Copernicus und CODE-DE (German Copernicus Data and Exploitation platform)

Michael Schmidt

DLR (German Aerospace Center) – Space Administration

28. November 2019

ESA-Ministerratskonferenz 2019

Deutschland investiert 3,3 Milliarden Euro in die europäische Raumfahrt und ist stärkster Beitragszahler der ESA

28.11.2019 **PRESSEMITTEILUNG** Luft- und Raumfahrt

Bundesministerium für Wirtschaft und Energie

Deutschland sorgt für die Zukunft der europäischen Raumfahrt

Bundesministerium für Verkehr und digitale Infrastruktur

ARTIKEL

Scheuer: Deutschland stärkt seine Führungsposition in der Erdbeobachtung

Copernicus unverzichtbarer Beitrag für Datenautonomie – BMVI stellt 594 Millionen Euro für neue (Copernicus) Weltraummissionen

Space19

esa

Total Subscriptions by Contributor 14.4 B€

Contributor	Subscriptions in M€	Share per Contributor in %
Austria	190	1.3%
Belgium	816	5.7%
Czech Republic	150	1.0%
Denmark	128	0.9%
Estonia	9	0.1%
Finland	110	0.8%
France	2,664	18.5%
Germany	3,294	22.9%
Greece	84	0.6%
Hungary	97	0.7%
Ireland	81	0.6%
Italy	2,282	15.9%
Luxembourg	129	0.9%
Netherlands	345	2.4%
Norway	284	2.0%
Poland	166	1.2%
Portugal	102	0.7%
Romania	44	0.3%
Spain	852	5.9%
Sweden	244	1.7%
Switzerland	542	3.8%
United Kingdom	1,655	11.5%
Slovenia	5	0.0%
Canada	114	0.8%
Total Contributions	**14,388**	**100.0%**

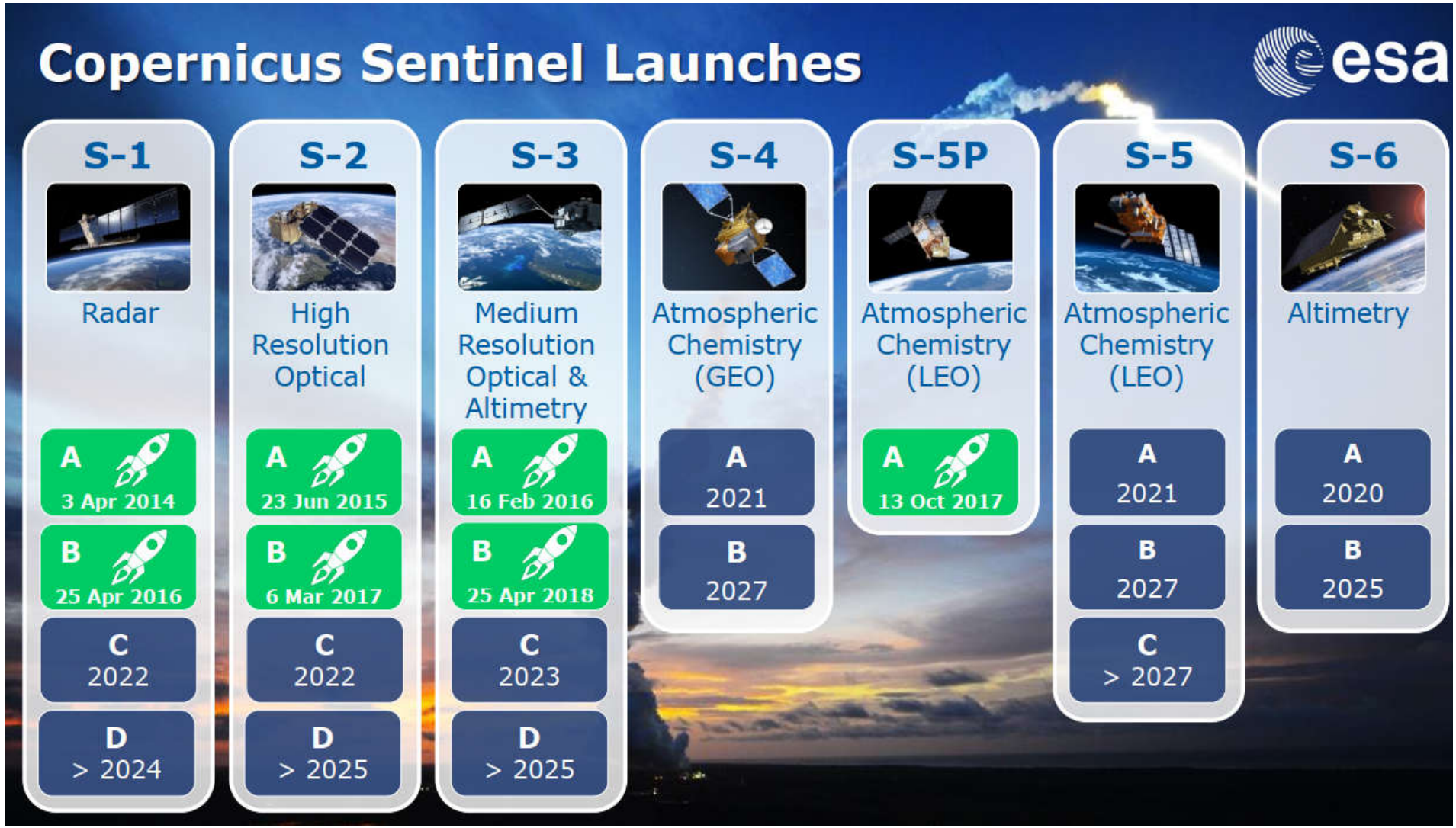
Deutschland ist mit 22,9 %, 3,3 Mil. € stärkster Beitrags-zahler der ESA, gefolgt von:

FR: 18,5 %, 2,66 Mil.€
IT: 15,9 %, 2,28 Mil. €
Uk: 11,5 % ,1,65 Mil. €

1.8 B€ Copernicus Space Component (CSC)

European Space Agency

Das Copernicus Programm – Die Weltraumkomponente



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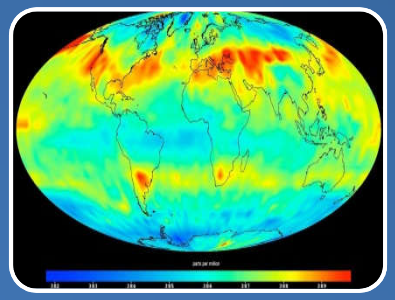
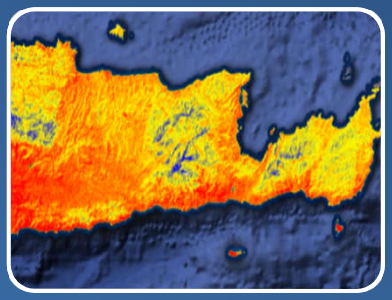
Copernicus @ ESAs Space19+

6 “High Priority Candidate Missions”

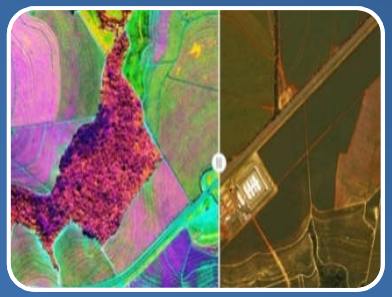


Anthropogenes CO_2 Abbildendes Spektrometer

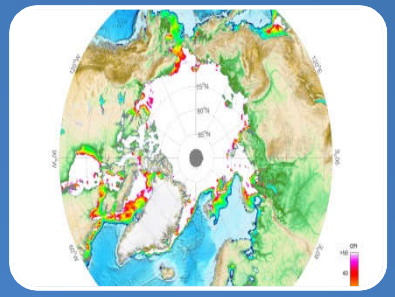


Oberflächen-temperatur

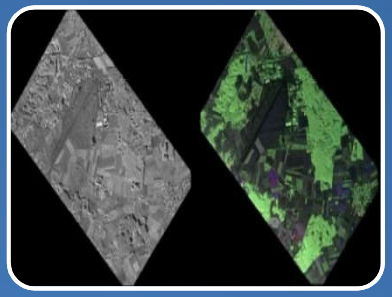
Polare Eis & Schnee Topographie



Hyperspektral-mission



Passive Mikrowelle



L-Band SAR

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Evolution der Dienste

- Kontinuität!

+ Bodenbewegungsdienst
+ CLC+
+ Coastal Service
+ Snow and Ice Service
+ Progamm-DEM (10m/30m/90m)
+ Kulturerbe

„Copernicus 2.0“

Monitoring the State of the Earth System Environment ...

