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# A detailed look at the new Global Flood Monitoring (GFM) product

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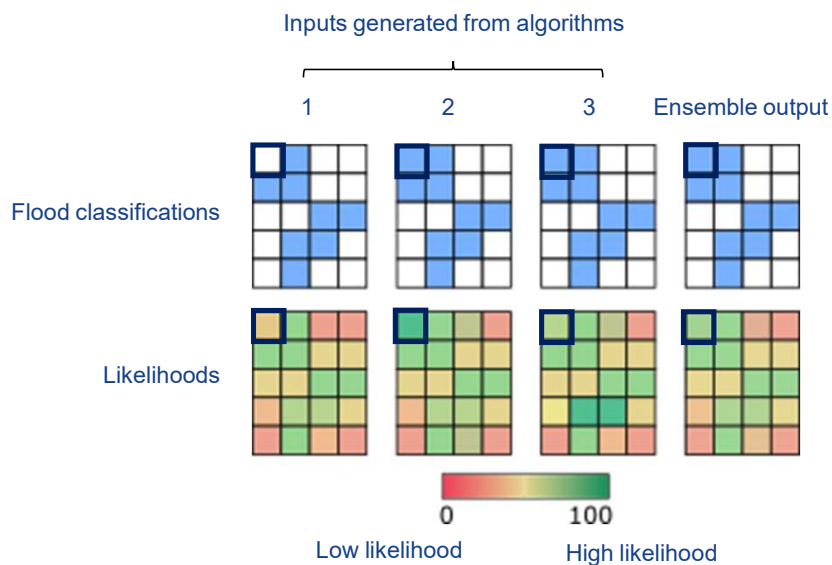
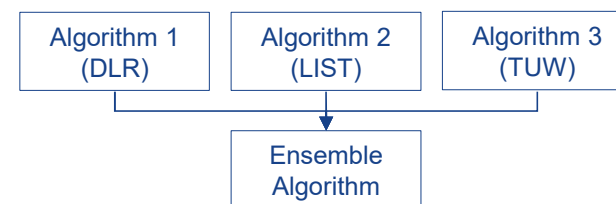


# GFM Product Principles

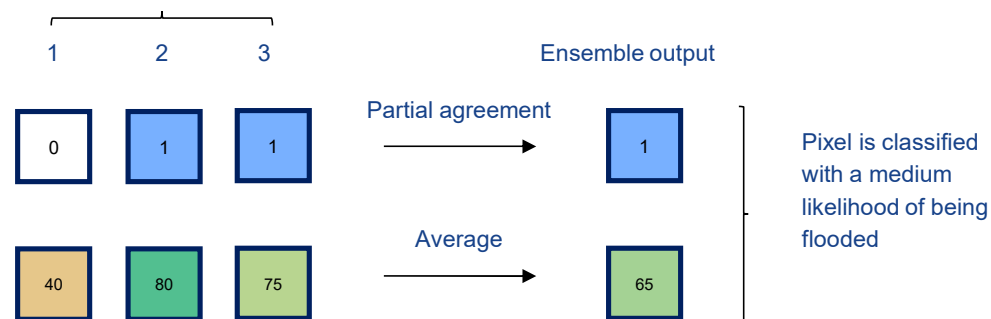


# Ensemble flood mapping algorithm

- Combining flood & likelihood values of all three flood algorithms
- Majority vote decides if a pixel is marked as flood or non-flood
- Final likelihood layer is the arithmetic mean of all likelihoods



