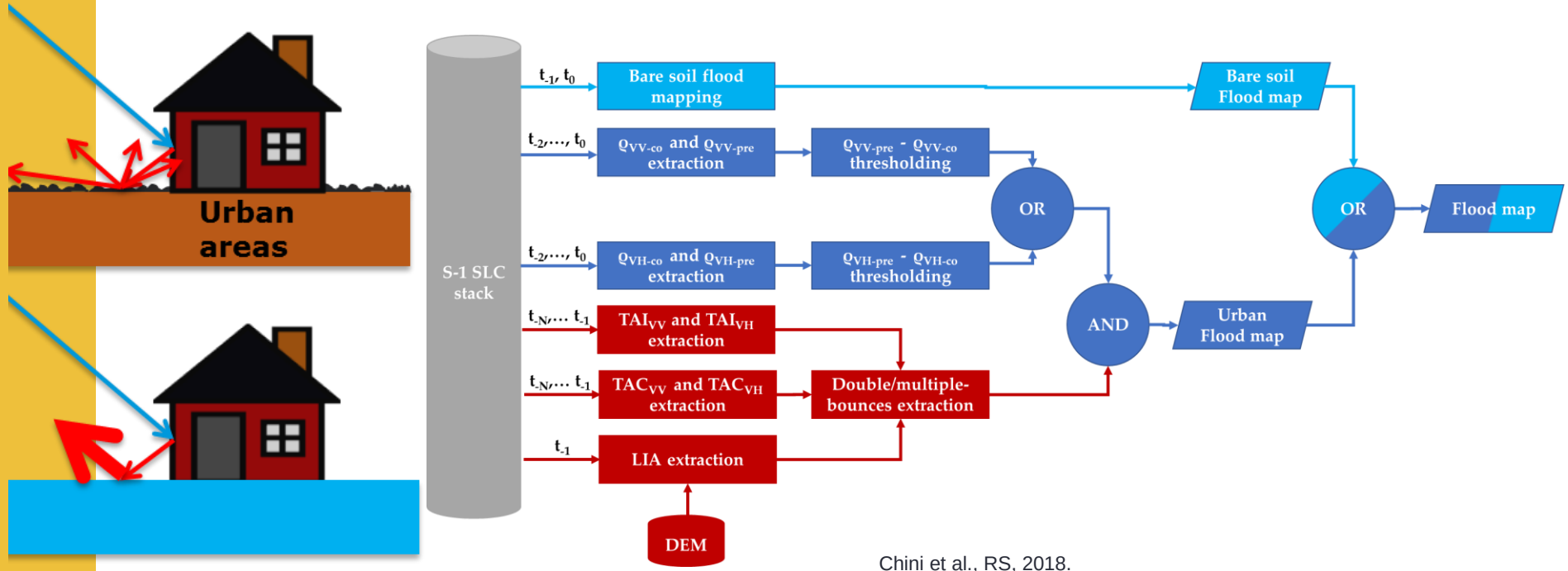






Zhao et al., RSE, 2021

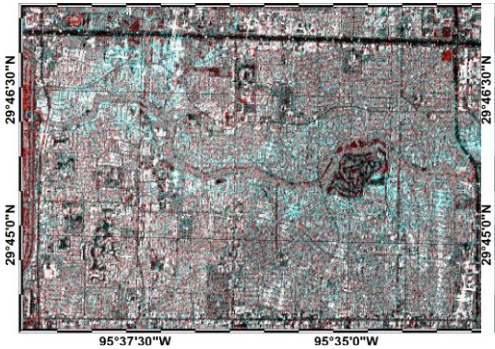
Floodwater mapping in urban areas



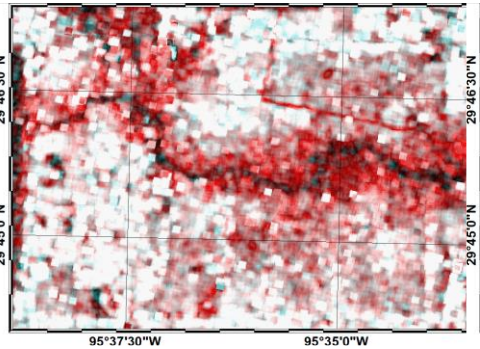
Chini et al., RS, 2018.
Chini et al., RS, 2019
Pelich et al., IEEE TGRS letters, 2021

