living planet symposium | BONN 23–27 May 2022

TAKING THE PULSE OF OUR PLANET FROM SPACE

EO Analytics for societal challenges

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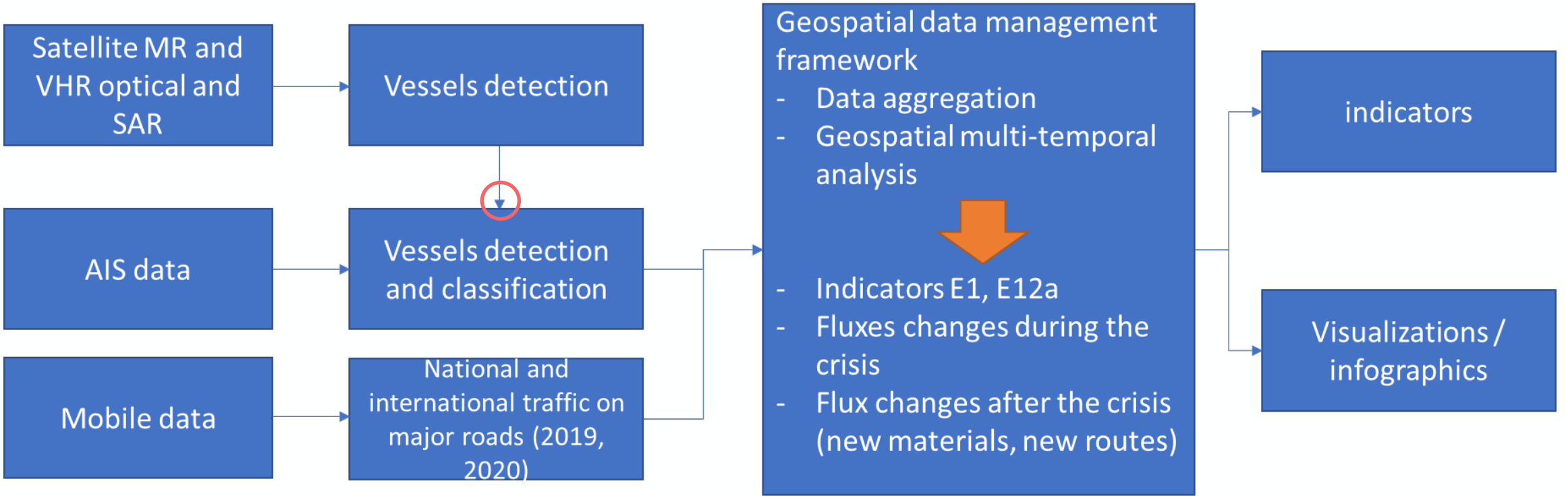
Scope of the activity

Demonstrate the capabilities achievable **fusing together Earth Observation data with mobility data** and **other geospatial data** (AIS) to assess the economic impact of COVID19 in two economic sectors:

- **Logistic hubs traffic** (dynamics across 2020 and 2021)
- **Agriculture** for work-intentsive / less mechanised crops (field preparation, gathering)

Logistic hub evolution

Concept: to perform an integrated maritime traffic / land traffic analysis to assess the impact of COVID in established fluxes.



Logistic hub evolution

Detecting ships docked at a pier from space gets easier as much the spatial resolution increases – reality?

Sensor	Date	Image features
KOMPSAT	**19/05/2018 13:10:10**	**MS, 4 bands, 2m**
Planetscope	04/04/2019 08/02/2020 14/02/2020 21/02/2020 14/03/2020	RGB ~5m
Pleiades	07/04/2020 11:34:27 06/05/2020 11:12:45 17/05/2020 11:26:23	MS, 4 bands
Sentinel 1	May 2019 April, May, June, July August, September, October, November 2020	RGB (VV, VH, ratio VV/VH)
Sentinel 2	May, June, July, August, September, October, November 2020	RGB

Sensor	Date	Image features
Cosmo Skymed	24/03/2019 05:53:12	HH
	25/04/2019 05:53:12	HH
	27/05/2019 05:53:17	HH
	28/06/2019 05:53:19	HH
	30/07/2019 05:53:18	HH
	23/08/2019 05:53:22	HH
	24/09/2019 05:53:25	HH
	02/03/2020 05:53:24	HH
	18/03/2020 05:53:25	HH
	03/04/2020 05:53:28	HH
	19/04/2020 05:53:28	HH
	05/05/2020 05:53:28	HH
	02/06/2020 05:53:26	HH
	18/06/2020 05:53:25	HH
	08/07/2020 05:53:23	HH
	08/08/2020 05:53:19	HH
	08/10/2020 05:53:19	VH
	05/11/2020 05:53:19	VH
	06/09/2020 05:53:19	VV
	22/09/2020 05:53:18	VV

