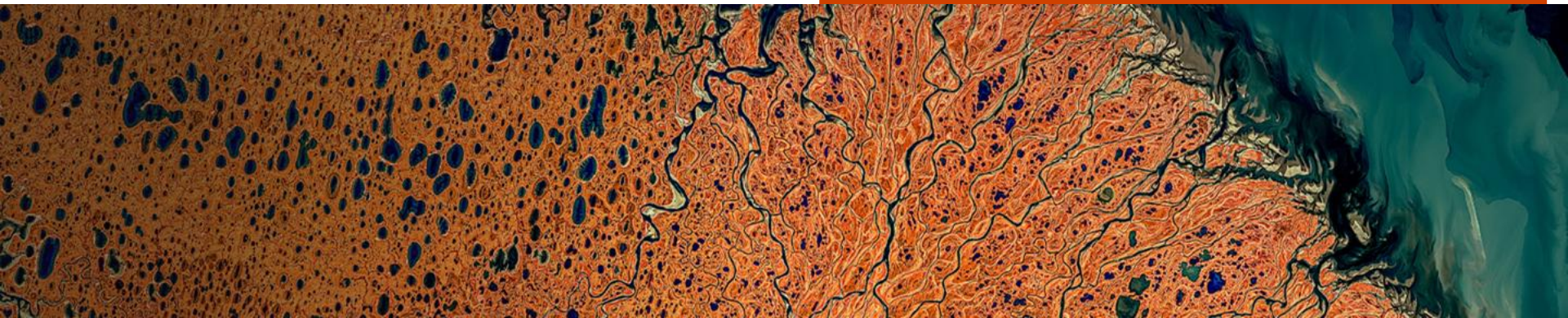


AI & Future Tech

Ian Schuler, CEO, Development Seed

2025 EuroGeographics General Assembly | Riga, Latvia



Data for Impact

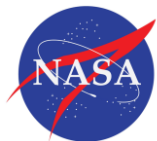
GOVERNMENT

BIG TECH

MULTILATERAL

NGO

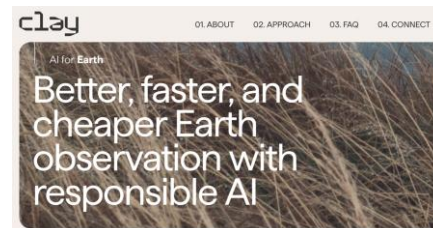
COMMERCIAL SPACE



**Billions of decisions
would benefit from
better geodata**



Large Earth Models



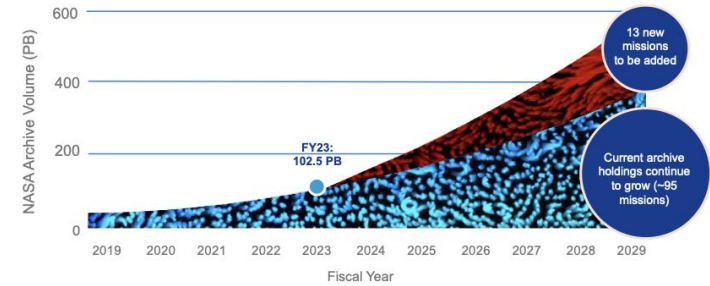
NEW DATA SOURCES

Data. So much data.



Source: ESA

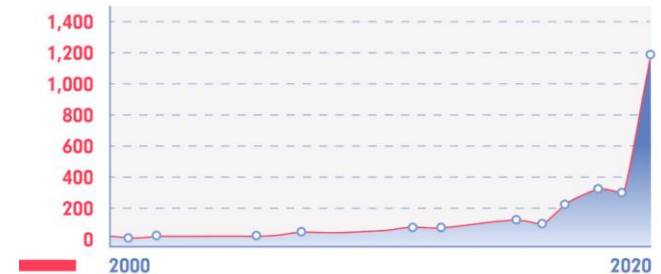
Earth Science Data Archive Growth Projection