Uban water detection

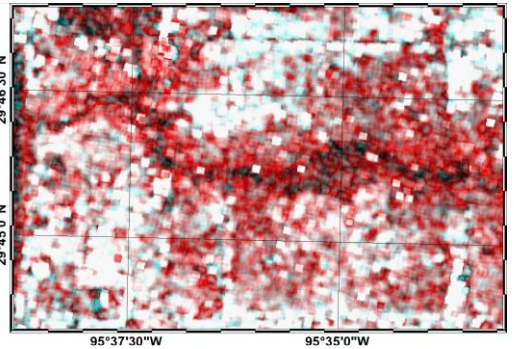
Intensity Pre-post RGB



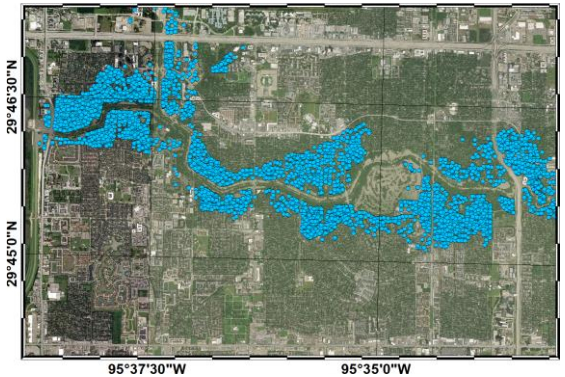
Coherence Pre-Co RGB (VV)



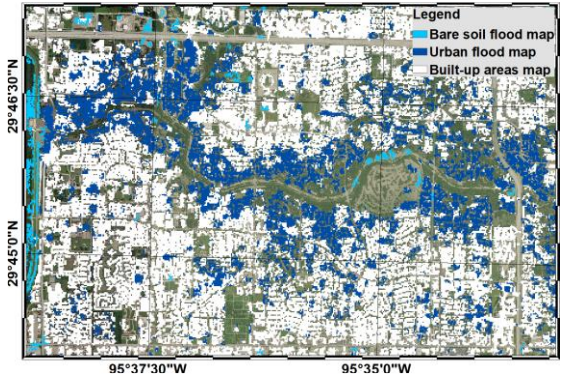
Coherence Pre-Co RGB (VH)



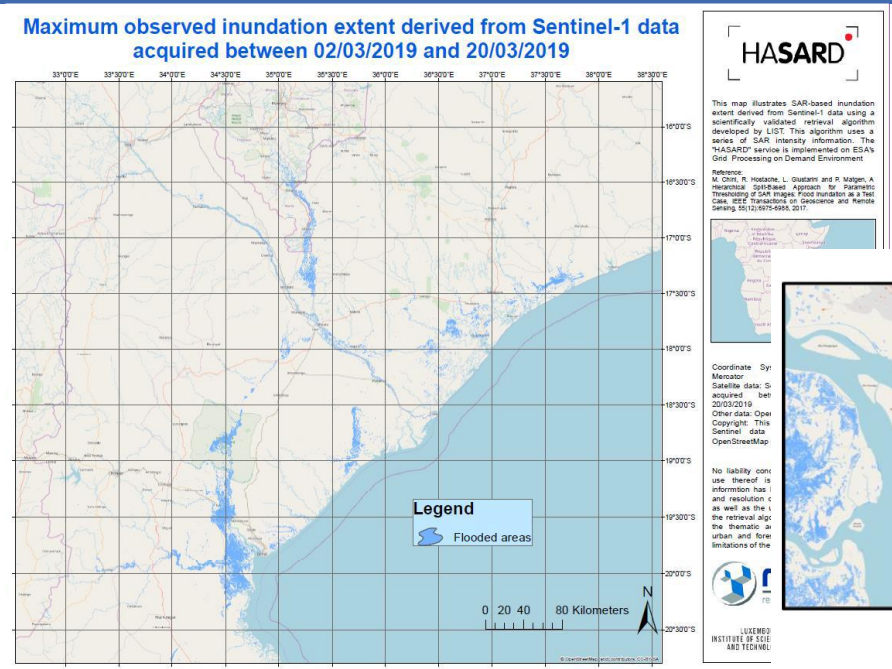
Digital Globe VHR imagery and crowdsourcing

