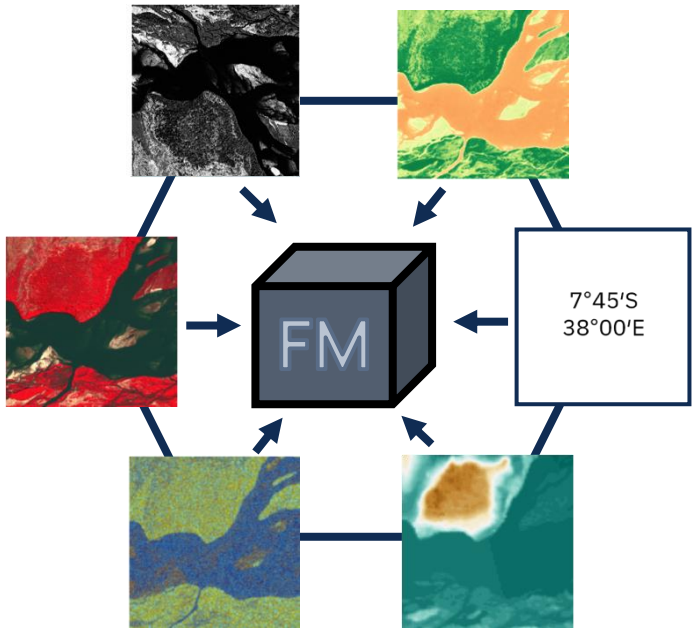
POLITECNICO MILANO 1863

Towards Streaming Continual Learning for Earth Observation Multimodal Foundation Models

2025-01-21 Marcello Matteo Declich

Earth Observation

Seasonal Trends



Distributional shifts

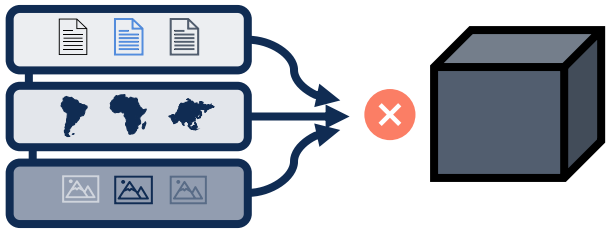
Multimodal data learned by Foundation Model

Current Limitations of Foundation Models in EO

- **Offline Pretraining.**
- **Frozen** knowledge base.
- Full **retraining unsustainable.**

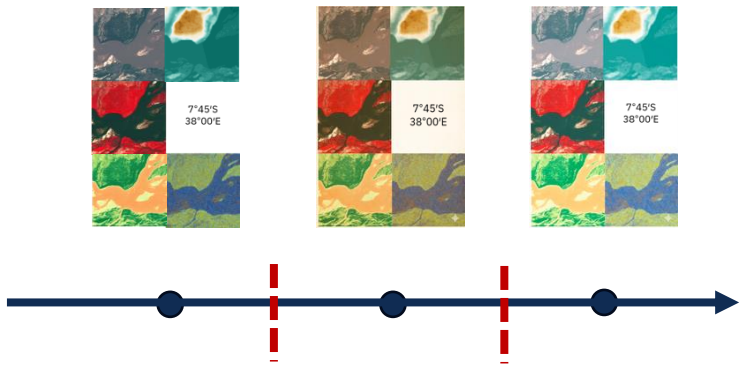
- No mechanism to **distinguish** seasonal patterns from distribution shifts.
- No **drift detection** capabilities.

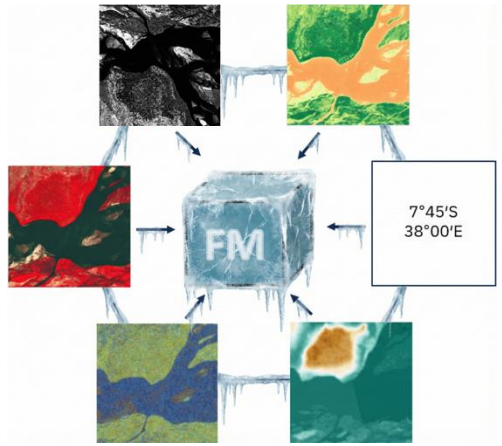
- **Static** fusion across modalities
- Rigid **strategy regardless** of **operating conditions.**



Terabytes of Data daily produced

Static Foundation Model





A Vision for Lifelong Learning Geo Foundation Models

- **Efficient** model **updating** for multimodal scenarios (e.g, **Continual Pretraining, Knowledge Distillation)**

- Explicit **Drift Detection.**
- **Cycle** recognition to produce **temporally aware** embeddings.
- Temporal allignment as training objective.

- **Adaptive Modality Fusion** allowing for real-time reweighting
- **Modality Extensibility** enabling the seamless integration of new sensor types

Thank you for the attention

If you are interested, join me at the poster session