... Six cross-cutting Thematic Services

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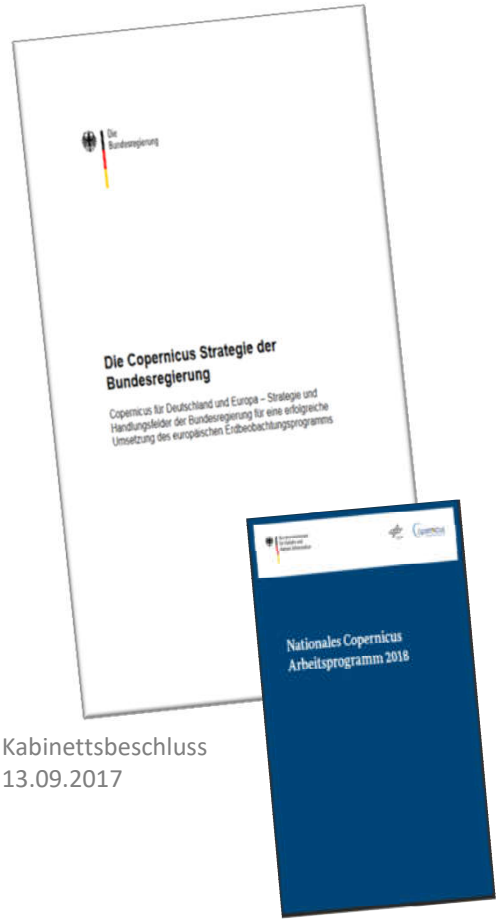
Nationale Copernicus Strategie und Arbeitsprogramm



Kabinettsbeschluss
13.09.2017

Ziele

1. Orientierung an Nutzen und Bedarf
2. Wachstumsimpulse für die deutsche Wirtschaft
3. Stärkung internationaler Zusammenarbeit
4. Beteiligung der deutschen Industrie, Wissenschaft und Institutionen
5. Sicherung der Nachhaltigkeit und Weiterentwicklung von Copernicus

Mit Nutzergruppen im Dialog sein	Zugang zu Daten und Diensten gewährleisten	Neue Dienste und Technologien entwickeln	Copernicus in Europa gestalten

https://www.d-copernicus.de/programm/strategie-der-bundesregierung/

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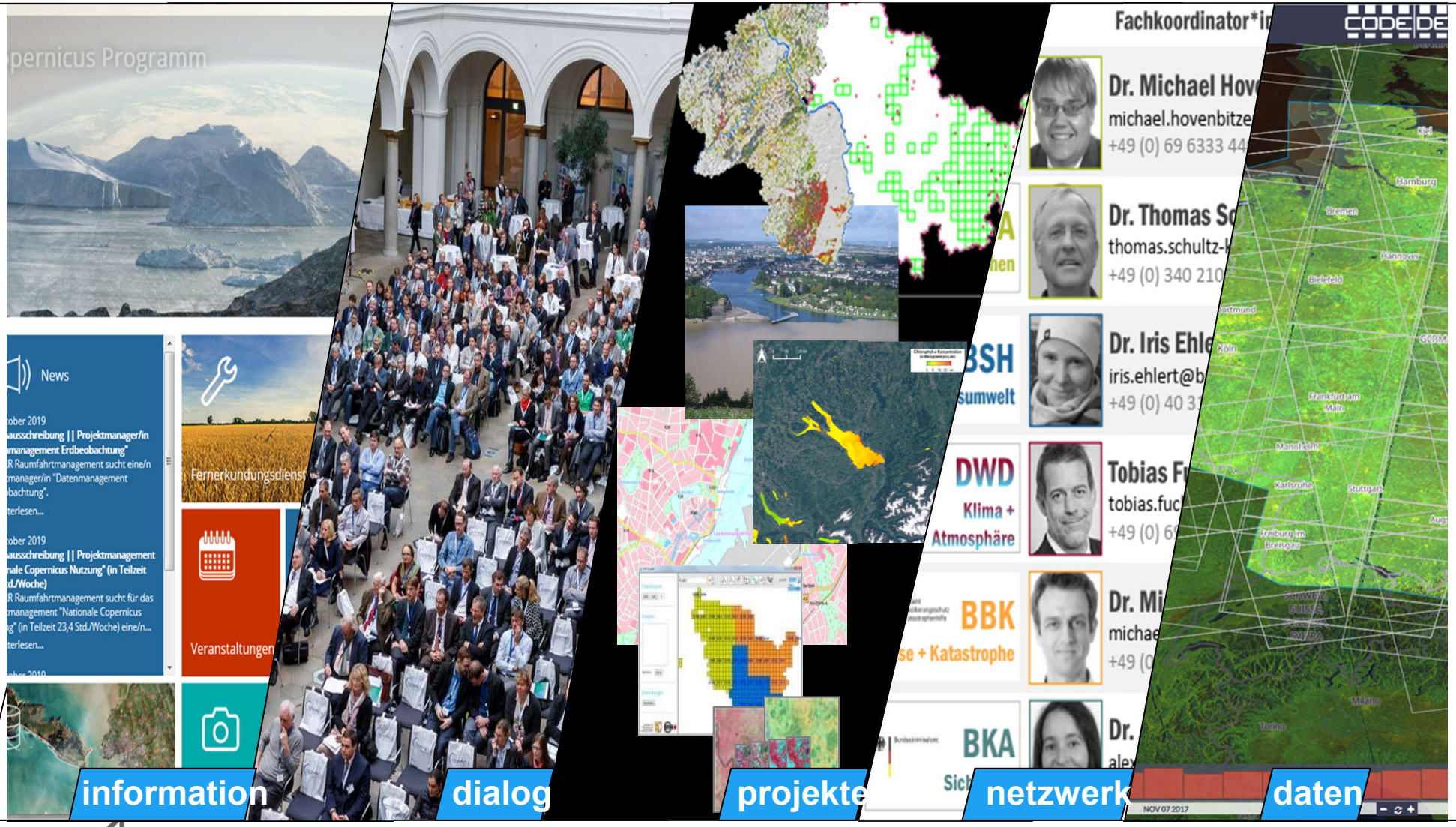
Copernicus in Deutschland



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Copernicus Forum: 10-12.03.2020

Framework Partnership Agreement on Copernicus User Uptake (FPCUP)

- FPCUP ist eine spezifische Maßnahme der ‘User Uptake Strategy‘ der Europäischen Kommission (EC)
- Fördert Maßnahmen zur Nutzergewinnung („User Uptake“) Copernicus-Daten und -Services
- Laufzeit: 2018 – 2022
- Konsortium: 48 Partner aus 23 Ländern; DLR: Projektleitung
- Konsortium schlägt EC user uptake Maßnahmen in jährlichen Arbeitsprogrammen vor (Budget: 5 – 9 Mio. €)
- EC finanziert Maßnahmen mit bis zu 85% ➔ Eigeninteresse der Partner notwendig
- Aktuell: 70 laufende Maßnahmen

opernicus FPCUP

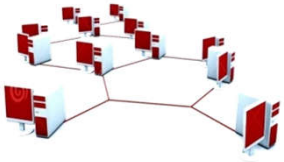
FPCUP

Förderfähige Maßnahmen:

1. Informations- & Fortbildungsmaßnahmen
2. Aufbau aktiver Nutzerdialoge
3. Downstream-Anwendungen & –Services
4. Innovationsmaßnahmen

für:

- Nationale & Internationale Nutzergewinnung
- Geschäftslösungen, innovative Produkte und Anwendungen



Beteiligungsmöglichkeiten?

- Einreichung von Maßnahmen zur Nutzergewinnung zusammen mit (einem) Konsortialpartner(n)
- Beteiligung an Ausschreibungen
- Teilnahme an Veranstaltungen

Kontakt: Dr. Julia Röhrig
Julia.roehrig@dlr.de

Nationale Copernicus Maßnahmen 2020-2024

Copernicus Bekanntmachung: November/Dezember 2019 – Frist 17.02.2020

Vernetzung → Projektbüros ergänzen nationale Fachkoordination

Förderprojekte → Kleine Pilotvorhaben, Leuchttürme, Beratung

CODE-DE → CODE-DE Phase 2

Kontakt: Lena Schultz-Lieckfeld
Lena.Schultz-Lieckfeld@dlr.de

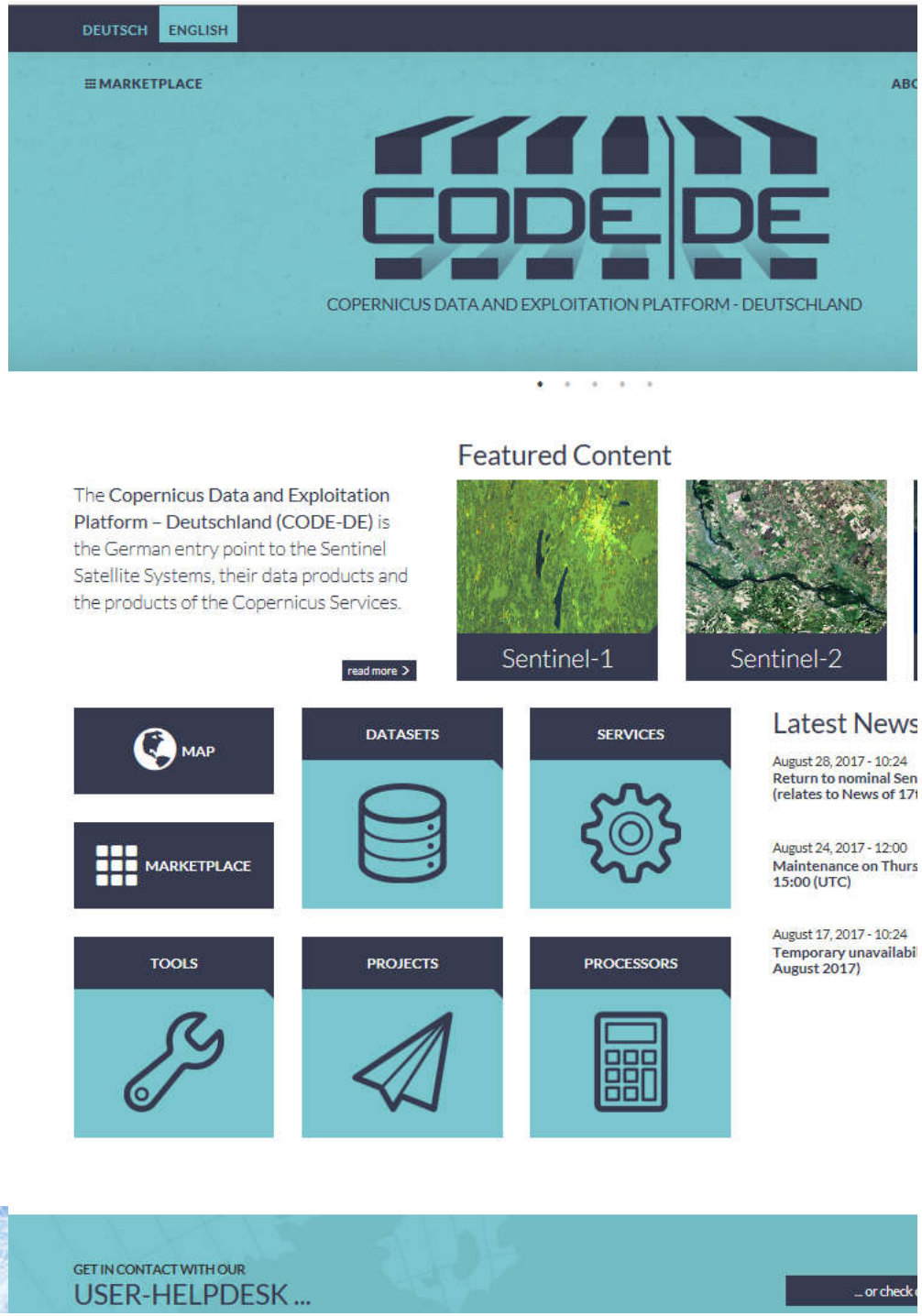
https://www.d-copernicus.de/fileadmin/Content/News/4_Bekanntmachung_BMVI_Copernicus_2019_final_04122019.pdf