Logistic hub evolution

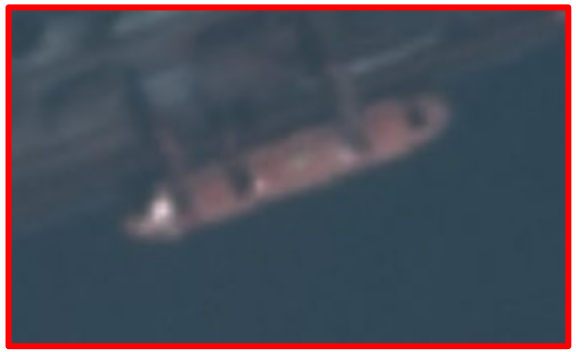
Vessels detection: HR imagery

Sentinel-2: 2020 - 04 - 04

Logistic hub evolution

Vessels detection: VHR imagery

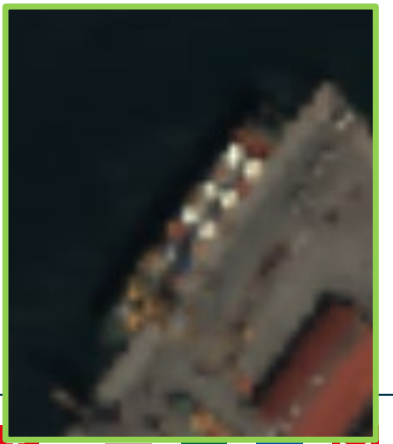
Planetscope: 2020 - 03 - 14



Logistic hub evolution

Vessels detection: VHR imagery

Pleiades: 2020 - 04 - 07

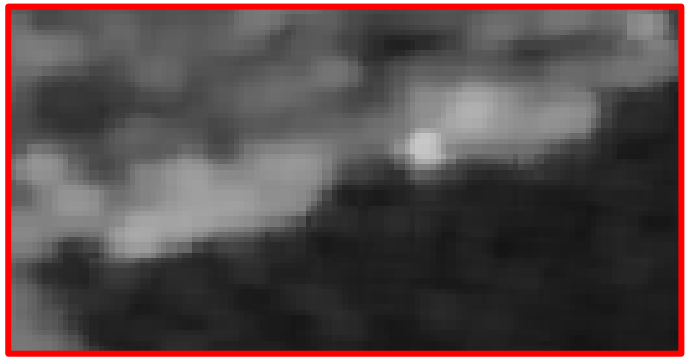


Logistic hub evolution

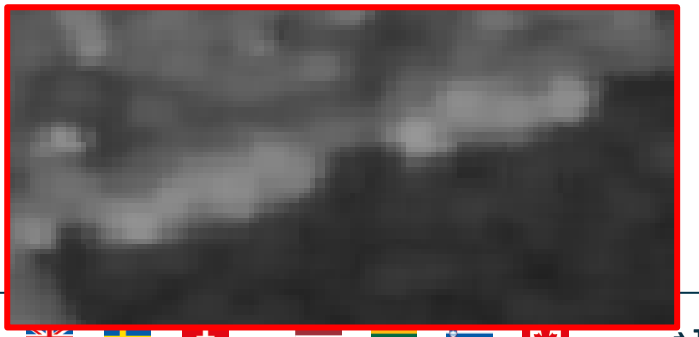
Vessels detection: HR imagery

Sentinel-1: 2020 - 04 - 28

Polarisation - VH

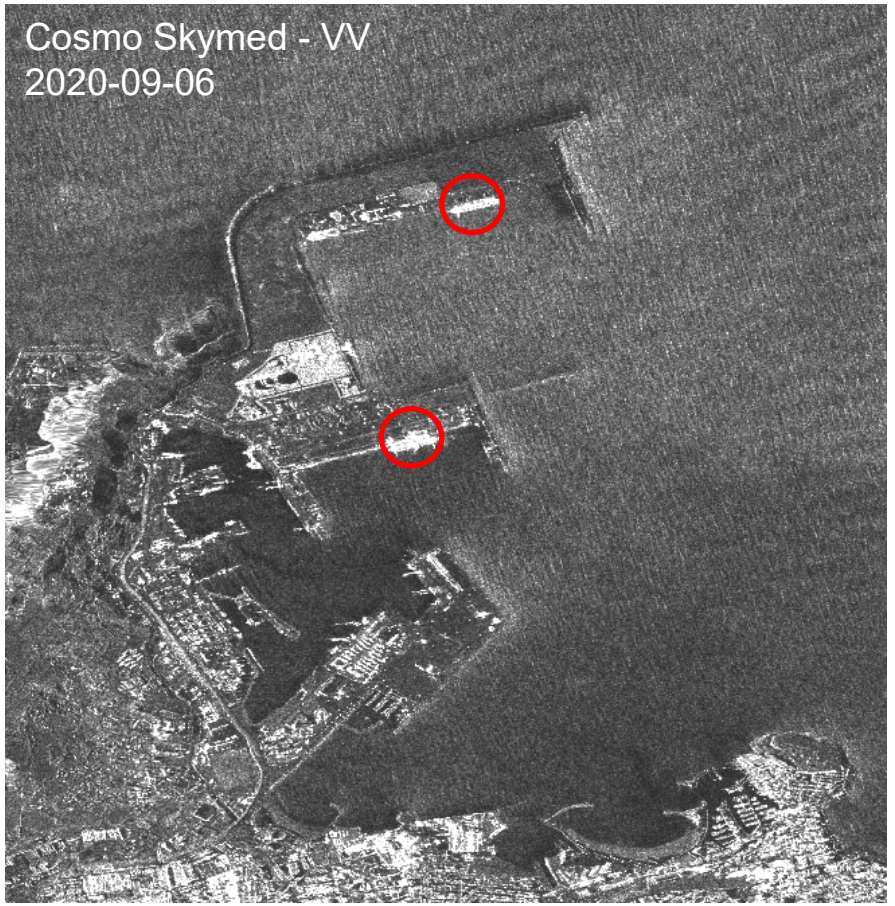


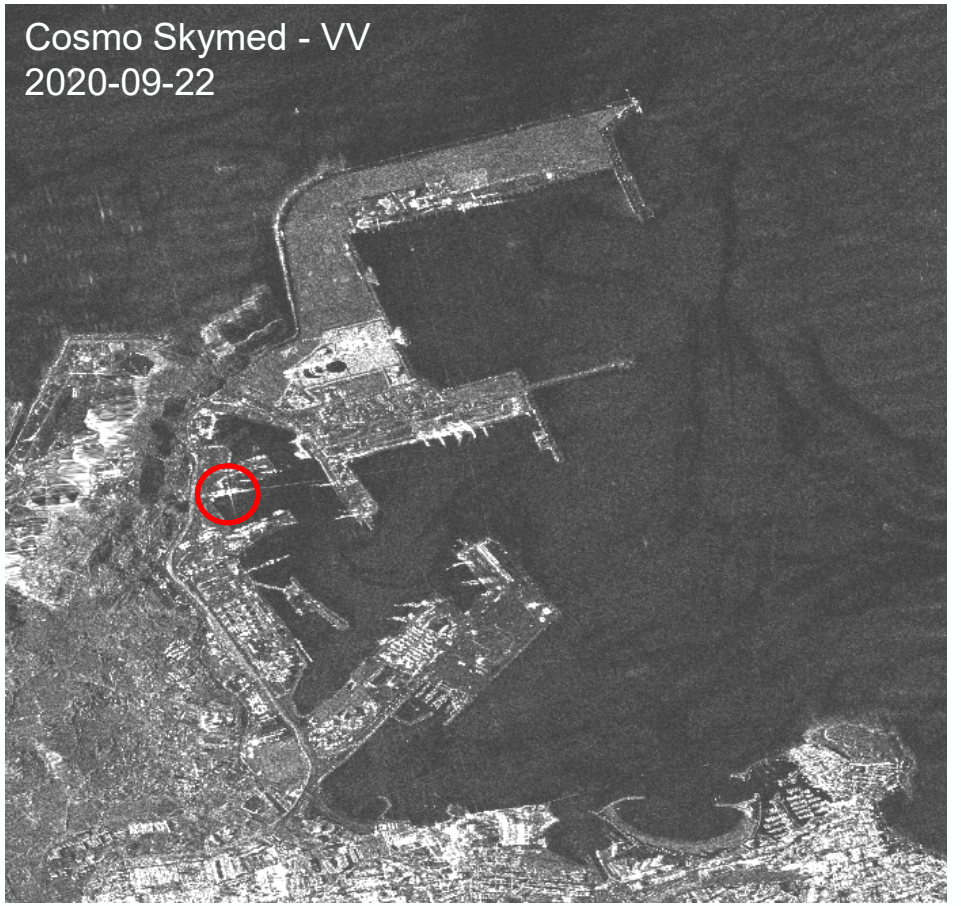
Polarisation - VV



Logistic hub evolution

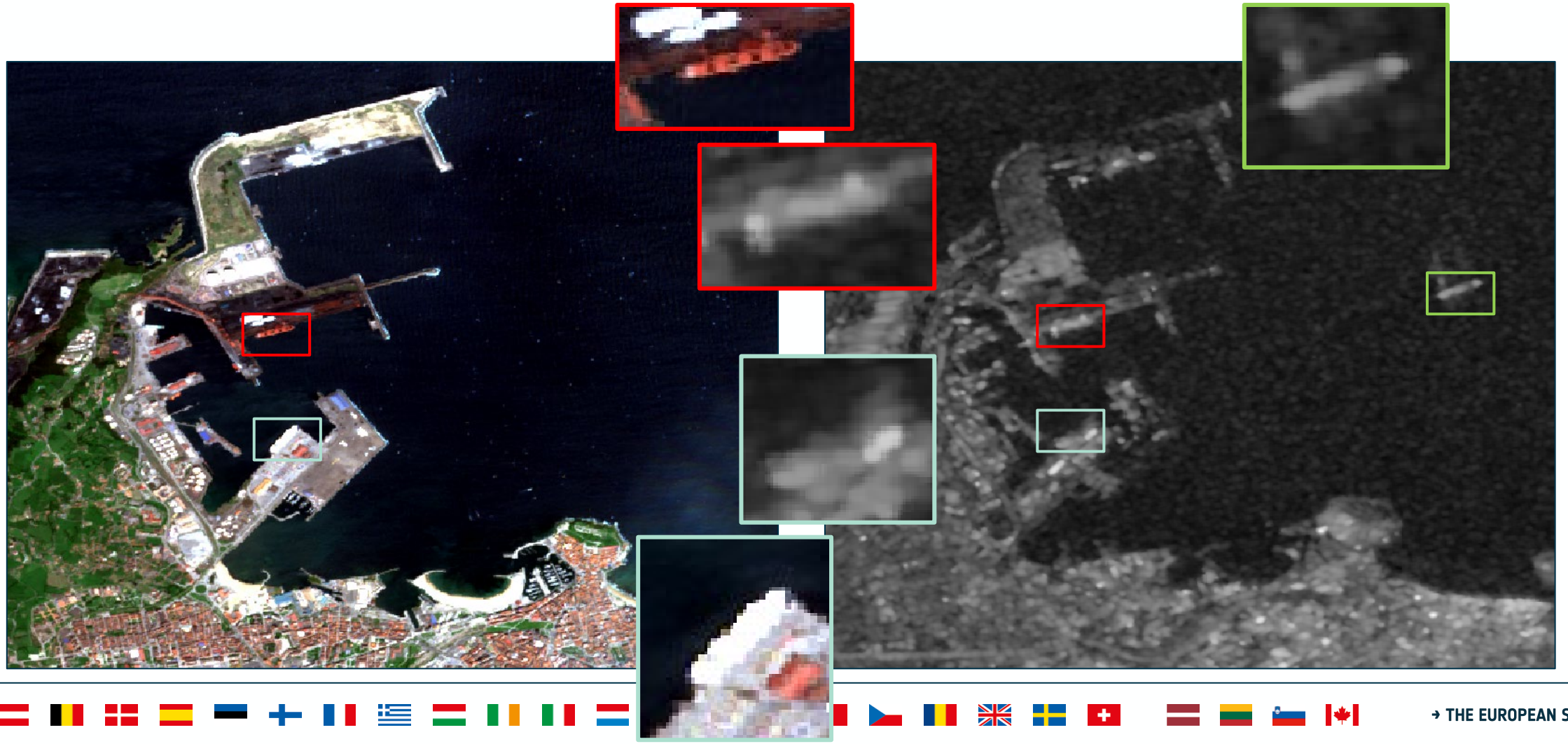
Vessels detection: Cosmo Skymed





Logistic hub evolution

Vessels detection: Sentinel 1 + sentinel 2 images (2019 - 05 – 12)