Example of values from three algorithms over same pixel location in SAR scene





# GFM Product Output Layers

# Product Output Layers: Water observations

## S-1 observed flood extent

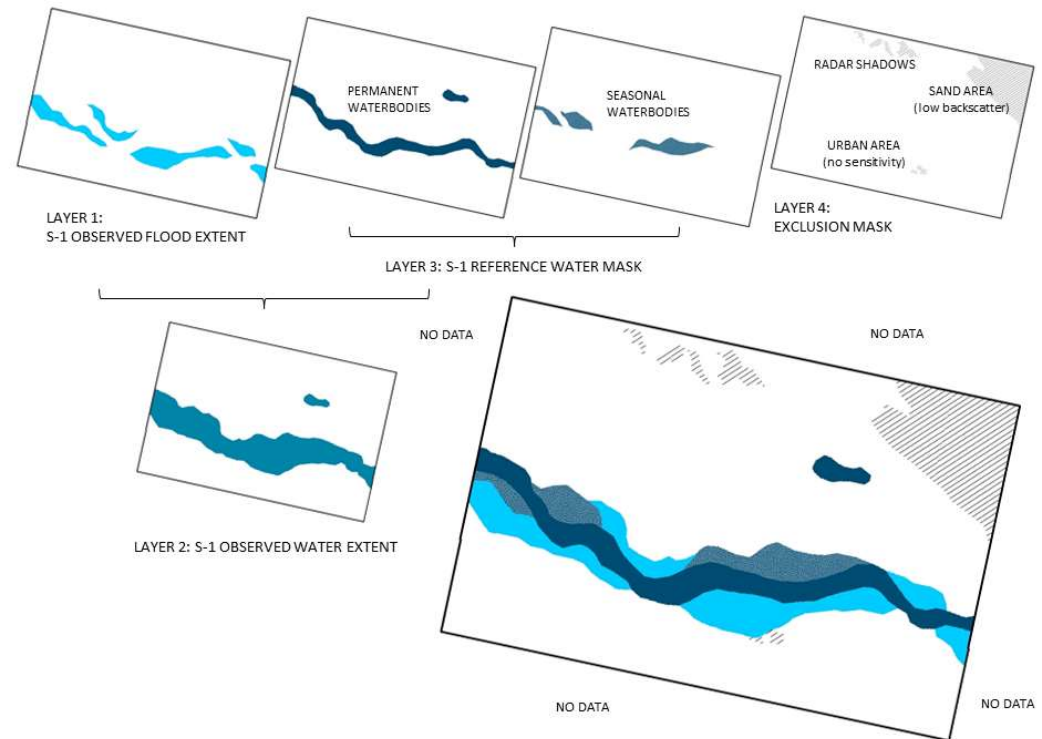
- Ensemble flood extent based on flood algorithms by DLR, LIST & TUW

## S-1 reference water mask

- Permanent & seasonal water based on water algorithms of DLR & LIST

## S-1 observed water extent

- Open water extent as combination of flood extent and reference water



# Product Output Layers: Contextual Information

## Exclusion mask

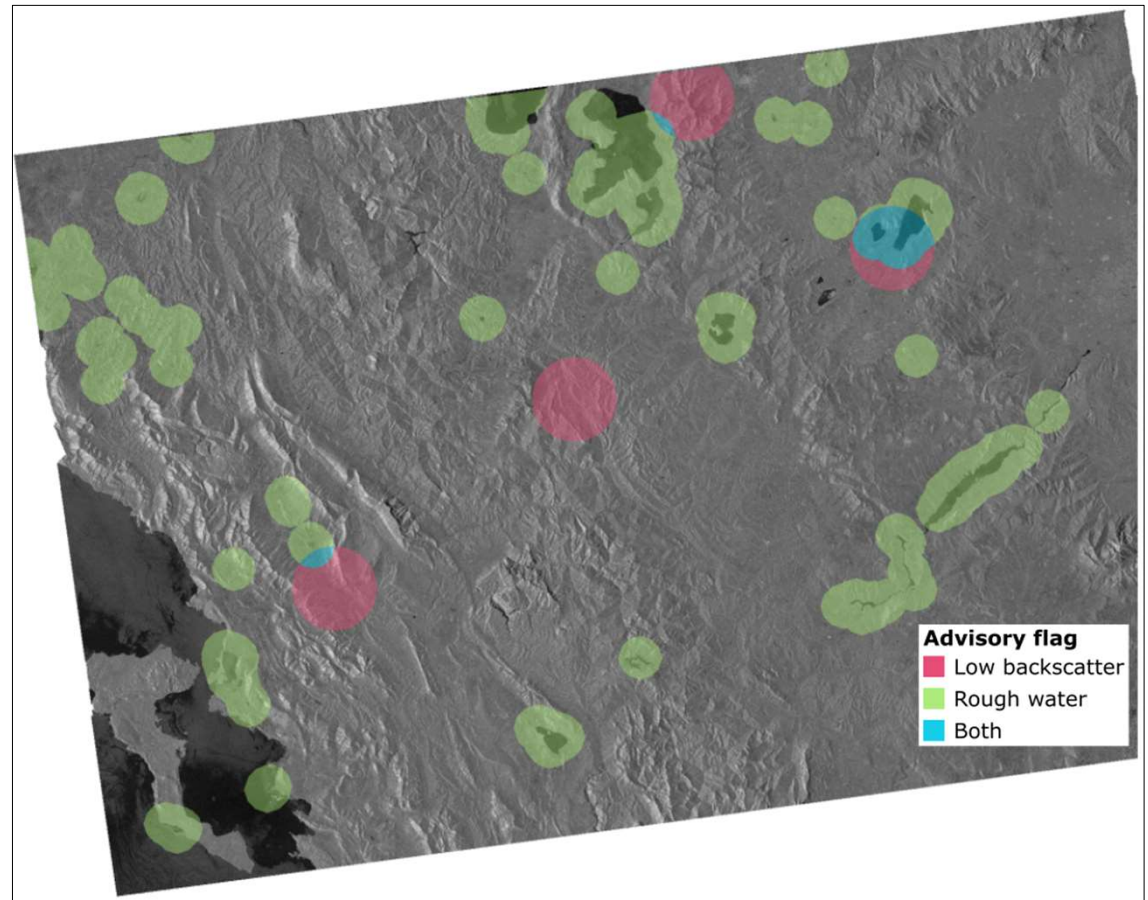
- Exclusion mask where S1 flood delineation is hampered