DLR

CODE-DE.org

- Initiated: 01.07.2016 (online since 03.2017)
- **Phase 2 will start April 1, 2020, financed until October 2024**

- Open View and Discovery Service
- Download after self-registration
- On-demand processing access:
  - Free-of-charge & for selected “applications” with user support
  - Scalable processing environment also for any third party users e.g. using the Open Telecom Cloud
  - Limited number of open processing resources

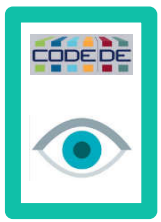


DLR

CODE-DE.org

Initiated: 07.2016 - online since 03.2017. Running until March 31 2020 @ DLR – DFD
From 1.April 2020 CODE-DE operated by CloudFerro

- Without registration

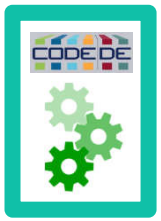

Discover


Browse


Help/FAQ

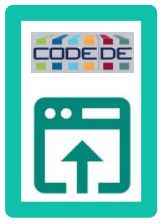
- With (self) registration

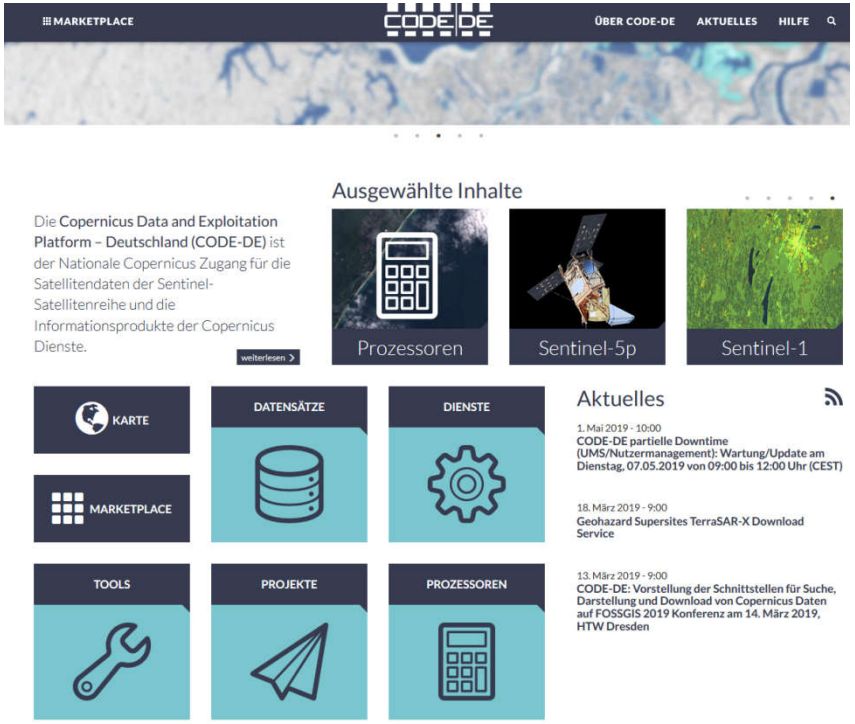

Download

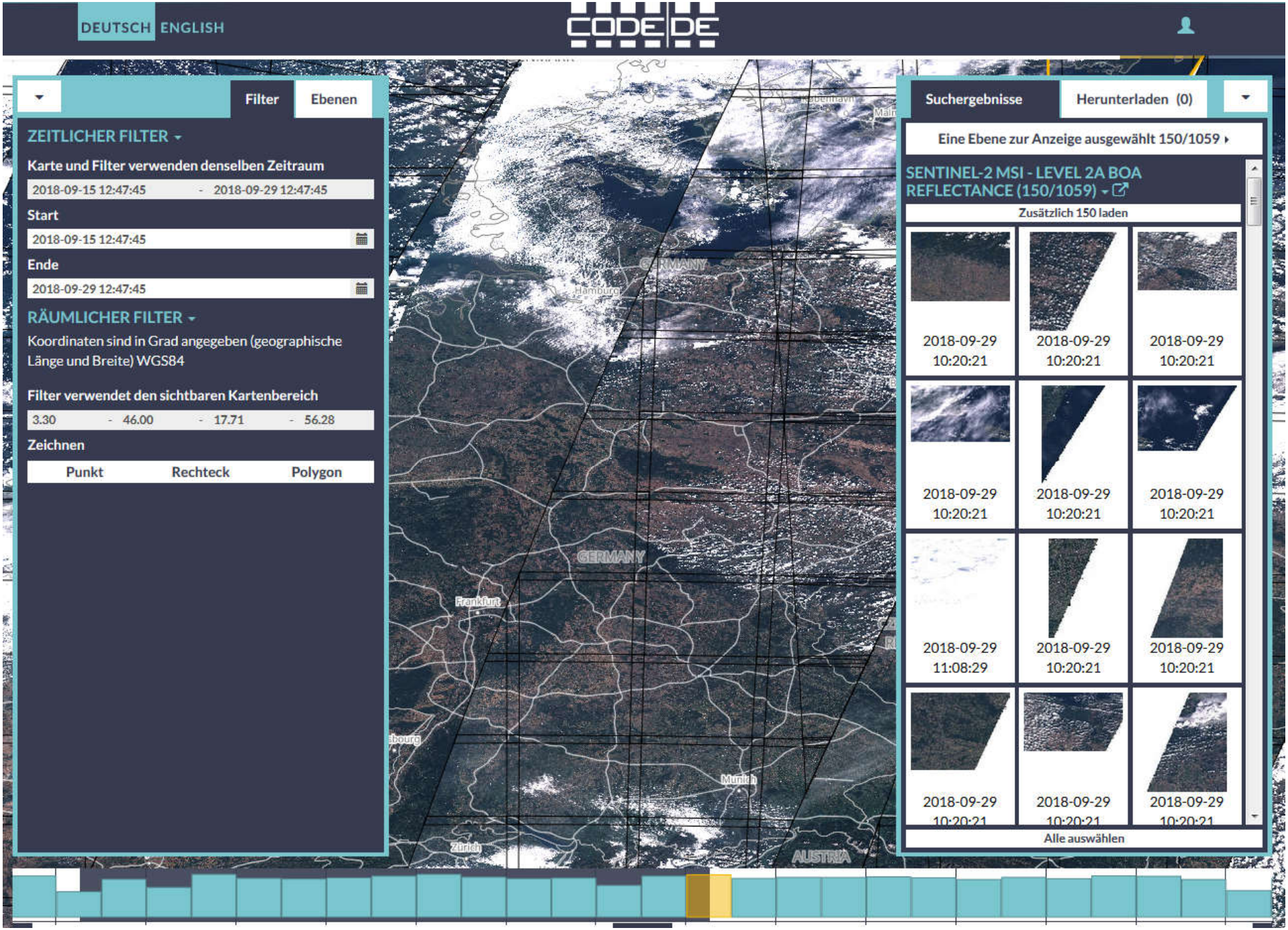

Process


Command

- Selected users -> contact RFM


Upload Processor




DEUTSCH ENGLISH
CODE DE
Filter
Ebenen
ZEITLICHER FILTER
Karte und Filter verwenden denselben Zeitraum
2018-09-15 12:47:45 - 2018-09-29 12:47:45
Start
2018-09-15 12:47:45
Ende
2018-09-29 12:47:45
RÄUMLICHER FILTER
Koordinaten sind in Grad angegeben (geographische Länge und Breite) WGS84
Filter verwendet den sichtbaren Kartenbereich
3.30 - 46.00 - 17.71 - 56.28
Zeichnen
Punkt
Rechteck
Polygon
GERMANY
Hamburg
Frankfurt
Munich
Zürich
AUSTRIA
Suchergebnisse
Herunterladen (0)
Eine Ebene zur Anzeige ausgewählt 150/1059
SENTINEL-2 MSI - LEVEL 2A BOA REFLECTANCE (150/1059)
Zusätzlich 150 laden
2018-09-29 10:20:21
2018-09-29 11:08:29
Alle auswählen