Logistic hub evolution

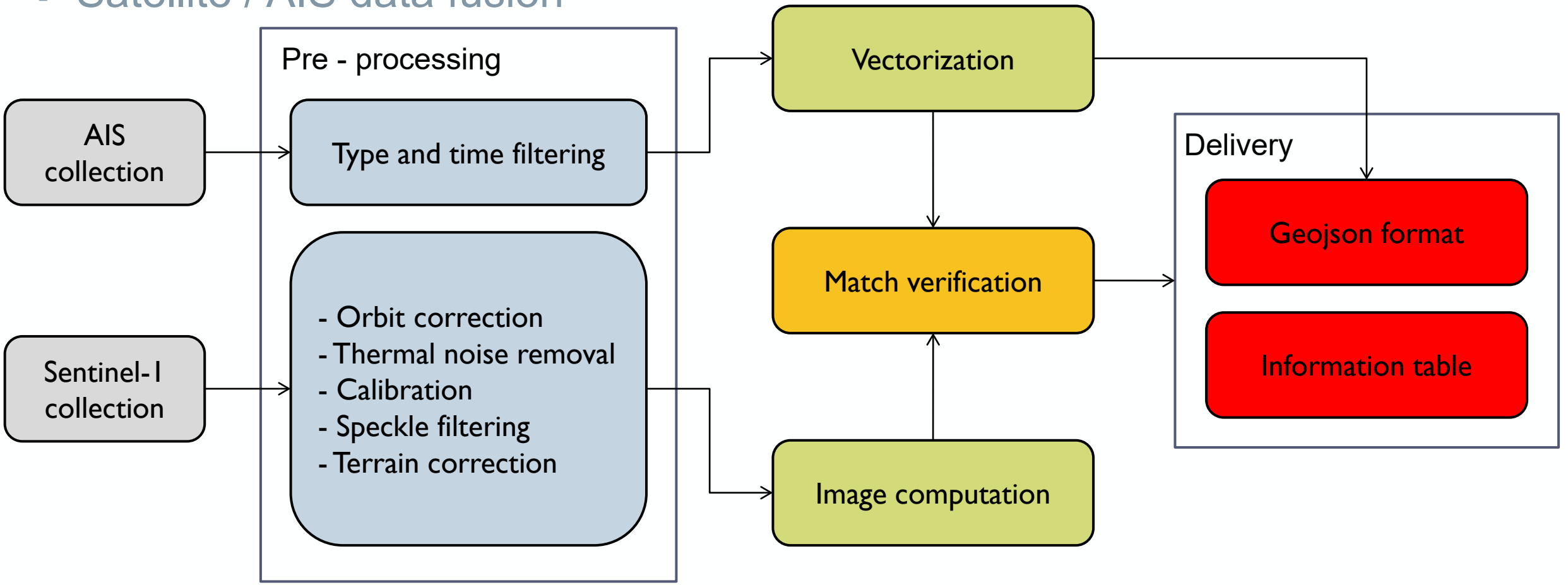
AIS - Marine Traffic

- Data is collected every hour
- Processed every 2 weeks
- Data filtered to deliver ground truth to Sentinel 1/2 Images

TIMESTAMP UTC	STATUS	LAT	LON	SPEED (KNOTSx10)	MMSI	TYPE_SUMMAI	TYPE_NAME	LENGTH
01/03/2019 00:00	3.0	4.356.161	667.017.214	0	225985954	Tug	Tug	24.4
01/03/2019 00:01	99.0	4.355.114	-1.024.126.961	0	224344220	Pleasure Craft	Pleasure Crat	9.0
01/03/2019 00:01	3.0	4.356.143	-56.999	0	224164000	Tug	Tug	30.5
01/03/2019 00:03	5.0	4.356.445	-5.697.282	0	305679000	Cargo	General Carg	137.97
01/03/2019 00:07	5.0	4.356.215	-569.681	0	224589000	Tug	Tug	60.0
01/03/2019 00:11	5.0	4.355.511	-5.690.423	0	538090510	Tanker	Oil/Chemical	184.32
01/03/2019 00:16	15.0	4.356.225	-5.700.538	0	224069770	Tug	Tug	30.0