Source: NASA

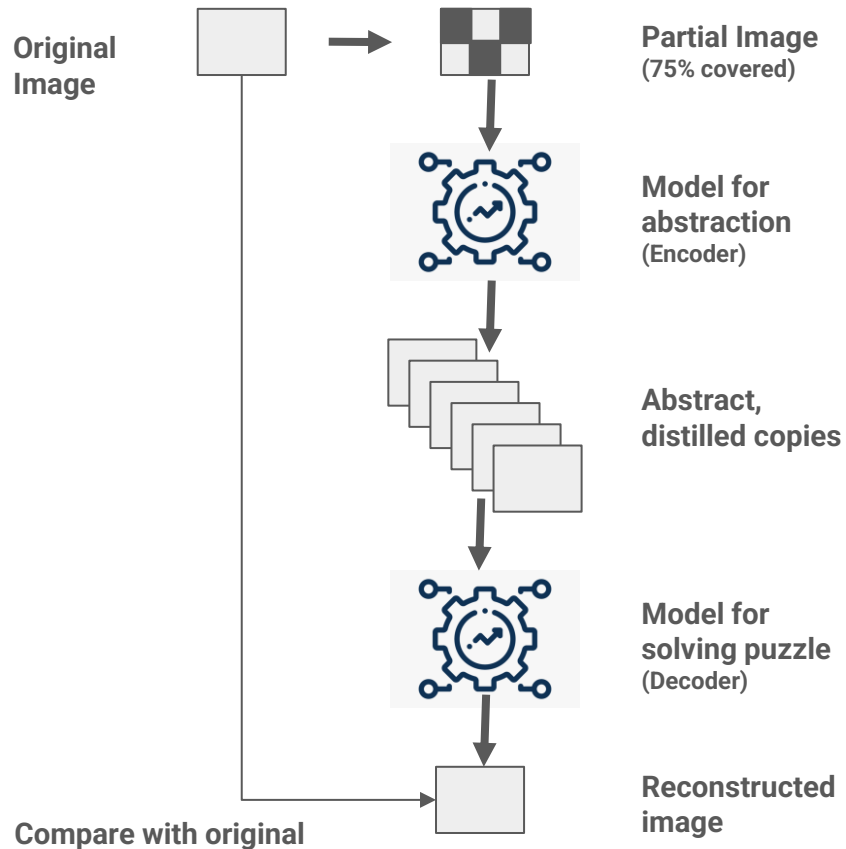
Number of Satellites Launched Per Year

Data Source: Union of Concerned Scientists

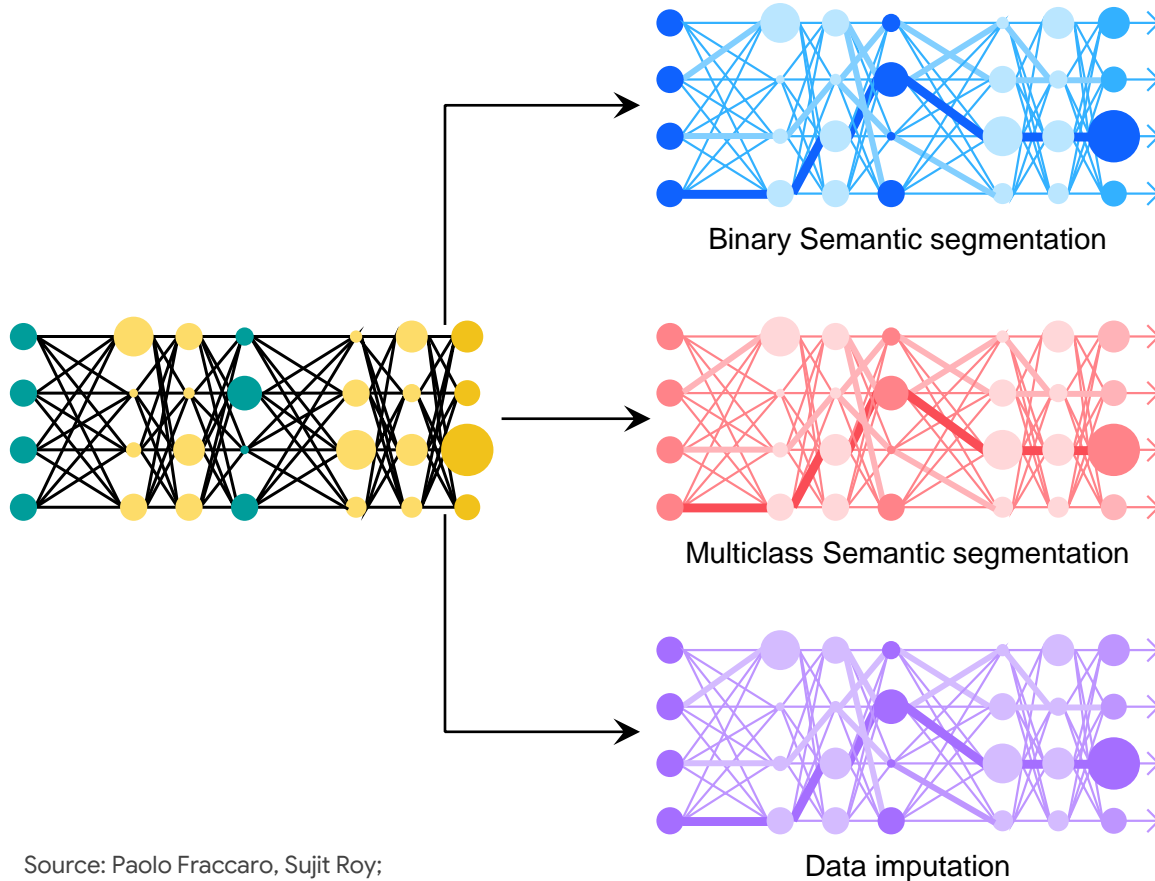


Let's solve a puzzle

- Reconstruct hidden parts of a satellite image
- What matters is the quality of abstraction in the intermediate step, not the reconstruction itself
- Replace the reconstruction with something useful, like biomass estimation