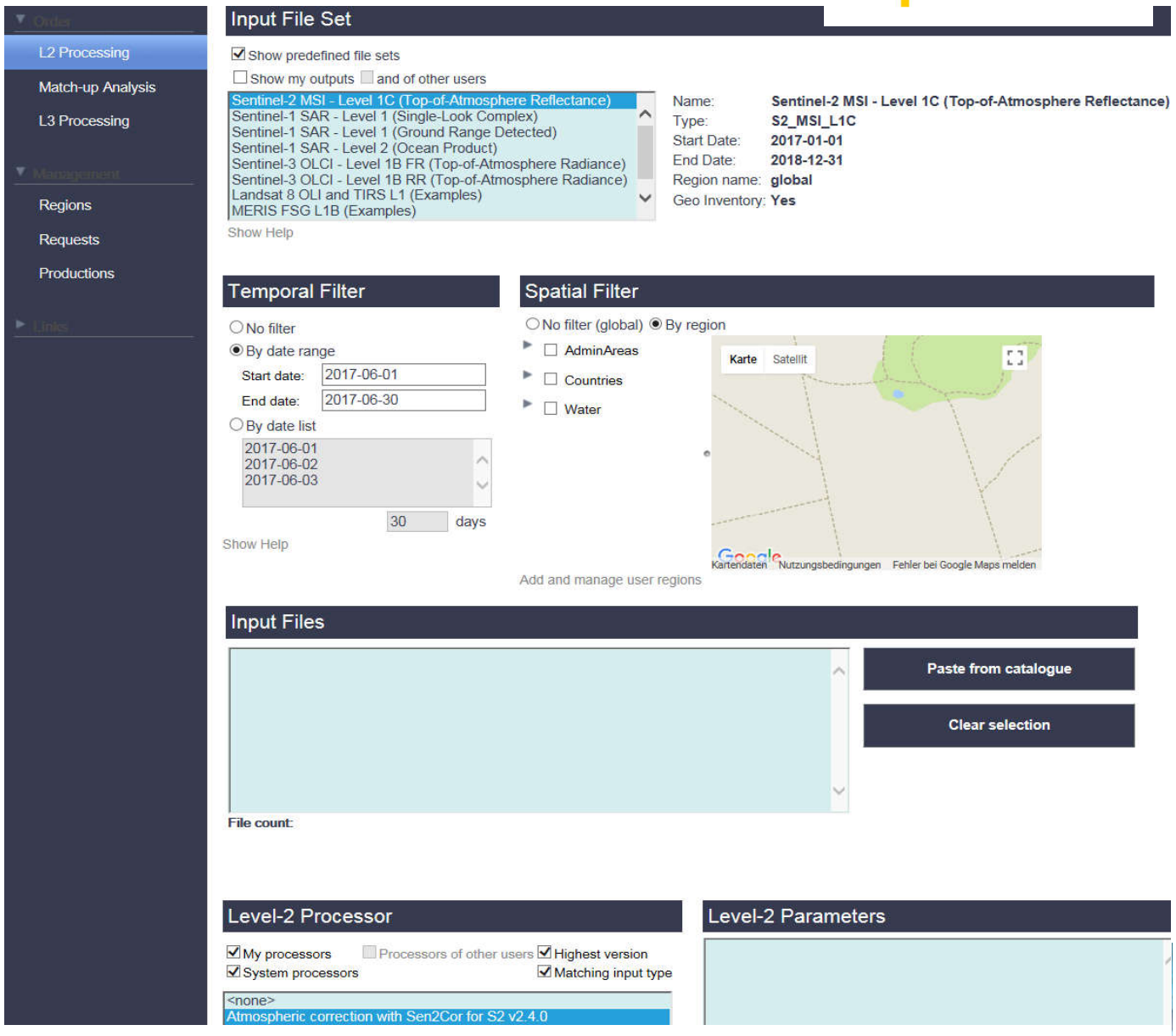
CODE-DE.org Big Data Processing – Calvalus

Bundesministerium für Verkehr und digitale Infrastruktur

Processors
- system-provided processors
- user-provided processors

Public cloud
- Sen2Cor
- BandMath
- …

Private cloud
- Docker
- Virtual Maschine

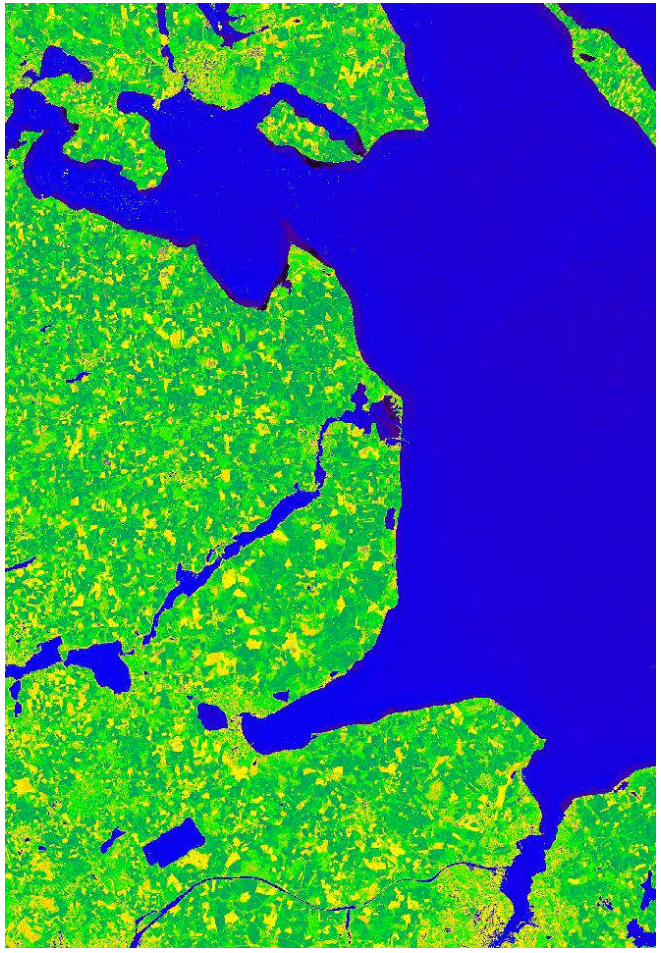


Processing example of northern Germany:

Sentinel-2,
Bands 4/5/7, April 8, 2019

CODE-DE Processing in Calvalus:

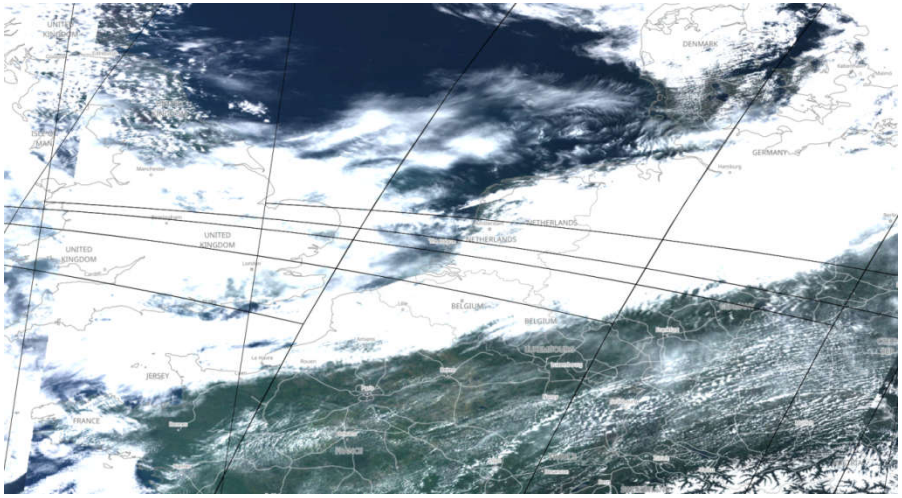
```
<parameters>
  <ndviExpression>
        (B8A - B4) / (B8A + B4)
  </ndviExpression>
</parameters>
```



Normalised Differenced Vegetaion Index (NDVI)

DLR

CODE-DE.org - Online Data Discovery and Access



Sentinel-3
Low-resolution browsing

DLR

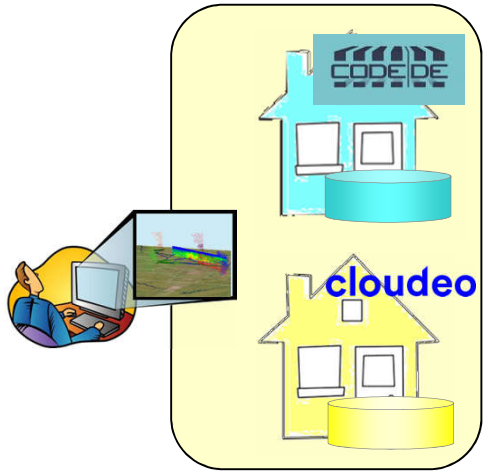
Dataset Retention Times

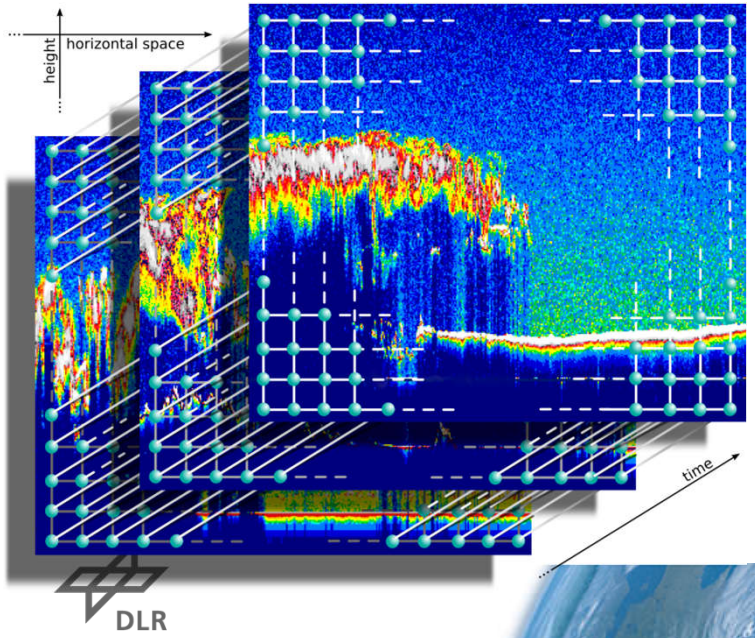
Red brackets: currently set retentions time