## Likelihood values

- Likelihood values accounting for classification confidence

## Advisory flags

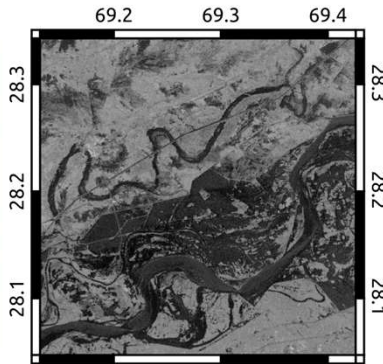
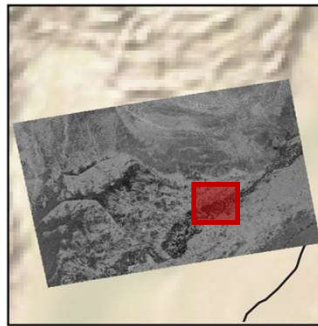
- Advisory flags indicating challenging classification circumstances



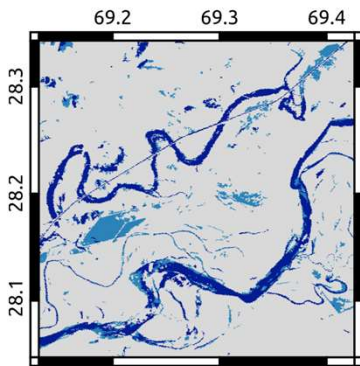


# GFM Results

# Results

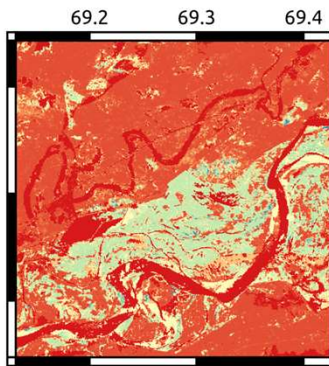


Sentinel 1-A



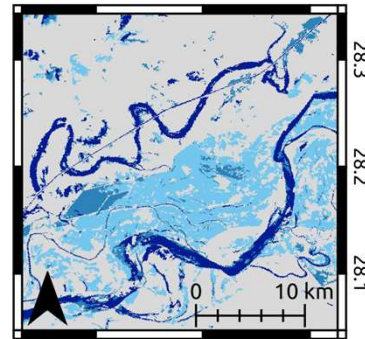
Reference water mask

■ Permanent   ■ Seasonal



Ensemble likelihood

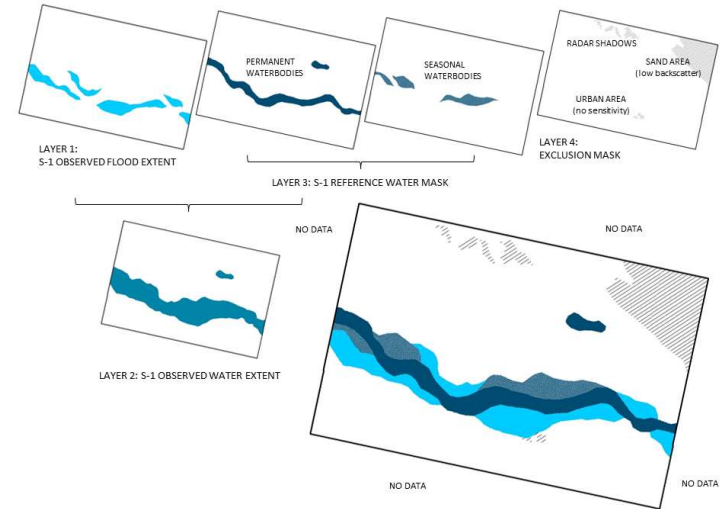
Low   High



Ensemble flood

■ Flood

- Flood disaster in Pakistan  
3 September 2022







# GFM Versioning



# Product Versioning

- Implementation of semantic versioning **Major.Minor.Patch**
- Major version reflects incompatible changes to API and data layers
- Minor version reflects changes in production system but retains backwards compatibility of the data layers
- Patch version reflects backwards compatible bug fixes or changes in the underlying auxiliary datasets used in the system
- Release of version 1.0.0 of GFM Product on 16 December 2021
- Release of version 2.0.0 of GFM Product on 2 January 2023
- <https://extwiki.eodc.eu/GFM/GFMVersioning>
- <https://semver.org/>