Prithvi HLS - Geospatial FM for many tasks



Detecting burn scars



Detecting floods



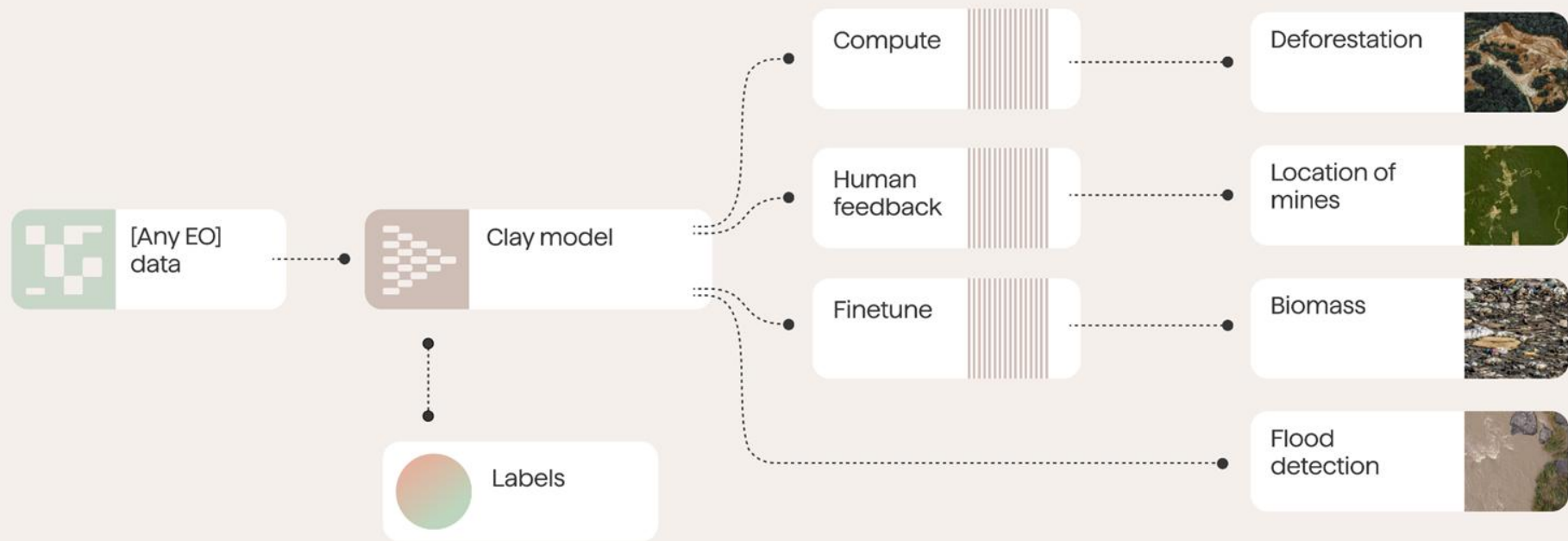
Classifying crop species



Cloud gap filling

Prithvi 100M Model





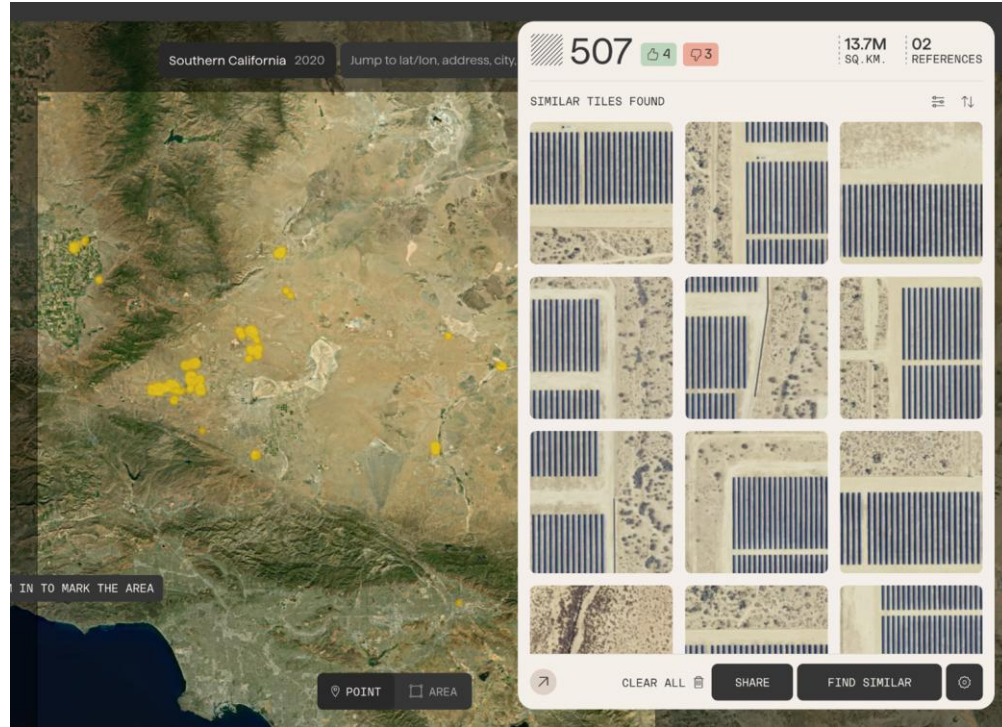
Mapping and Monitoring

Similarity search

Change Detection

Segmentation

Finetune vision models without massive training data

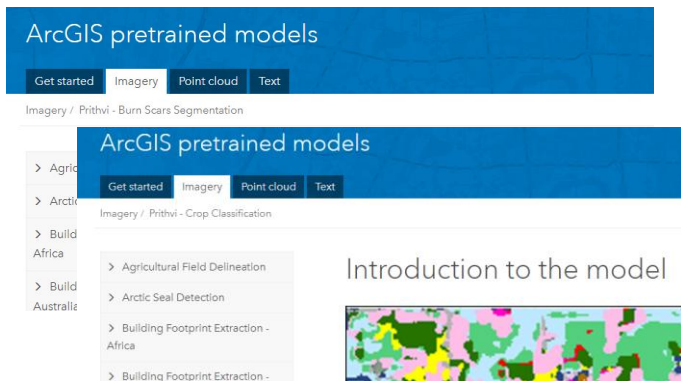


Screenshot of <https://explore.madewithclay.org/>

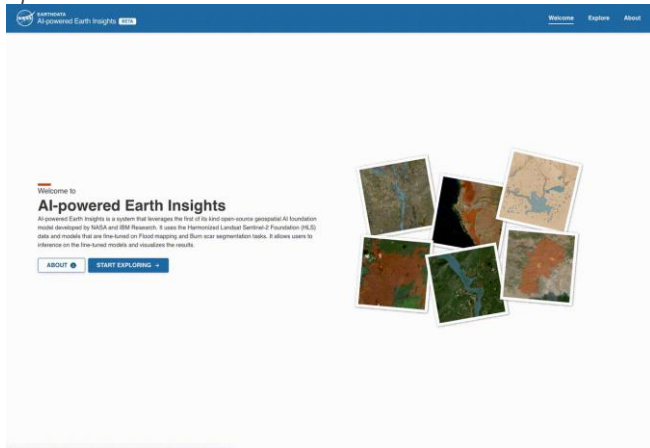


Prithvi HLS Success Story: Downstream Applications and Adoption

- Burn scar detection
- Flood water delineation
- Crop classification
- Cloud gap filling
- LULC (HK region)
- Eddy covariance
- Insect damage estimation
- *Locust breeding ground prediction**
- *Semantic segmentation of mangrove forest**



(3) ESRI Living Atlas



TerraTorch

[Documentation](#)

Overview

TerraTorch is a library based on [PyTorch Lightning](#) and the [TorchG](#) main purpose is to provide a flexible fine-tuning framework for G interacted with at different abstraction levels.