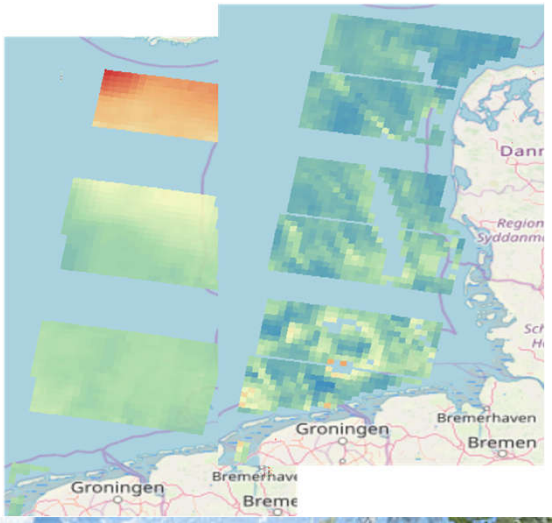
Mission	Instrument	Level and Product	Retention Time [Months]			Notes
			Central Europe	Europe	Global	
Sentinel-1	SAR	L1 SLC	36	12 (1,5)	0 (8d)	
	SAR	L1 GRD	36	12	1	
	SAR	L2 OCN	-	-	6 (12)	
Sentinel-2	MSI	L1C	36	12	1	
	MSI	L2A	36	14d	9d	Since Dec 2018
Sentinel-3	OLCI	L1	36*	12*(24)	1	* NRT products will be evicted after 8 days when a NTC product is available for the same aquisition.
	OLCI	L2 Land	36*	12*(24)	1 (3)	
	OLCI&SLSTR	L2 SYN	-	-	-	
	OLCI&SLSTR	L2 VGT-P, VGT-S	-	-	-	
	SLSTR	L1	36*	12*	1	
	SLSTR	L2	36 *	12*	1	
	SRAL	L1	36*	12*	1	
	SRAL	L2 Land	36*	12*	1	
Sentinel-5p	TROPOMI	L1 TROPOMI	-	-	-	Since Jan 2019
	TROPOMI	L2 TROPOMI	-	-	1 (36)	Since Jan 2019

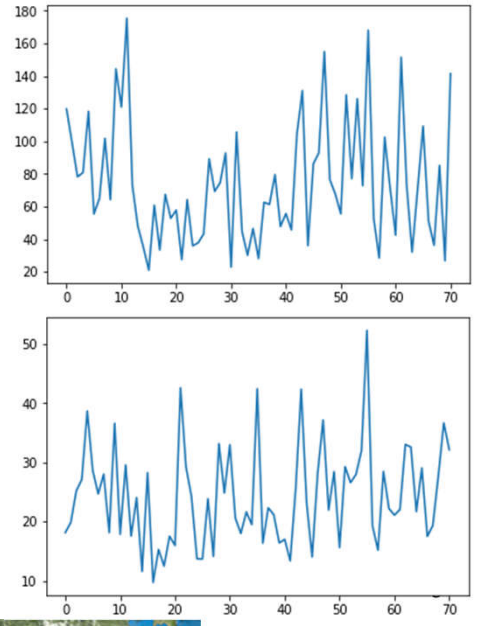
BigDataCube Pilot: Datacube Analytics as a Commodity

- *On-demand datacube analytics* @ CODE-DE
  - OGC datacube standards: *WCS*, *WMS*
  - Public / private datacube federation
- Sentinel 1 and 2 data, ~400 TB
  - + wind speed and sea state (DLR SAINT)
  - + DTM/DEM (cloudeo)









How to integrate WCS requests into a python script

You can install required Python libraries for demos with the *pip* tool https://pypi.org/project/pip/.

In [ ]:
```
# Install required libraries
pip install requests
pip install owslib
pip install numpy
```

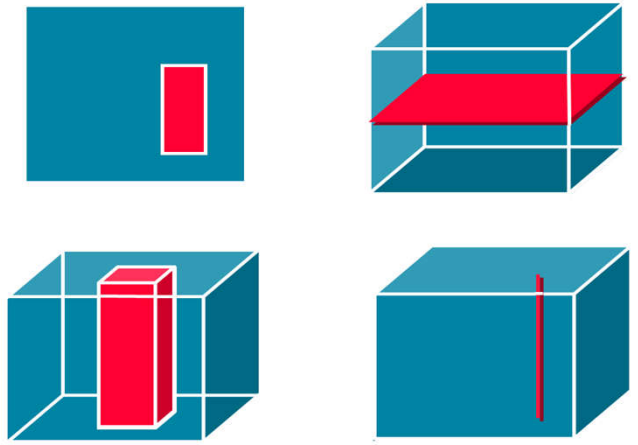
- The *requests* library can be used to send requests to server and parse result (*if in XML*) manually.

In [ ]:
```
# Using requests library to send GET/POST requests to server
import requests

# Set base url which can be used in further code examples
```

```
# Display result directly
Image(data=response.content)
```

Out[5]:



Nach IP 300 verschiedene Nutzer
Mit bis zu 2500 Zugriffen pro Tag

http://rasdaman.org/bigdatacube/index.html?page=demo-apps&group=client&app=jupyter-notebook

Search and download scripts

https://github.com/dlr-eoc/code-de-tools

The scripts are located in the `bin/` subdirectory. The script header contains instructions on how to use. For convenience the usage help is listed below.

code-de-query-download.sh

Performs an OpenSearch query and downloads the found products.

```
USAGE:

./code-de-query-download.sh -c|--condition=... [-b|--baseurl=https://catalog.code-de.org] [-o|--curlOpts=curl-option
  --condition is the full OpenSearch query, for example:
    -c 'parentIdentifier=EOP:CODE-DE:S2_MSI_L1C&startDate=2018-06-04T00:00:00.000Z&endDate=2018-06-04T23:59:59.999&b
  --user in the form username:password (alternatively use --curlOpts='--netrc-file...myNetRc...file'
  --baseurl of the CODE-DE services (default is https://catalog.code-de.org)
  --curlOpts allos specifying special curl options like -o='--progress-bar --netrc-file=...myNetRc...file'
  --limit the amount of products to be retrieved (default=50, max=500)
  --parallel count of retrievals, WARNING: do not overload your system and network (the server might limit you to 2
  --noTransfer to test the query
```

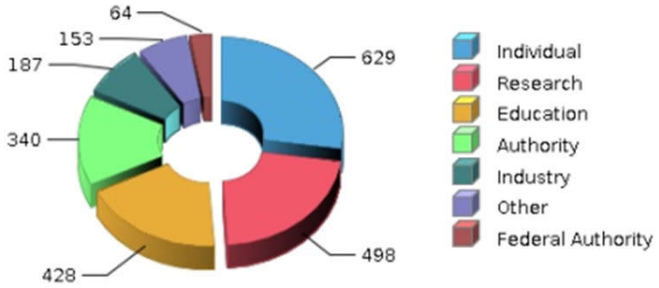
Output products are placed in the current directory.

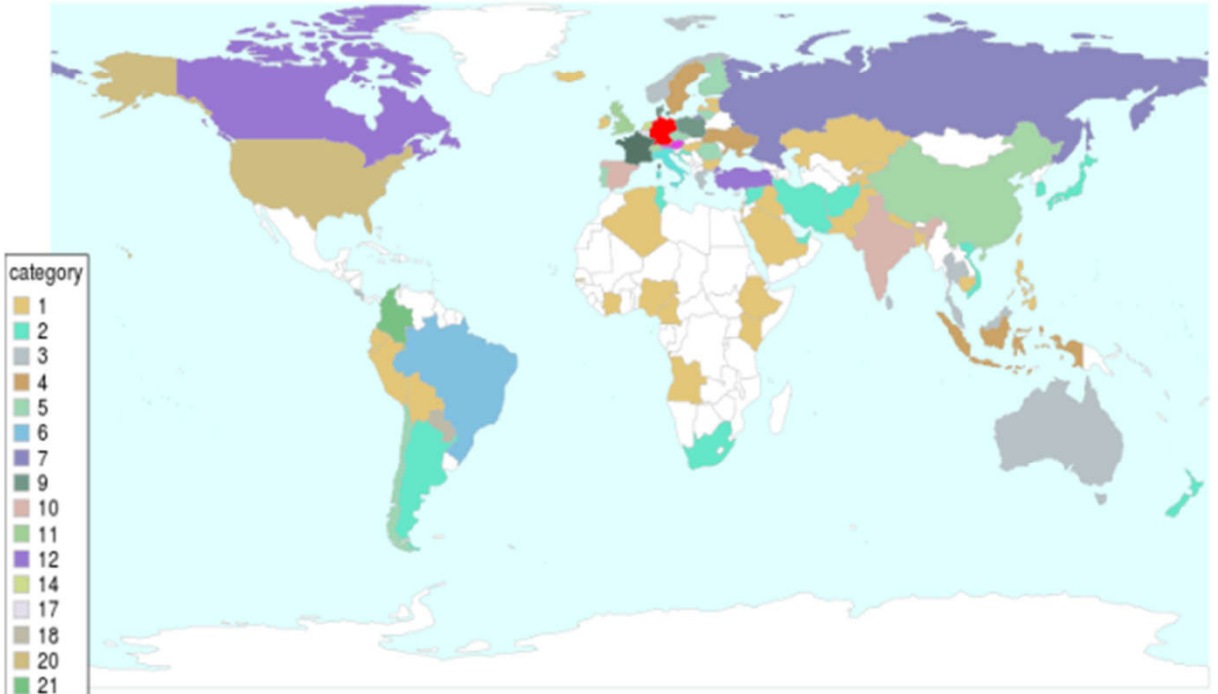
Example

```
code-de-query-download.sh -c 'parentIdentifier=EOP:CODE-DE:S2_MSI_L1C&startDate=2018-06-04T00:00:00.000Z&endDate=201
```