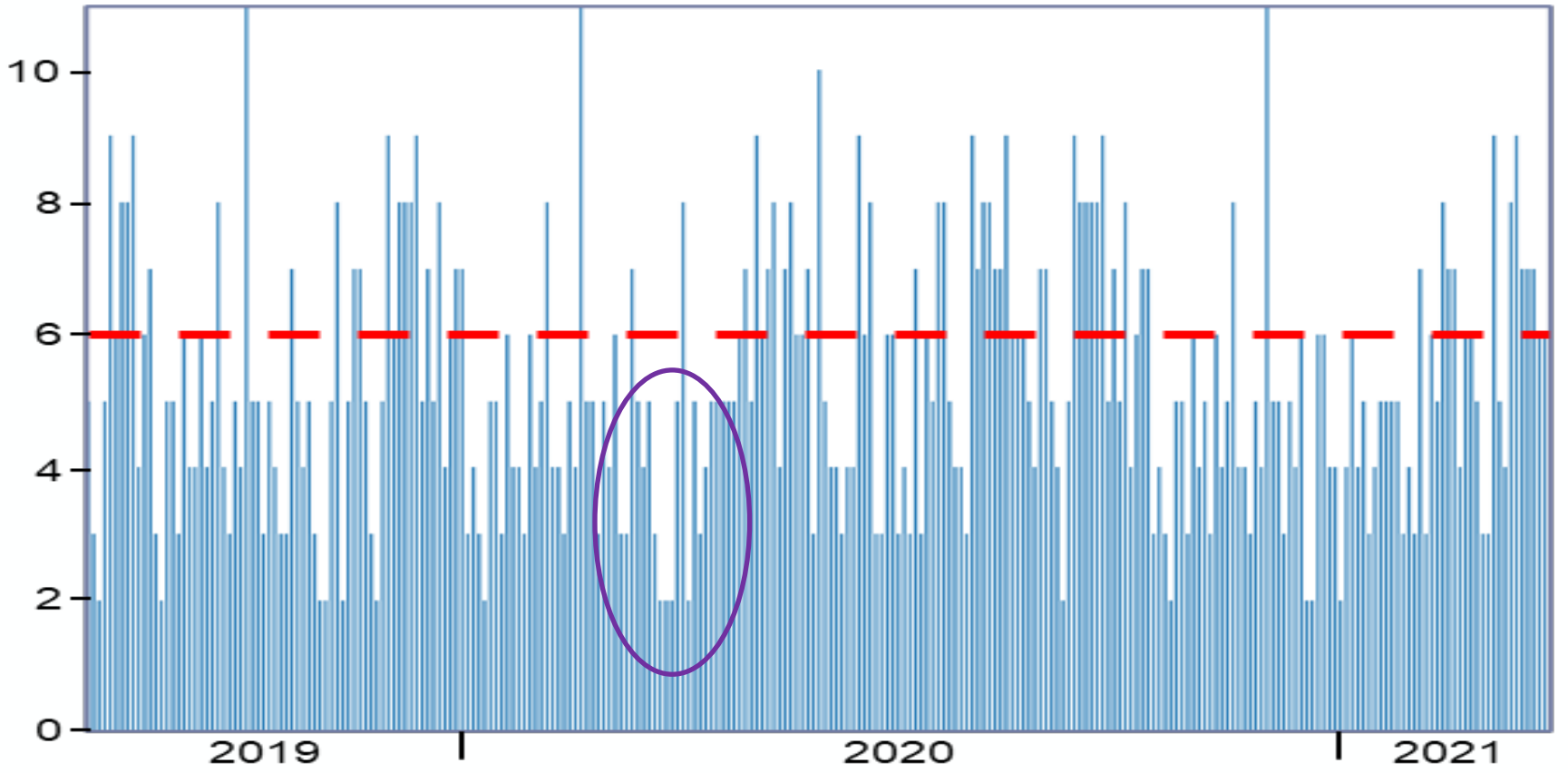
Logistic hub evolution

- Satellite / AIS data fusion



Logistic hub evolution

- Number of ships at pier: second semester 2019 to first semester 2021.

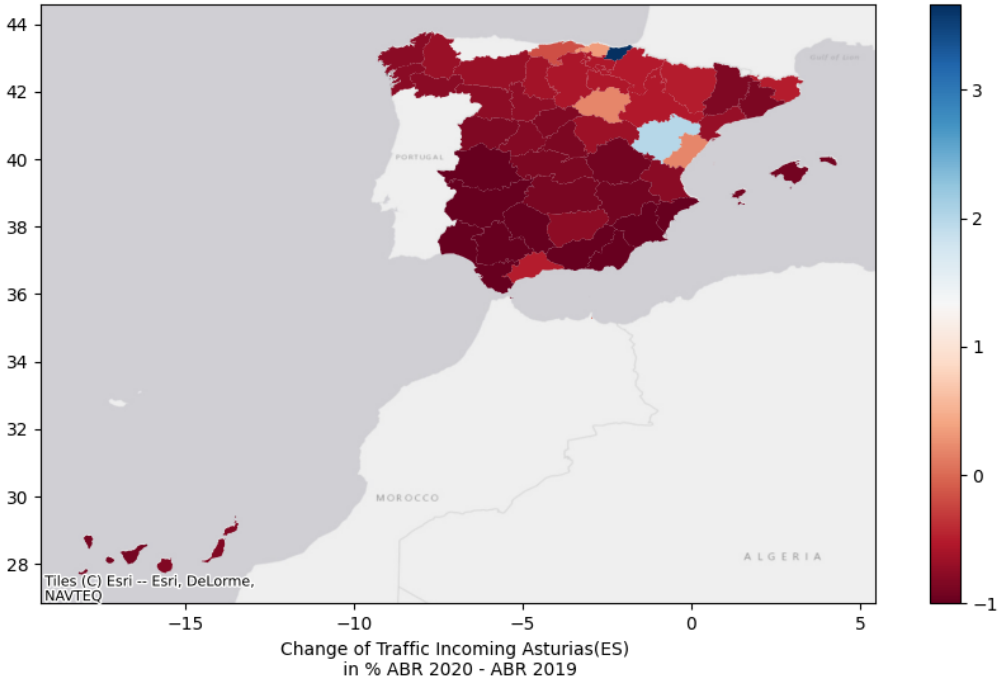


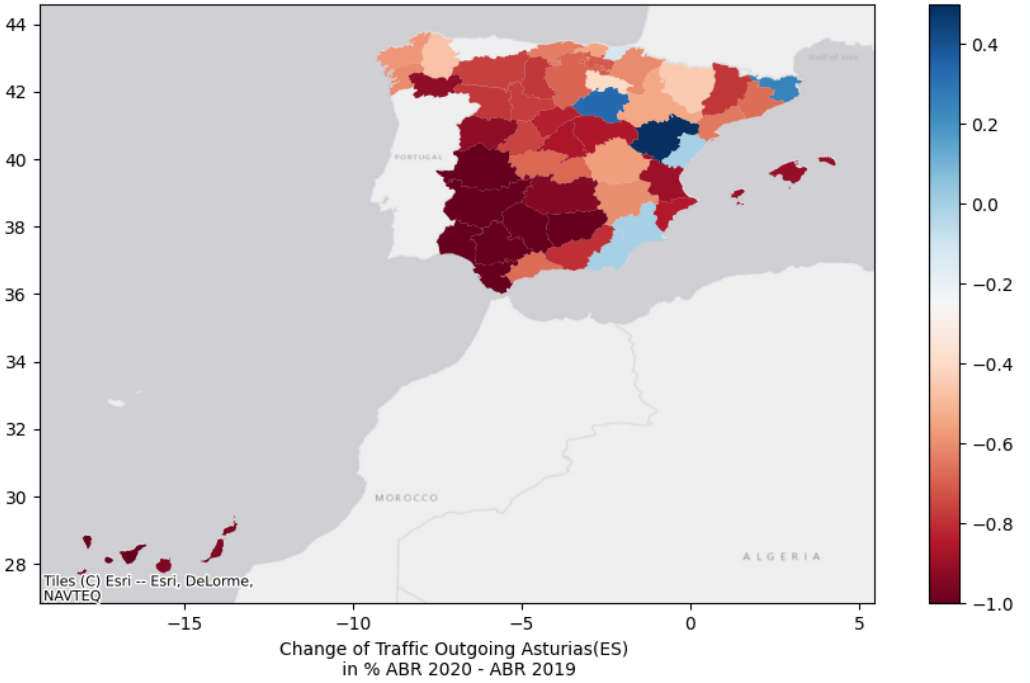
Logistic hub evolution

- Road Traffic Analysis - Vodafone Data
- Which data are collected:
  - **National**: incoming and outgoing trucks from / the Gijon region (Asturias)
  - **International**: incoming trucks to Asturias