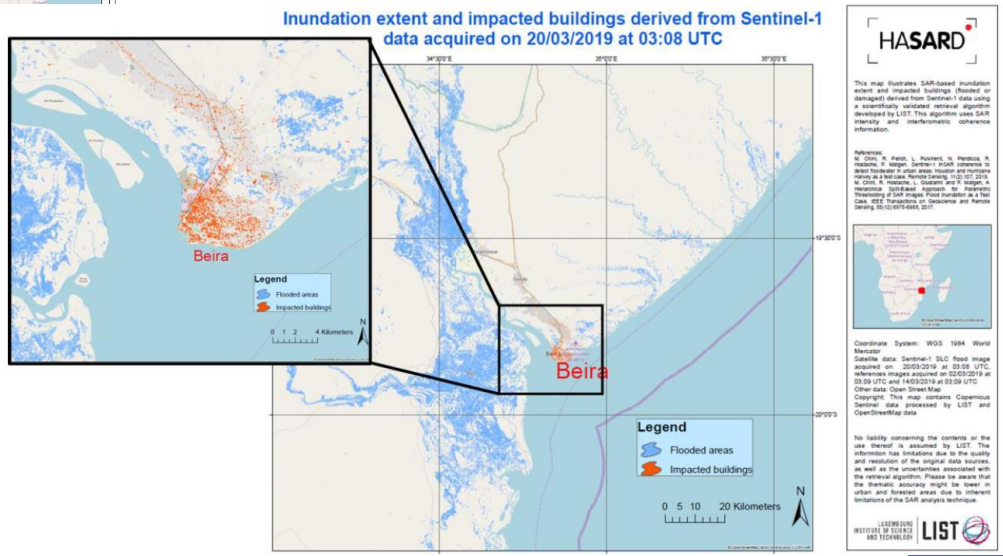


Flood map



Uban water detection





Thank you for your attention

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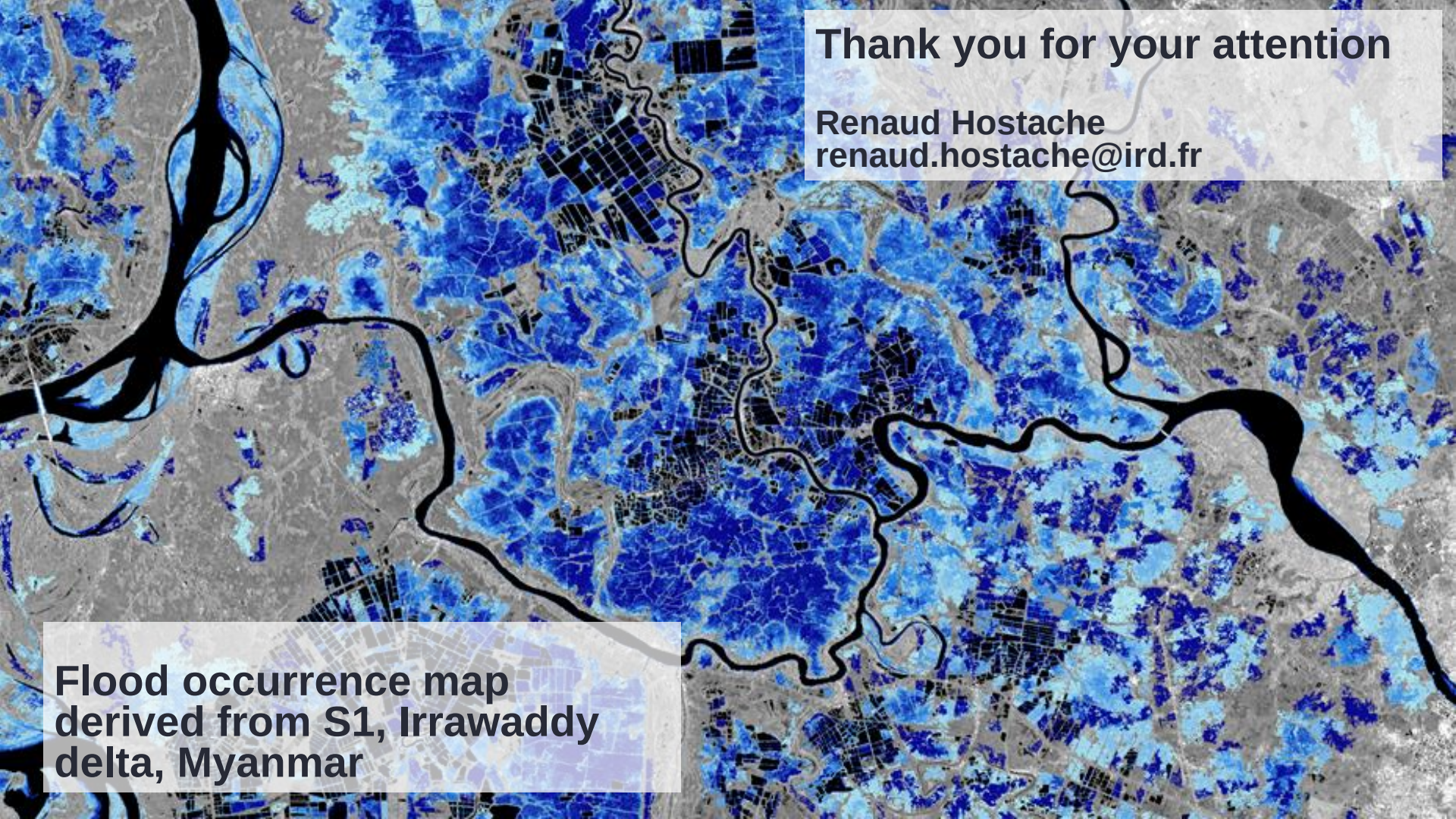

Flood occurrence map derived from S1, Irrawaddy delta, Myanmar