(4) IBM Open Source Library for Fine Tuning

(5) Integration with NASA Data Systems

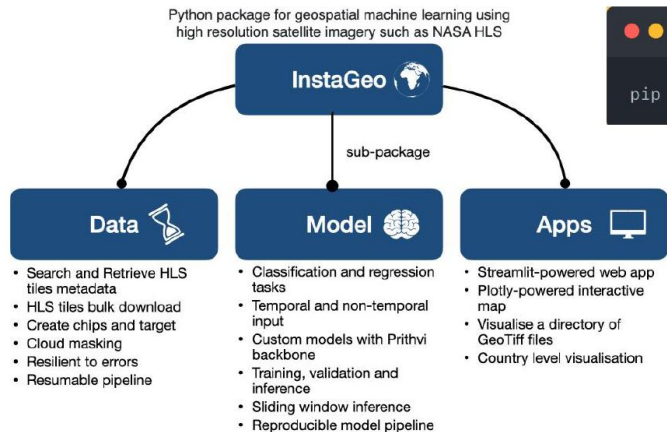


Scholar articles [Foundation models for generalist geospatial artificial intelligence](#)
J Jakubik, S Roy, CE Phillips, P Fraccaro, D Godwin... - arXiv preprint arXiv:2310.18660, 2023
Cited by 23 [Related articles](#) [All 2 versions](#)

(1) HLS Paper Citations



(2) Locust breeding ground prediction + Tooling



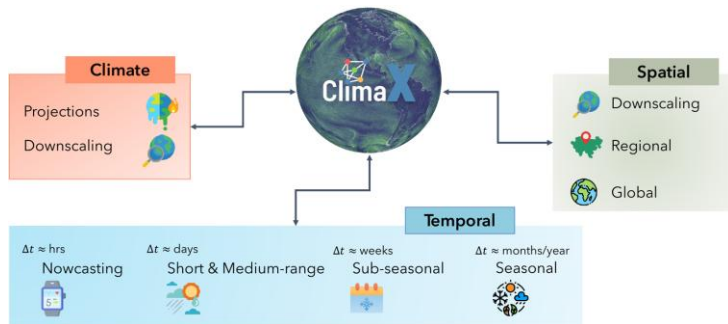
Source: Arnu Pretorius, Yusuf Ibrahim InstaDeep

Source: Rahul Ramachandran, NASA - "AI Foundation Models for Science" - used with permission

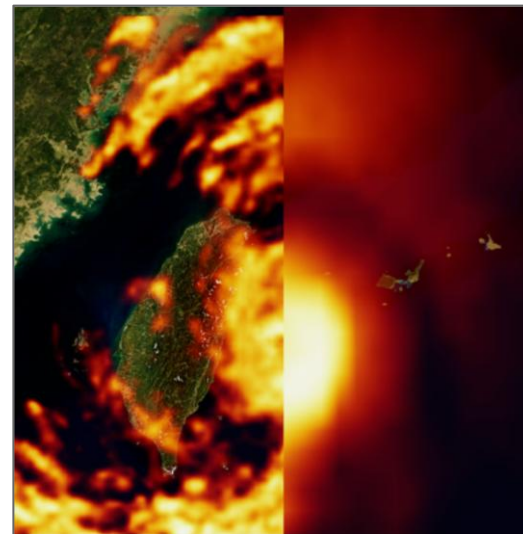


Predictive Models

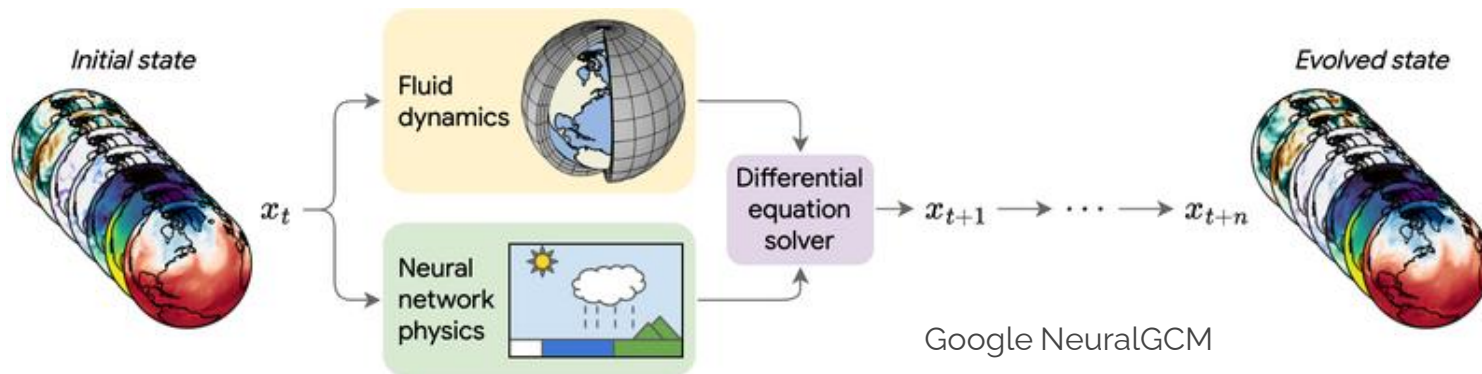
Weather and Climate Models



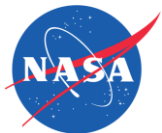
Microsoft ClimaX



NVIDIA FourCastNet + CorrDiff



Google NeuralGCM



Prithvi-WxC :Foundation model for weather and climate

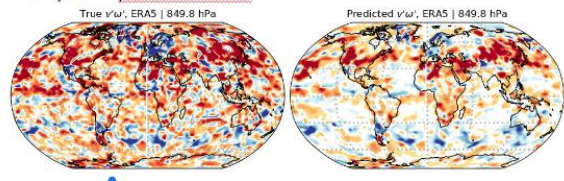
Technical Objectives

- Multi-region, multi-resolution, multi-dataset
 - 1 model capable to work with multiple datasets (HRRR, ERA5, MERRA2) from 3 to 60 Km.
- Supports spherical and Euclidean topology
- Generate Forecasting emulators by tuning
- Integrate select observations.