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Response

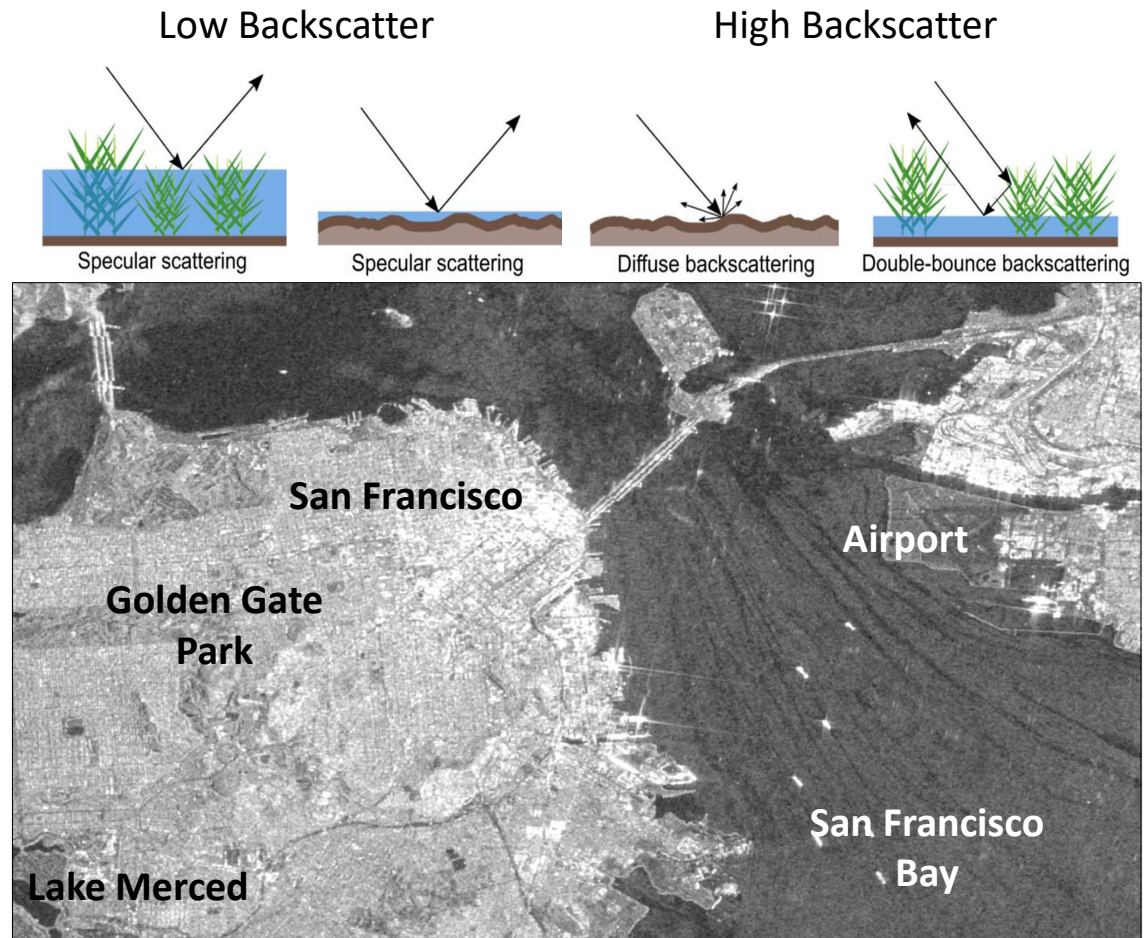
Rapid Mapping   Risk & Recovery Mapping   Floods   Fires   Droughts   Population   Built-up areas

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# Appendix

# Sentinel-1 & water detection

- Specular (i.e. mirror-like) scattering over **calm water bodies**
- **Water look-alikes**
  - Tarmacs
  - Dry soil
  - Wet snow
  - Agricultural fields
- **Rough water surfaces** disturb specular scattering
- Double-bounce backscattering in **urban areas**
- Diffuse backscatter over **dense vegetation**



# Product Evolution

- Update exclusion mask
  - No sensitivity, i.e. refinement of parameters
  - Refinement of Non-water low backscatter over arid areas
  - Radar shadow, i.e. integration of CopDEM simulated radar shadow
- Computing the reference water mask for a period of 5 years (instead of 2 years)
- Flag scenes as flooded with anomaly detection
- Reprocessing of the flood archive
- Incorporate Sentinel 1-C
- Adding new GHSL data for flood impacts