Logistic hub evolution

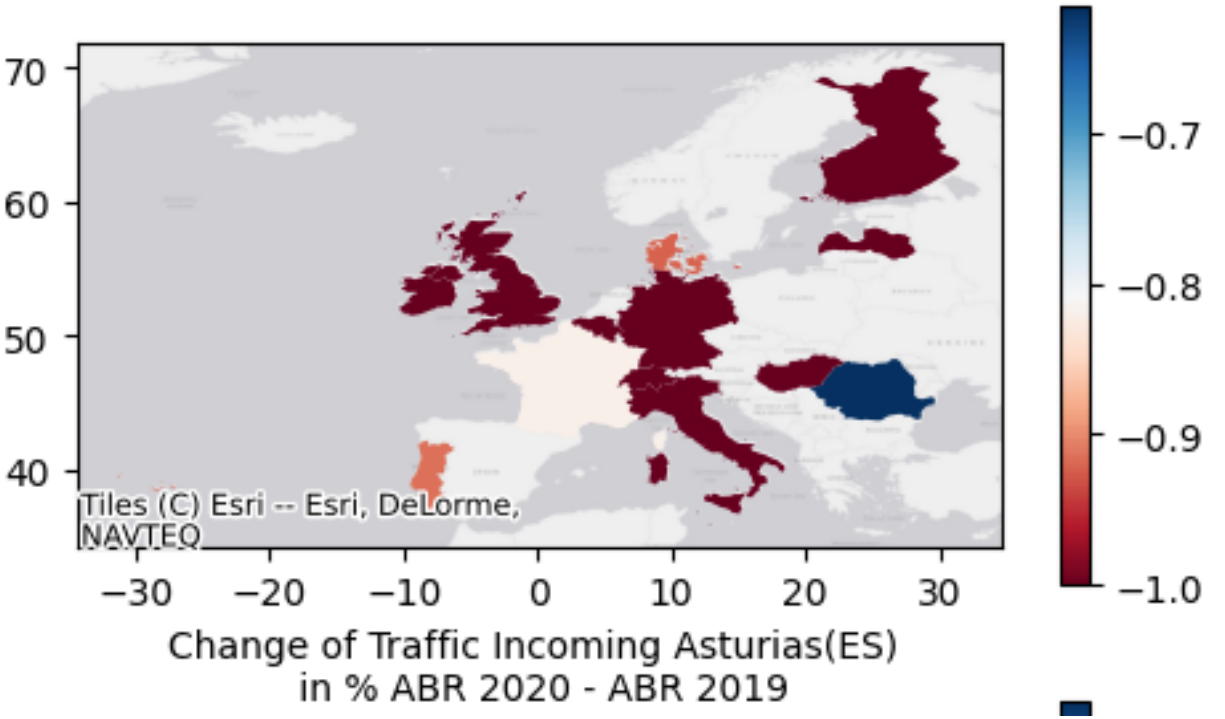
- Road Traffic Analysis - Vodafone Data
- Change of Incoming and Outgoing Traffic from Asturias (ES) between April 2020 and April 2019 in %





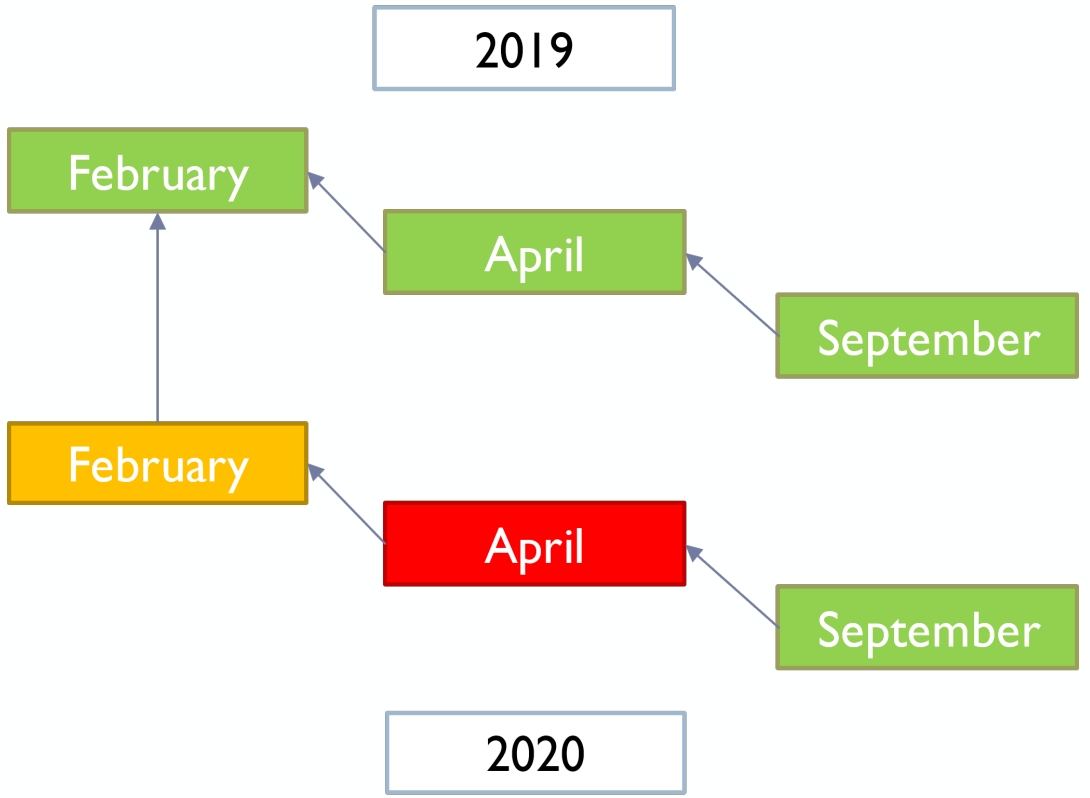
Logistic hub evolution

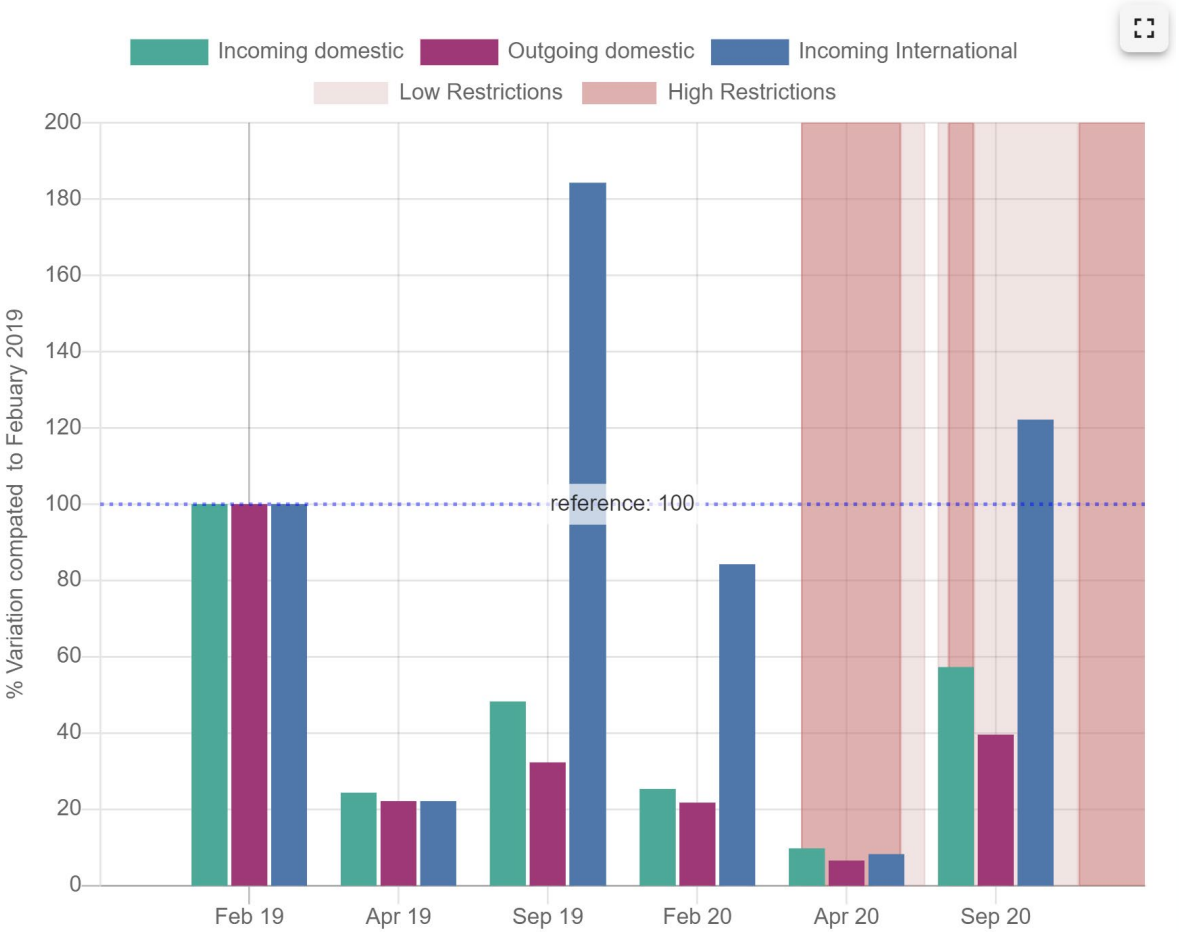
- Road Traffic Analysis Vodafone Data
- Change of Incoming Traffic from Asturias (ES) between April 2020 and April 2019 in %