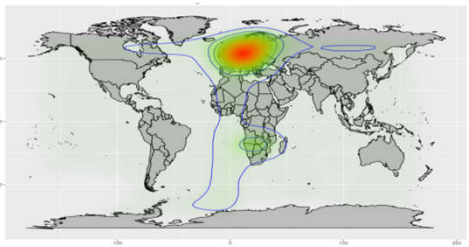
Aktuelle Nutzer - Dezember 2019

2.299 CODE-DE Nutzer
(1.842 National)

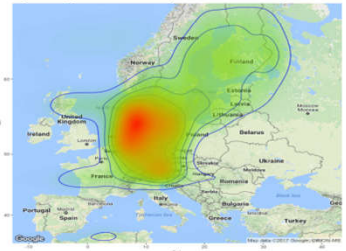




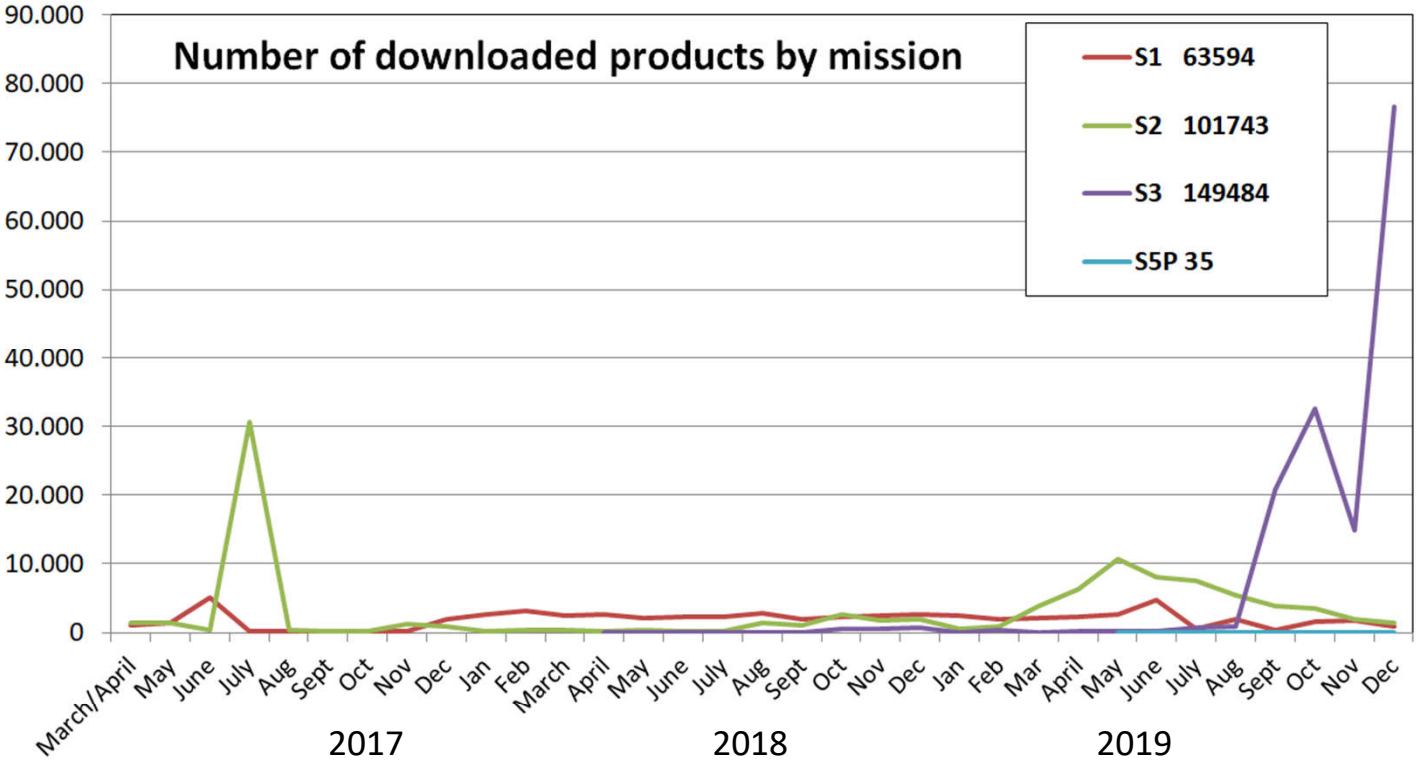
Zeitliche (rechts) und räumliche Verteilung der heruntergeladenen Daten (November 2019: Bild unten)

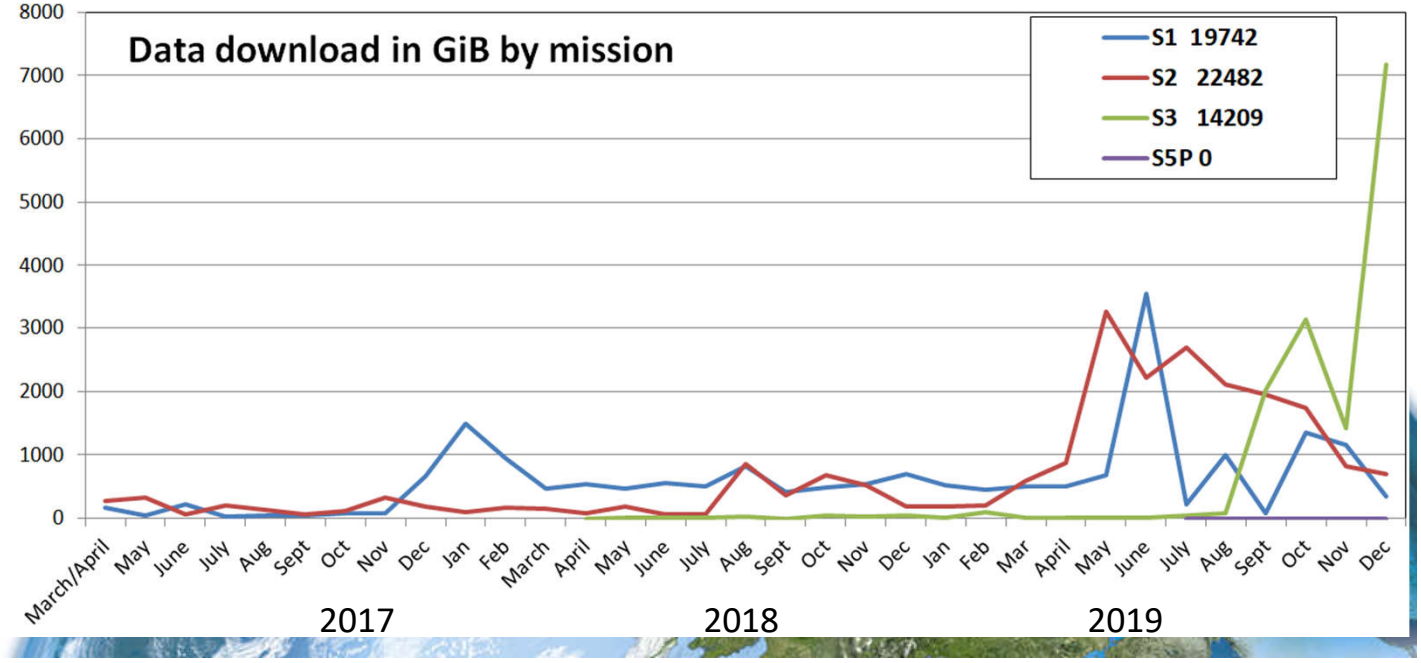


The density of complete downloaded products worldwide (01.11.2019 - 30.11.2019)



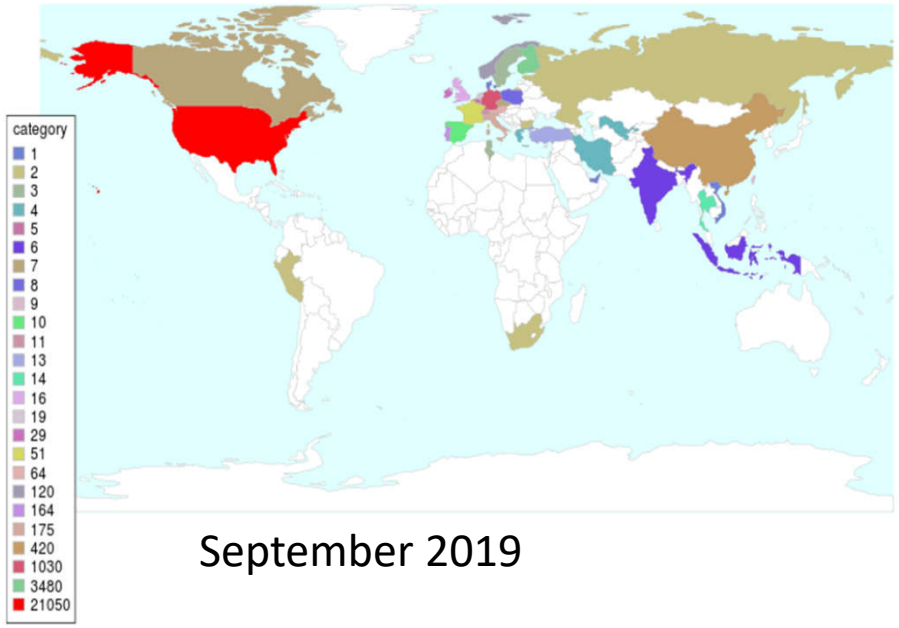
The density of complete downloaded products over Europe (01.11.2019 - 30.11.2019)