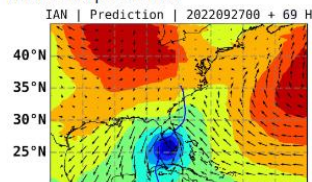
12x downscaling of climate model data



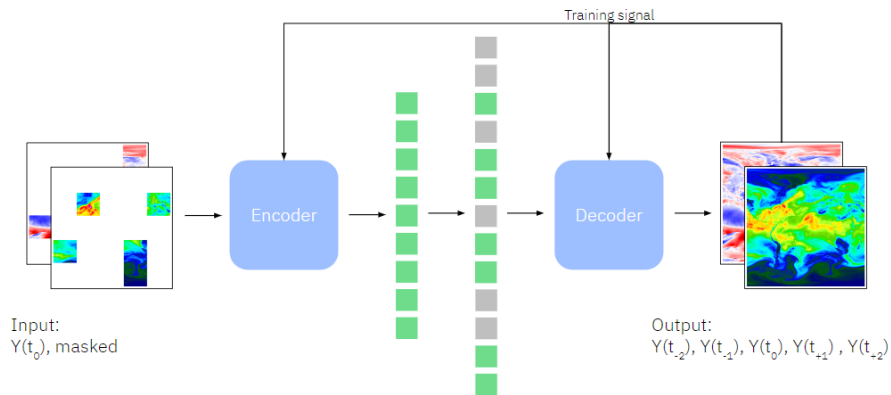
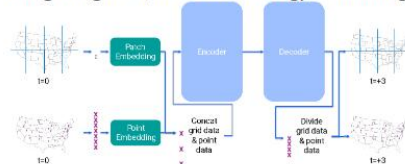
Gravity wave parametrization



Hurricane prediction



Integrating obs. / renewable energy forecasting



Mixture of forecasting & data assimilation / state estimation.
We are using [-24, -12, -6, -3, 0, +3, +6, +12, +24] hours ahead.

Weather & climate Forecasting

Downscaling

Model output statistics/bias correction

Multi-model ensembling

Parameterization

Data Assimilation

Detection

Tracking

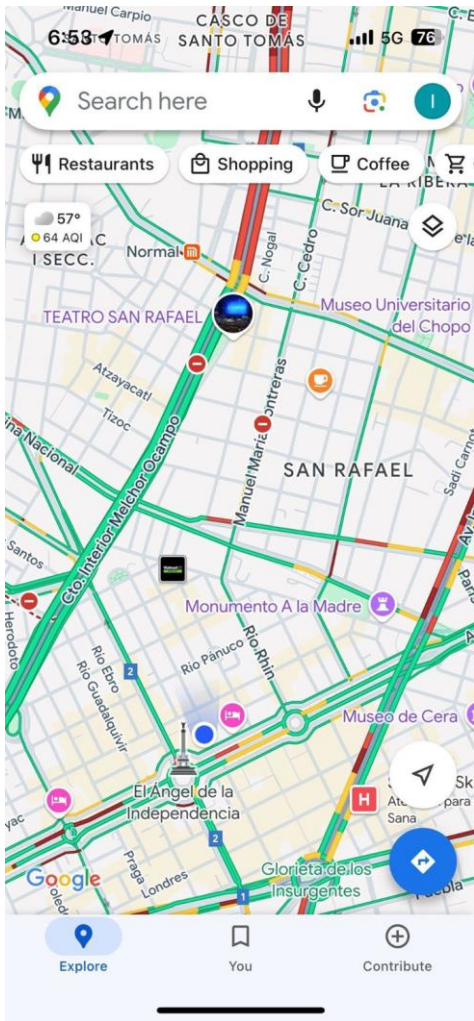
Impact Modeling

Source: Rahul Ramachandran, NASA - "AI Foundation Models for Science" - used with permission



THE STATE OF PLAY

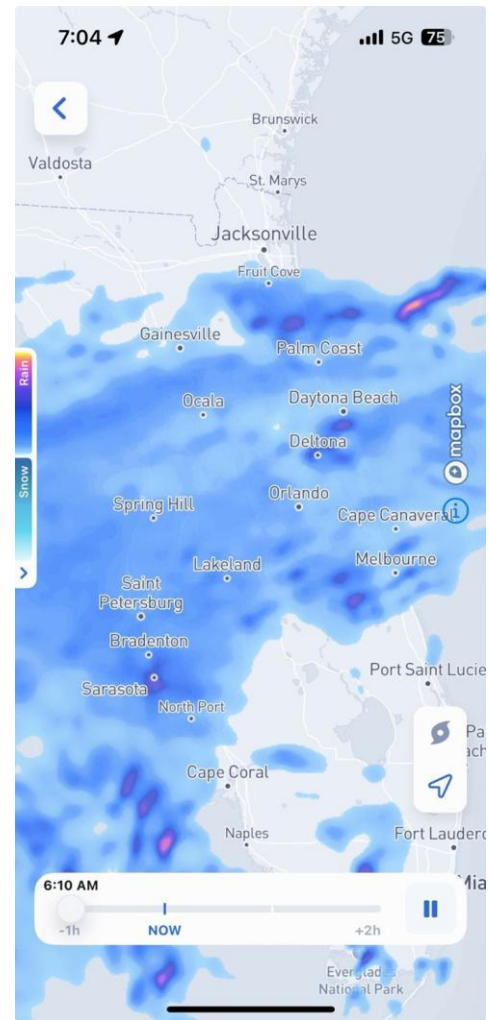
Digital Twins



What now?

What Next?

What If?