Logistic hub evolution

- E12 named as “Change in commercial fluxes”





Impact of COVID on agriculture

Scope:

analysis of flux / anomalies of workers of agricultural fields across lockdowns

Input data:

Satellite data (HR / VHR optical data)

mobile data and services (presence within an area, roaming, visitors, workers)

Expected output:

Identification or worked / not worked fields

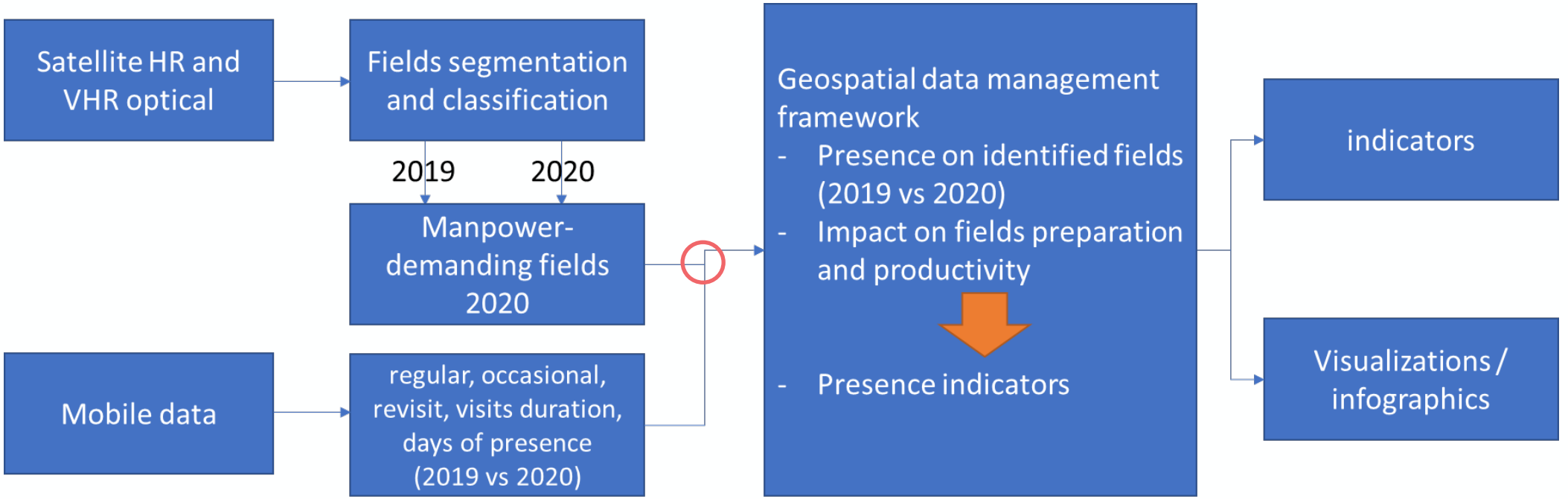
Identification of regular / irregular work activities

Changes of workers in field per time range (pre / during / post pandemic)

Impact of COVID on agriculture

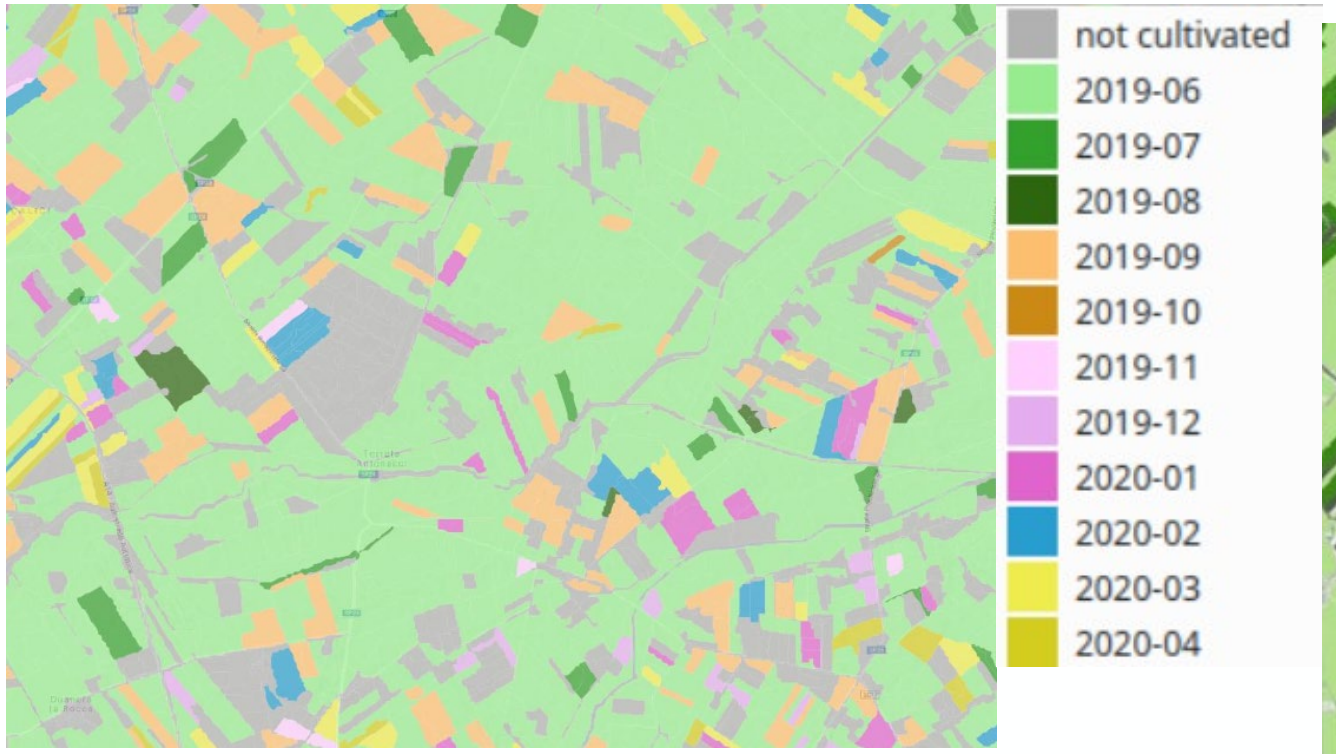
Concept: to use satellite data to

- Estimate the behaviour of agricultural fields across the pandemic
- identify the areas on which to focus the mobile data analysis.