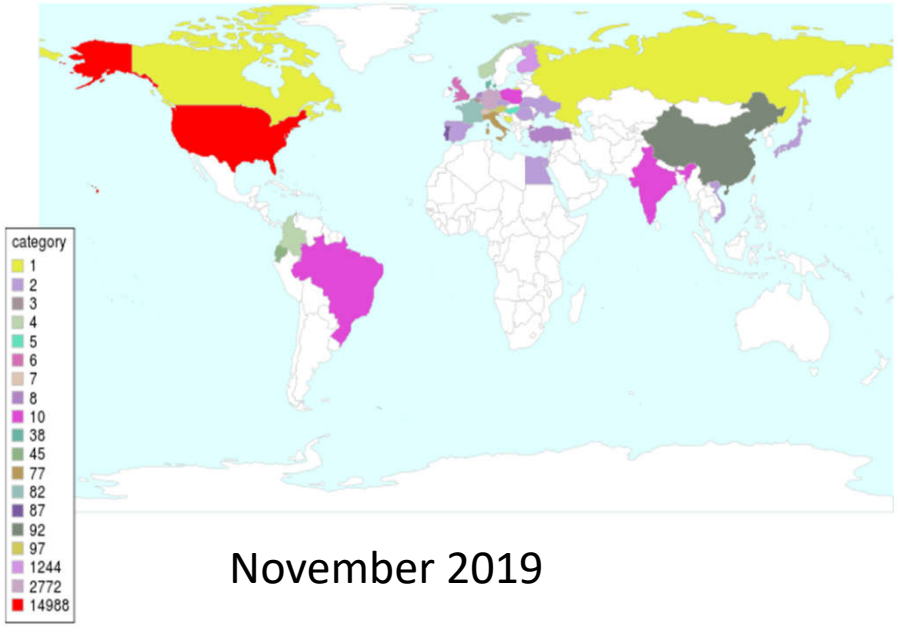


-> hoher Download von S3 Daten in den vergangen Monaten von einem Nutzer aus den USA (registriert in Landwirtschaft) und Finnland

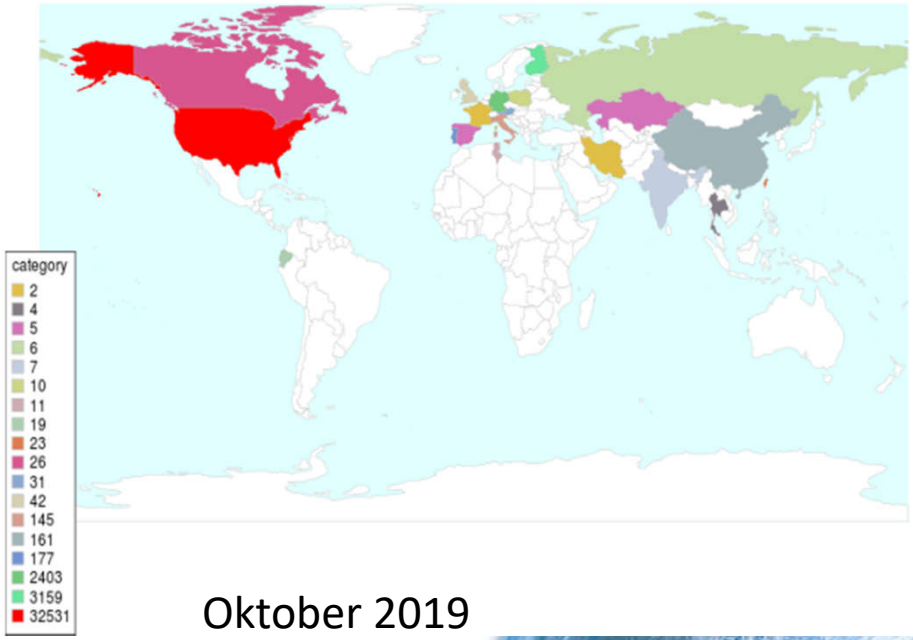
Produkt downloads nach Region der vergangenen 4 Monate mit Top Downloads:
USA, Deutschland und Finnland