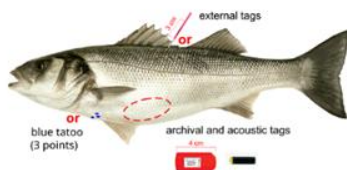
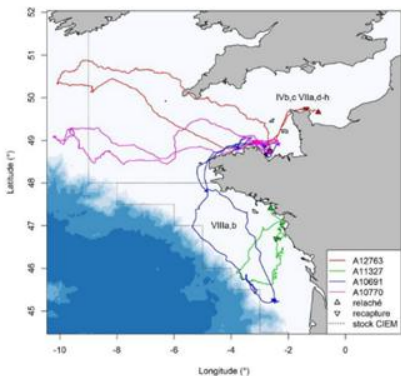
From Data to Insight



developmentSEED

Fish Track Modeling

Based on biologging data of individual tagged fish and the ocean around them



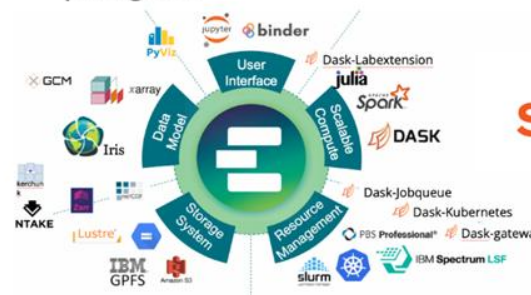
Web Interface

Making the vast amount of data generated by the model useful to decision makers.



Pangeo Infrastructure

Cutting edge models will be combined with the cloud based simulations from the DestinE ocean data based on pangeo.