Impact of COVID on agriculture

Map of the harvesting period



Map of total number of

Estimated **reduction of tomatoes** production 2020 vs 2019: **~ 13%** (verified with production data)

The **loss** has been **higher for vegetables in late summer** than for cereals during June and July

Impact of COVID on agriculture

Data Fusion approach:

1. **Identification Vodafone cells belonging to specific agriculture class** (“aree a vegetazione sclerofilla”) (reglional land cover database, crop classification from satellite)
2. Extraction of Vodafone data, per month (04/2019, 08/2019, 04/2020, 08/2020):
    - #Italian: external worker (IE)
    - #italian: Internal worker (II)
    - #Foreigner with Italian SIM: external worker (FIE)
    - #Foreigner with Italian SIM: internal worker (FII)
    - #Foreigner: external worker (FE)
    - #Foreigner: internal worker (FI)
    - #Masked: external worker (ME)
    - #Masked: internal worker (MI)

Impact of COVID on agriculture

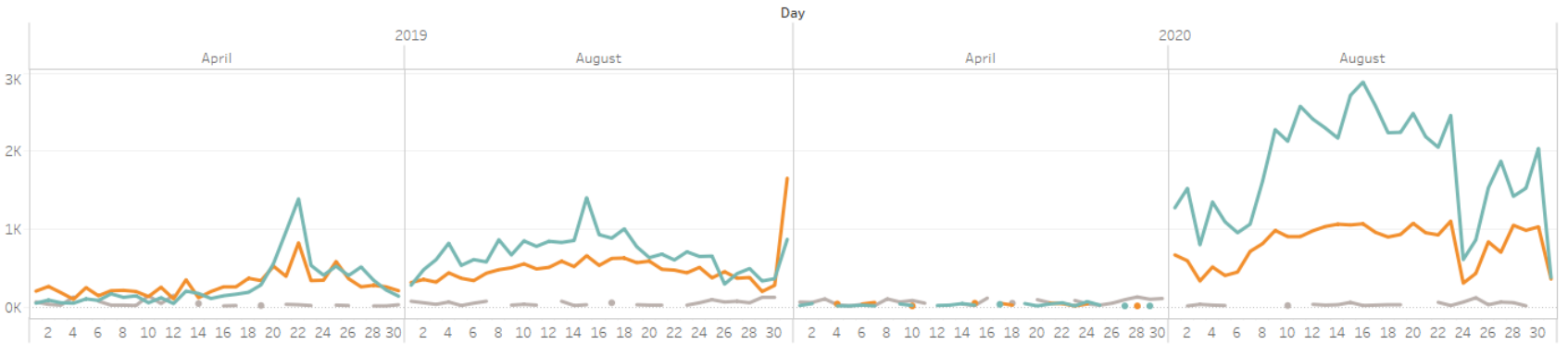
Perimeter of Analysis | Presence | Presence: Day of Week | Monthly presence | Monthly OD | Daily OD | Long term Analysis

Vodafone Analytics

PRESENCE

Day of Week	All
Time Slot	All
Worker	All
Area Name	All
Description..	aree a vegetazione sclerofilla
Camp Pres..	All