simula



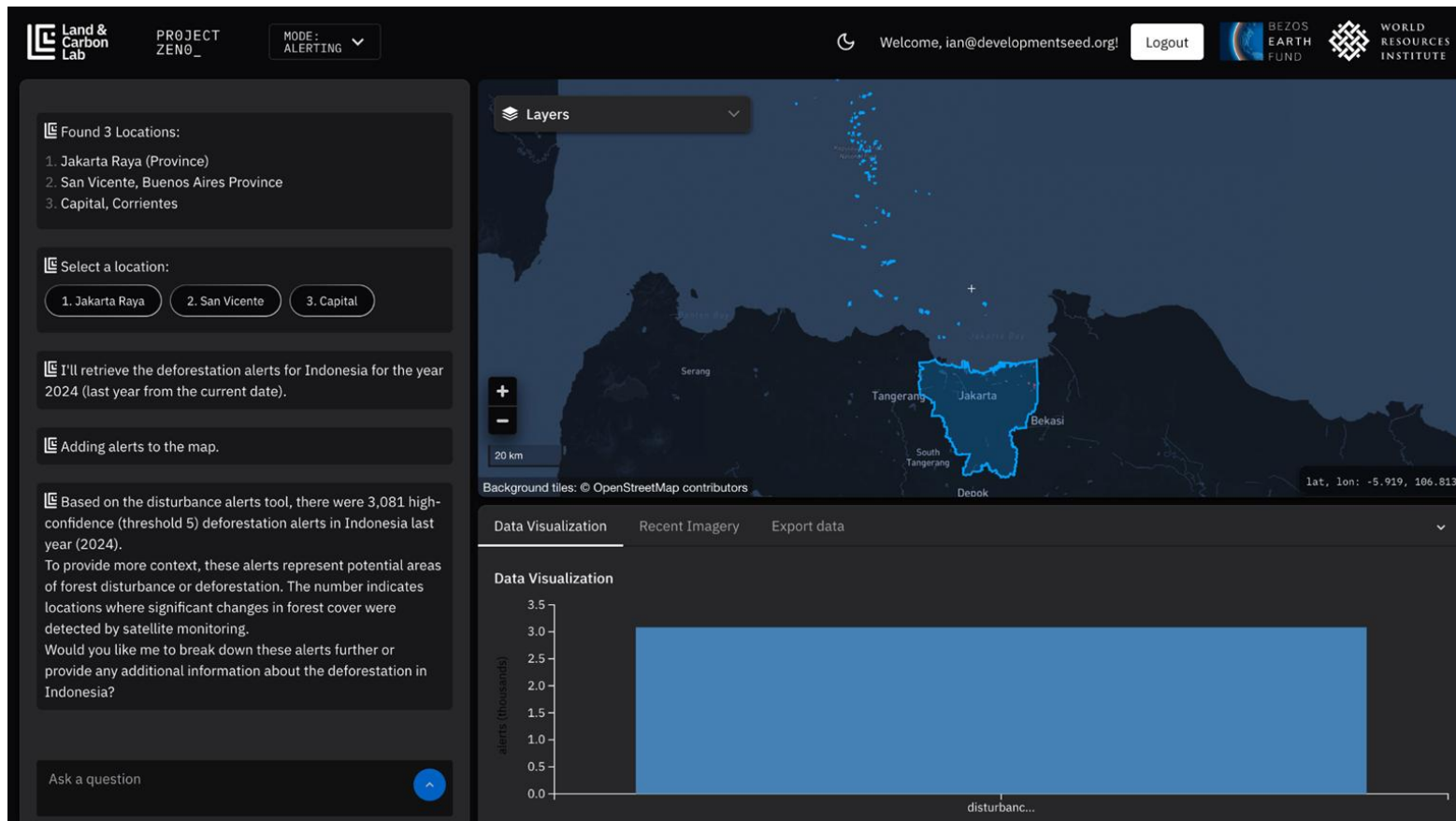
THE STATE OF PLAY

GeoAgents

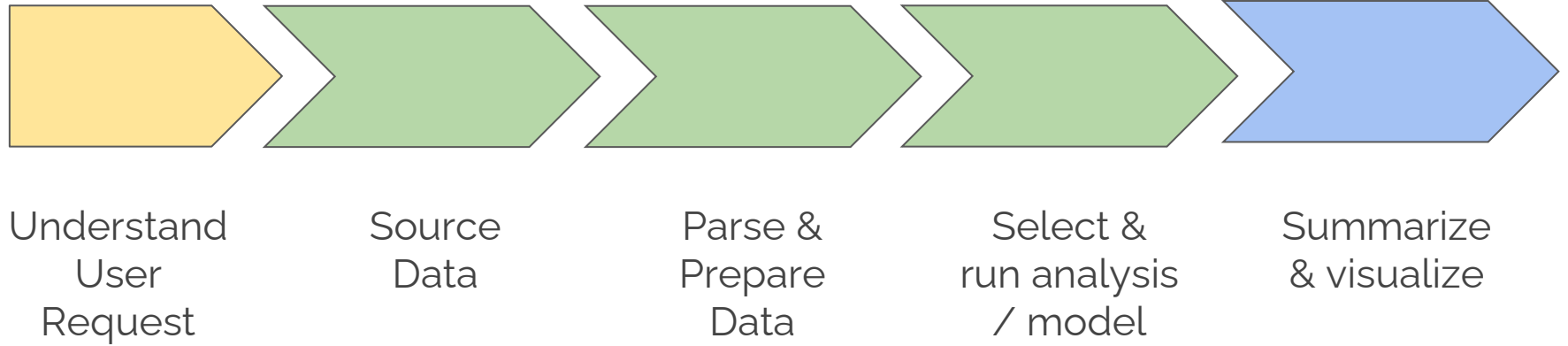
Geo Agents



Geo Agents



Geodata for decision-making



Geodata for decision-making



Understand
User
Request

Source
Data

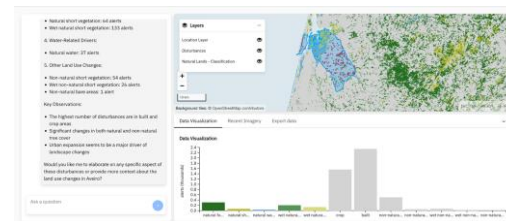
Parse &
Prepare
Data

Select &
run analysis
/ model

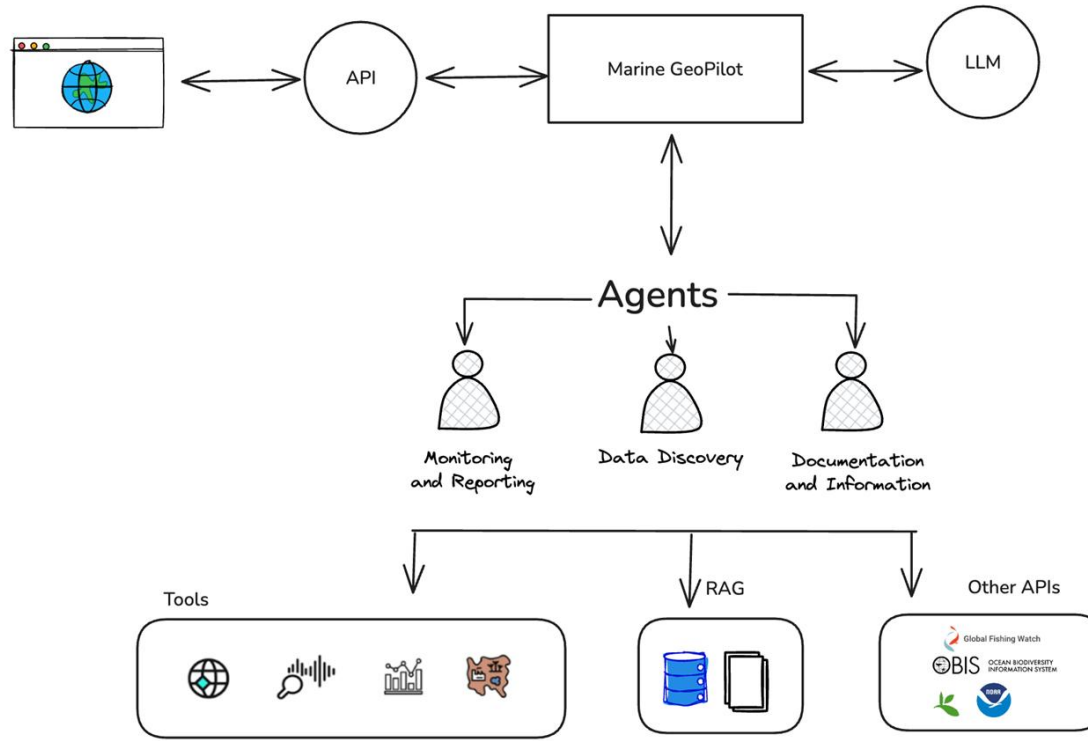
Summarize
& visualize

$$\begin{pmatrix} a_{11} & a_{12} & a_1 & a_n \\ a_{21} & a_{22} & a_2 & a_2 \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & \dots & a_m & a_n \\ a_{m1} & a_{m2} & a_m & a_n \end{pmatrix}$$

```
1 import requests
2 from langchain_core.tools import tool
3 from pydantic import BaseModel, Field
4
5 class LocationInput(BaseModel):
6     """Input schema for location finder tool"""
7
8     query: str = Field(
9         description="Name of the location to search for. Can be a city, region, or country name."
10     )
11
12 @tool("location-tool", args_schema=LocationInput)
13 def location_tool(query: str) -> dict:
14     url = f"https://api.mapbox.com/search/geocode/v6/forward?q={query}&autocomplete=false&limit=3&access_token=xxx"
15
16     response = requests.get(url)
17
18     return response.json()
```



Geo Agents





THE STATE OF PLAY

The Great Retooling

	Mapping	Monitoring	Mobilizing
Data needs	High fidelity & spatial consistency	Regular revisit + temporal consistency	High fidelity + low latency
FM opportunities	"one shot" feature detection; features with regional variation	automation for speed and volume; multimodal monitoring	"curiosity-led" exploration; AI Agents
For digital twins	An input	A signal	The point
Infrastructure Implications	Global extent & consistency	Temporal extent & consistency	Multi-dimensional & model data
	Raster + Vector	Embeddings	Heavy on-demand processing
	Tiling & chipping	Batch processing	
	Fast rendering	Fast vector search	Fast inference
			Fast integration of new data

Formats by Data Type

Format	Data Type	Standard Status
Cloud-Optimized GeoTIFF (COG)	Raster	OGC standard for comment
Zarr, Kerchunk	Multi-dimensional raster	ESDIS and OGC standards in development
Cloud-Optimized Point Cloud (COPC), Entwine Point Tiles (EPT)	Point Clouds*	no known ESDIS or OGC standard
FlatGeobuf, GeoParquet,	Vector	no known ESDIS, draft OGC standard

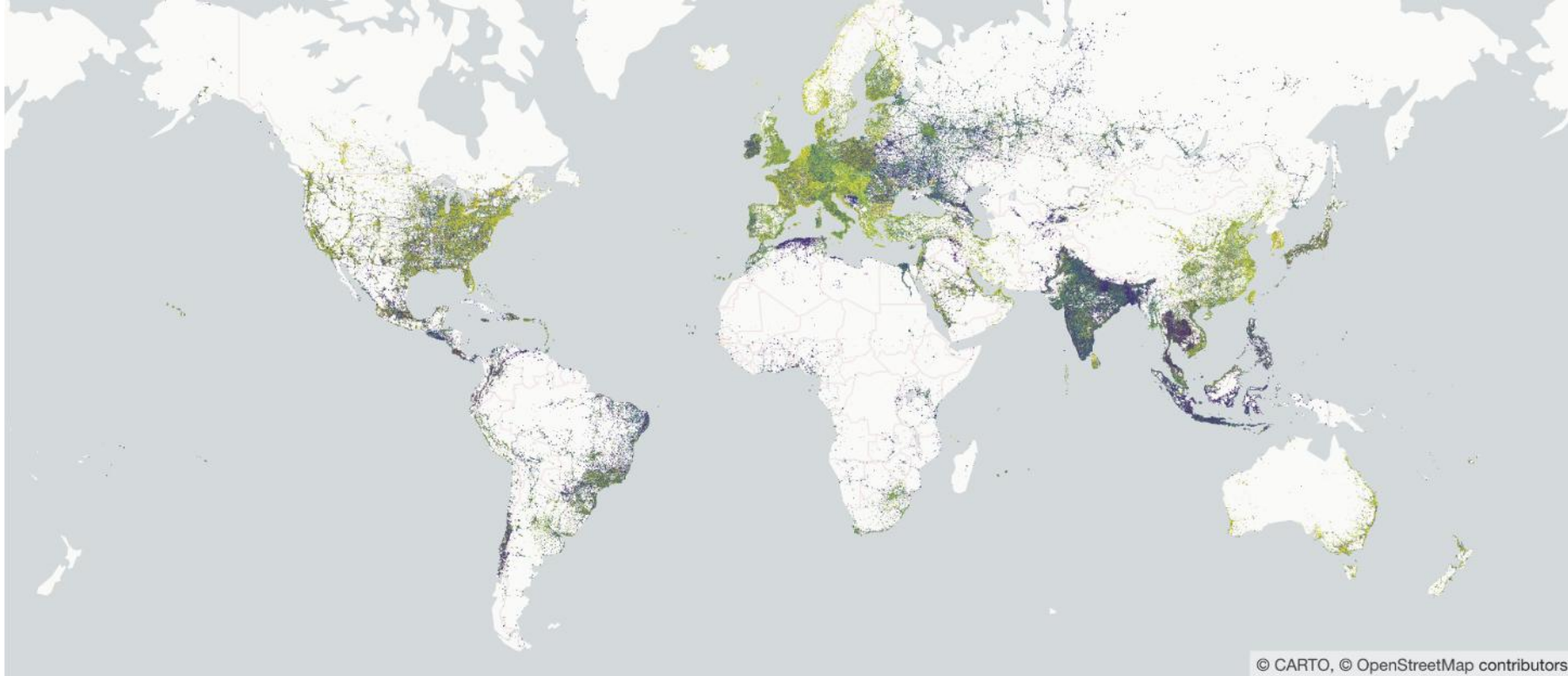
Source: <https://guide.cloudnativegeo.org/>



Architectural Patterns

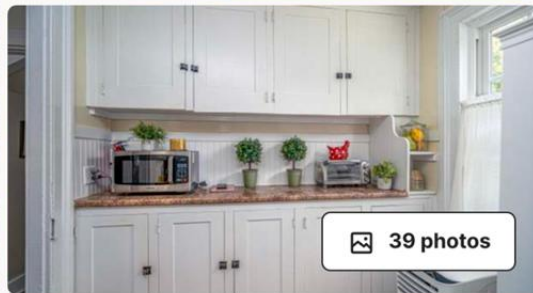
- Blob object storage in cloud optimized data format (COG, ZARR)
- "Processor-friendly" metadata and cataloging (STAC)
- APIs and streaming data services (TiTiler / eoAPI)
- On-demand research environment (JupyterHub)
- Model training & inference (PyTorch, GeoParquet)
- Processing and pipelining tools
- In-browser analysis, investigation, and storytelling (veda-ui, Lonboard)

Visualize and analyze massive geodata



Visualize and analyze massive geodata



[← Search](#)[Overview](#)[Neighborhood](#)[Property details](#)[Sale & tax history](#)[Climate](#)[♡ Favorite](#)[🔍 Hide](#)[➦ Shar](#)

Listed by Stacey Loya • PennyDot Realty.

● FOR SALE - ACTIVE

155 S Main St, Salem, NY 12865

\$215,000

Est. \$1,301/mo

[Get pre-qualified](#)

2

Beds

1.5

Baths

1,260

Sq Ft



Contact listing agent

At this time, Redfin doesn't have an agent available to help you with this home.

Stacey Loya

PennyDot Realty

518-338-8998

Climate risks

Most homes have some risk of natural disasters, and may be impacted by climate change due to rising temperatures and sea levels.



Flood Factor - Extreme

99% chance of flooding in next 30 years



Fire Factor - Moderate

1% chance of being in a wildfire in next 30 years



Heat Factor - Minor

7 days above 92° expected this year, 16 days in 30 years



Wind Factor - Minor

4% chance of strong winds in next 30 years



Air Factor - Minor

0 unhealthy days expected this year, 1 days in 30 years



[View full report](#)

Provided by First Street 

Contact listing agent

At this time, Redfin doesn't have an agent available to help you with this home.

Stacey Loya

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staceysellshouses@yahoo.com

Finance this home

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What Next?

What If?



Thank you!

ian@developmentseed.org