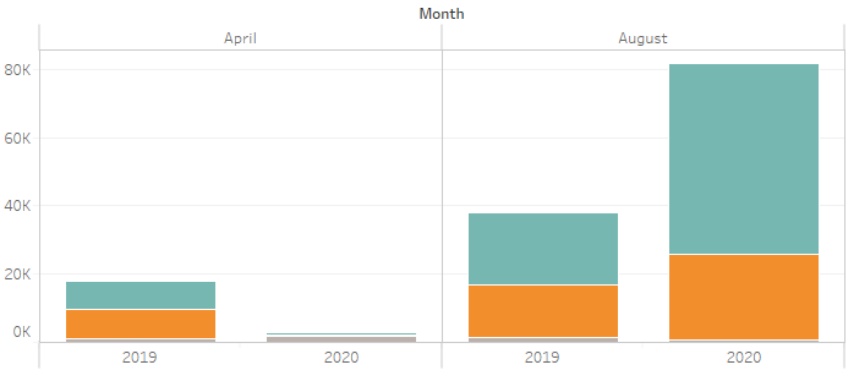
Daily trend by worker type



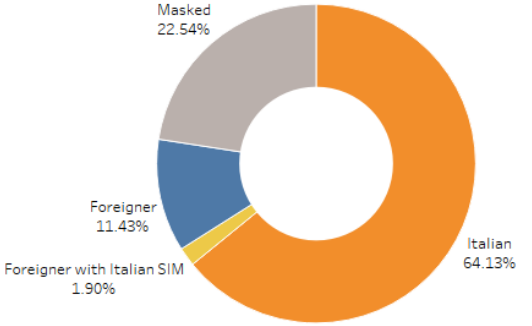
Area of interest

Worker
- Internal Worker
- External Worker
- Masked

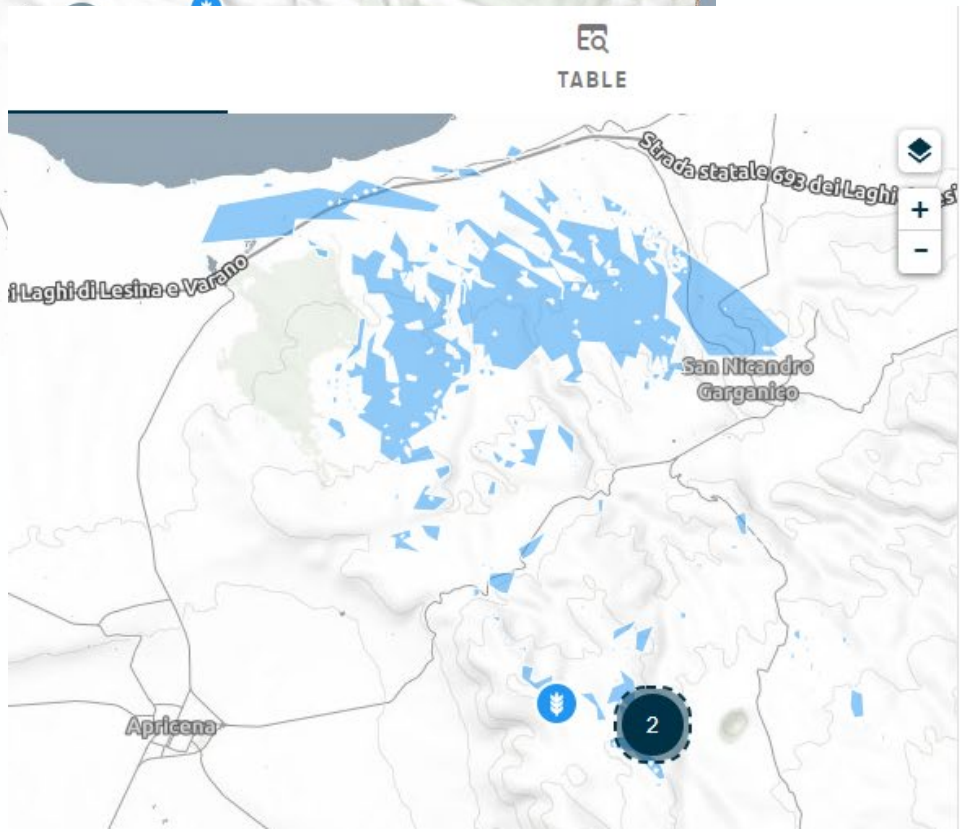
Monthly distribution

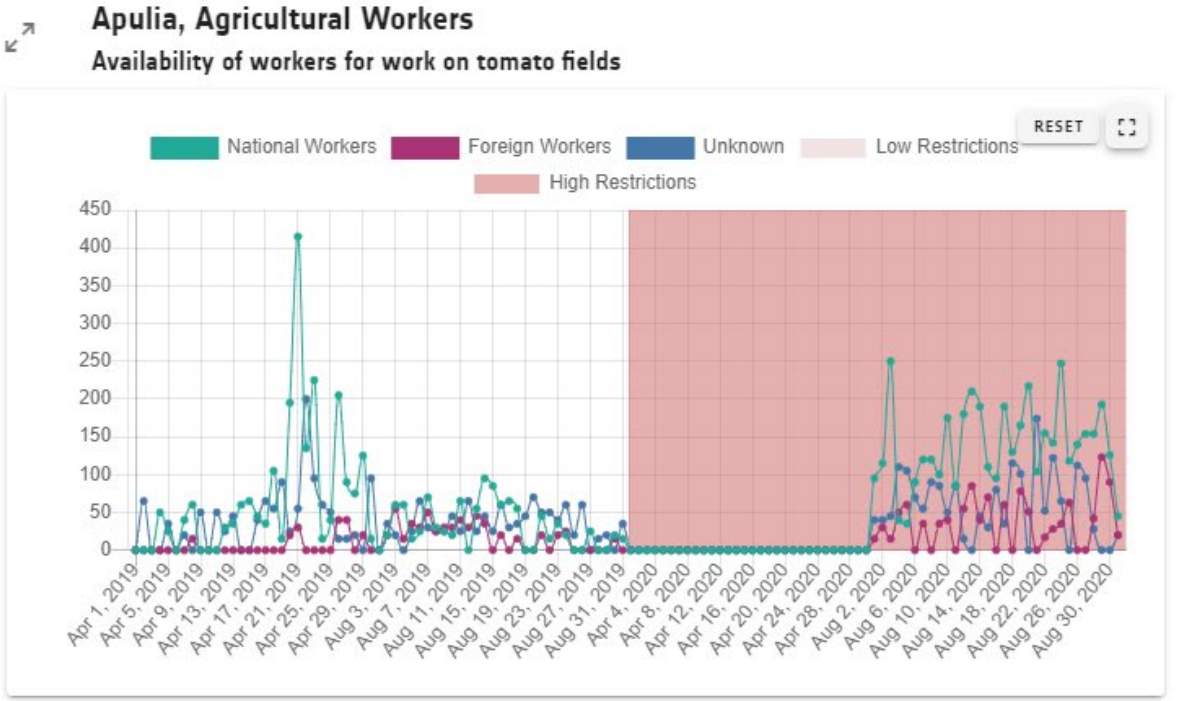


Customer class distribution



Impact of COVID on agriculture





DOWNLOAD CSV EMBED CHART

ADD TO CUSTOM DASHBOARD

Impact of COVID on agriculture

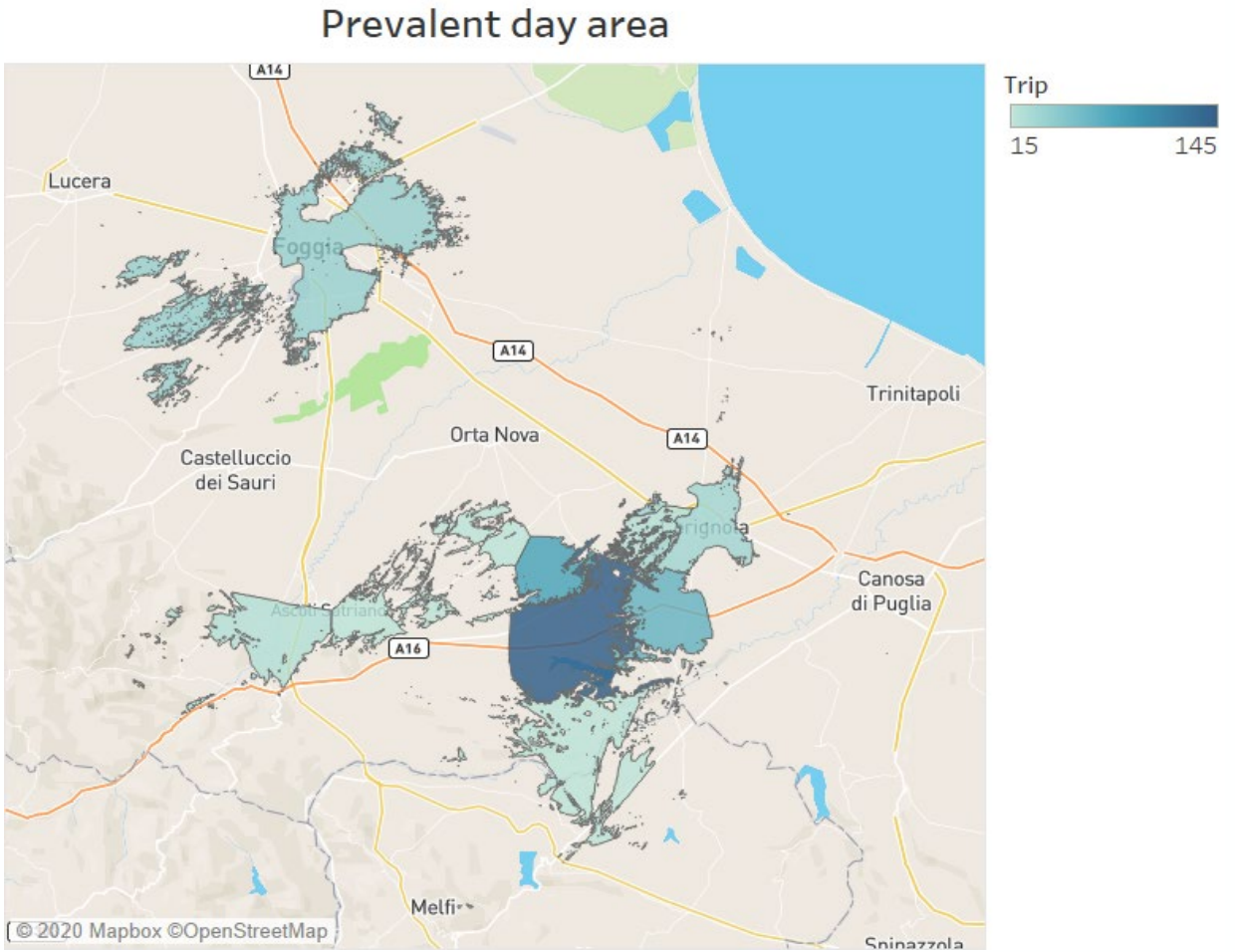
Mobile Data analysis

Pros

- Very small time slot (hours)
- Local movements are well represented

Cons

- cells are too large to represent a single phenomenon
- Data are masked for groups less than 15 elements



Conclusions and remarks

Summary of the activities

Positive results from fusing together EO data with mobile and other geospatial data (they enrich each other)

- **Repeatability**

The analyses shall be repeated to capture the full dynamics of the pandemics over years

- **Possibility to automate**

Very limited at the moment

- **Future perspectives**

Evolve the prototyped data working framework to simplify the data fusion schemas and move toward (semi)automated tools