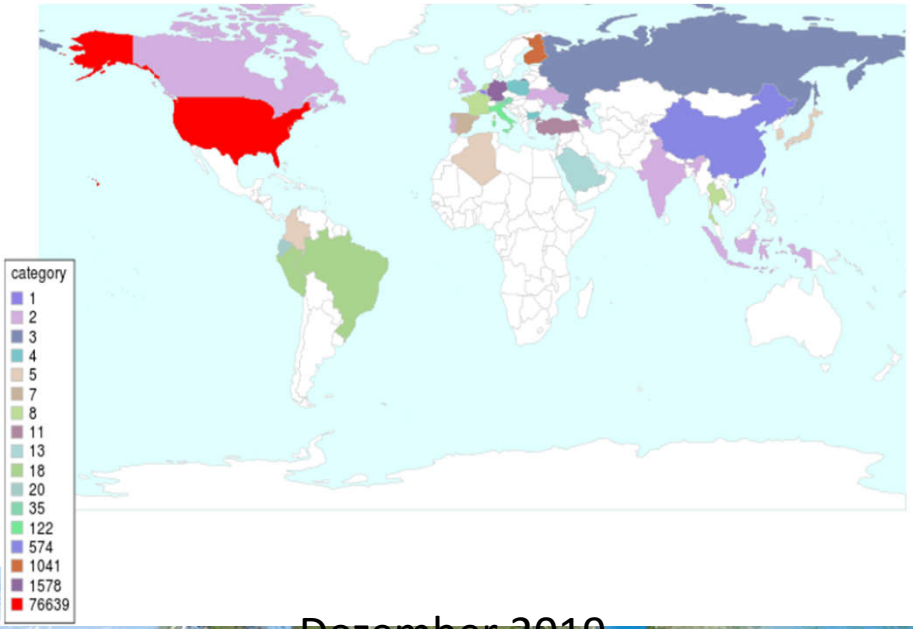
September 2019



November 2019

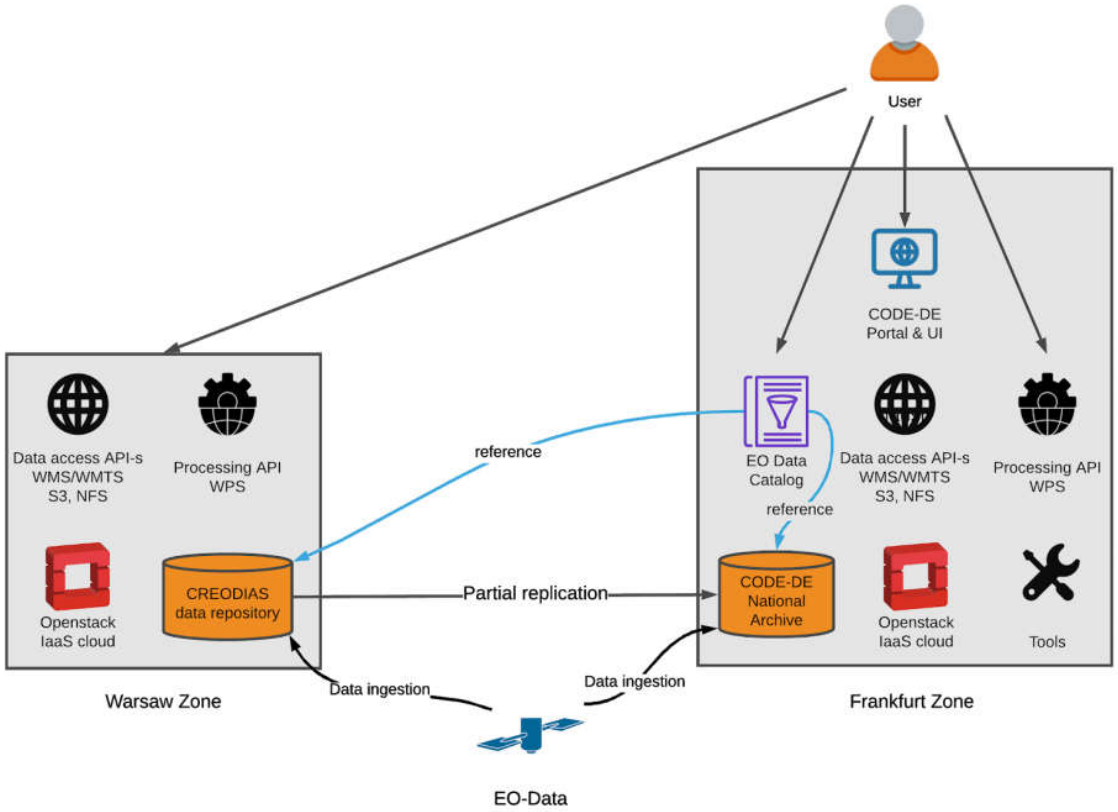


Oktober 2019



Dezember 2019

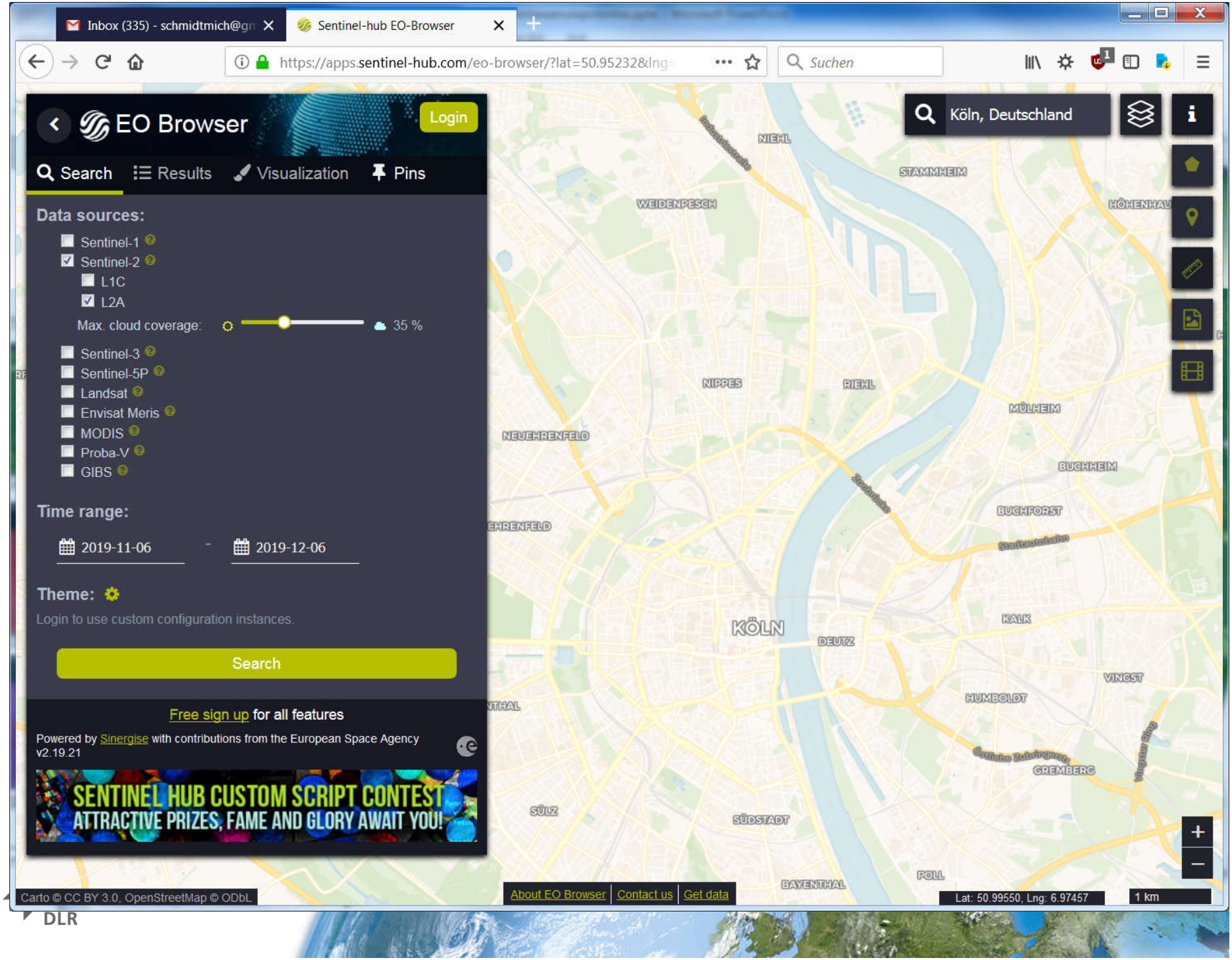
CODE-DE Phase 2 – ab 01.04.2020



System Architektur mit CODE-DE Server in Frankfurt und Anbindung an CreoDIAS in Warschau.

Erfüllt BSI Richtlinien

DLR


Inbox (335) - schmidtmich@gm
Sentinel-hub EO-Browser
https://apps.sentinel-hub.com/eo-browser/?lat=50.95232&lng=
Suchen
EO Browser
Login
Search
Results
Visualization
Pins
Data sources:
Sentinel-1
Sentinel-2
L1C
L2A
Max. cloud coverage:
35 %
Sentinel-3
Sentinel-5P
Landsat
Envisat Meris
MODIS
Proba-V
GIBS
Time range:
2019-11-06
2019-12-06
Theme:
Login to use custom configuration instances.
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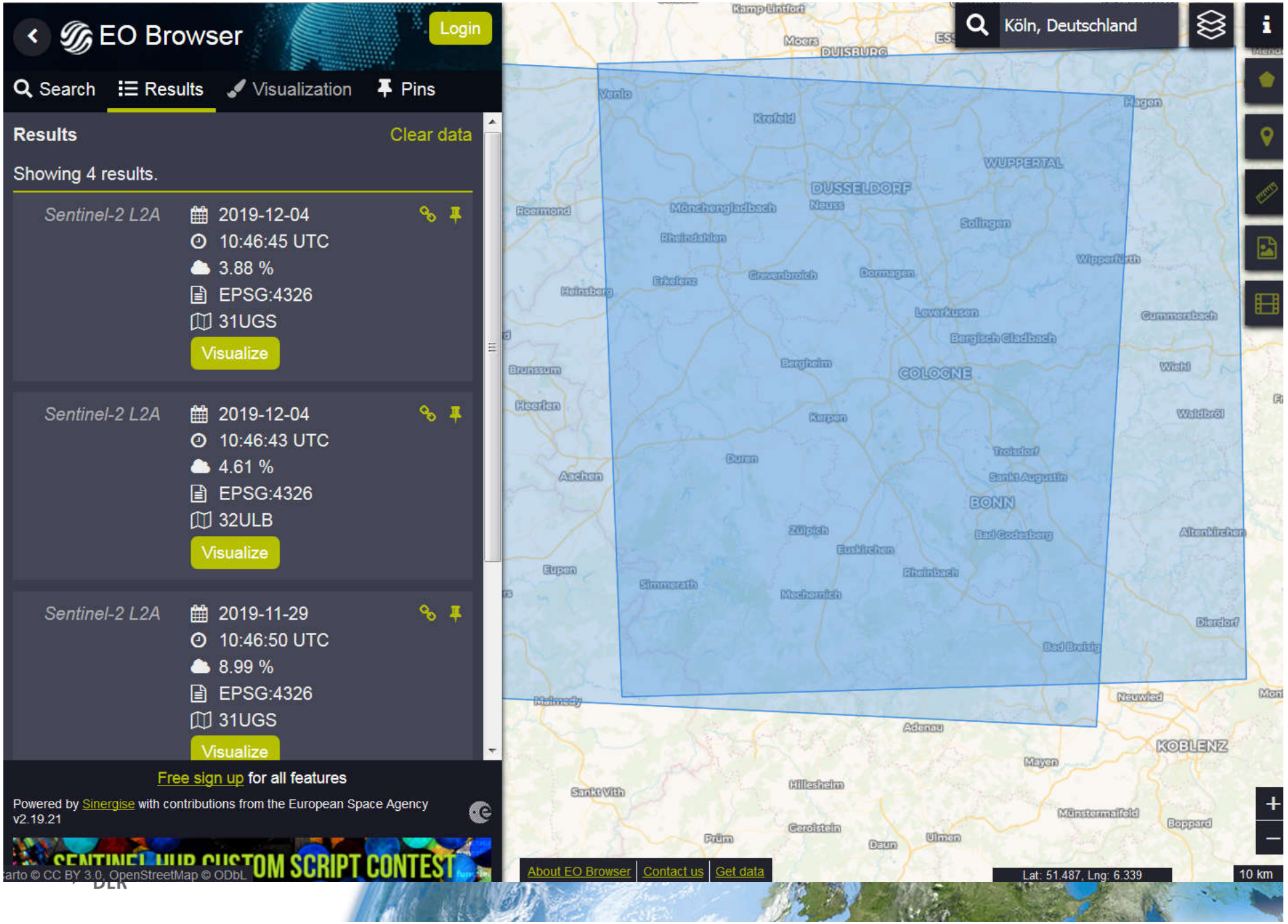
Lat: 50.99550, Lng: 6.97457
1 km


EO Browser
Login
Search
Results
Visualization
Pins
Results
Clear data
Showing 4 results.
Sentinel-2 L2A
2019-12-04
10:46:45 UTC
3.88 %
EPSG:4326
31UGS
Visualize
Sentinel-2 L2A
2019-12-04
10:46:43 UTC
4.61 %
EPSG:4326
32ULB
Visualize
Sentinel-2 L2A
2019-11-29
10:46:50 UTC
8.99 %
EPSG:4326
31UGS
Visualize
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Grevenbroich
Dormagen
Wipperfürth
Heinsberg
Leverkusen
Gummersbach
Bergisch Gladbach
Brunssum
Bergheim
COLOGNE
Wiehl
Heerlen
Kerpen
Waldbröl
Troisdorf
Düren
Aachen
Sankt Augustin
BONN
Zülpich
Bad Godesberg
Altenkirchen
Euskirchen
Eupen
Rheinbach
Simmerath
Mechernich
Dierdorf
Bad Breisig
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Hillesheim
Münstermaifeld
Boppard
Gerolstein
Prüm
Daun
Ulmen
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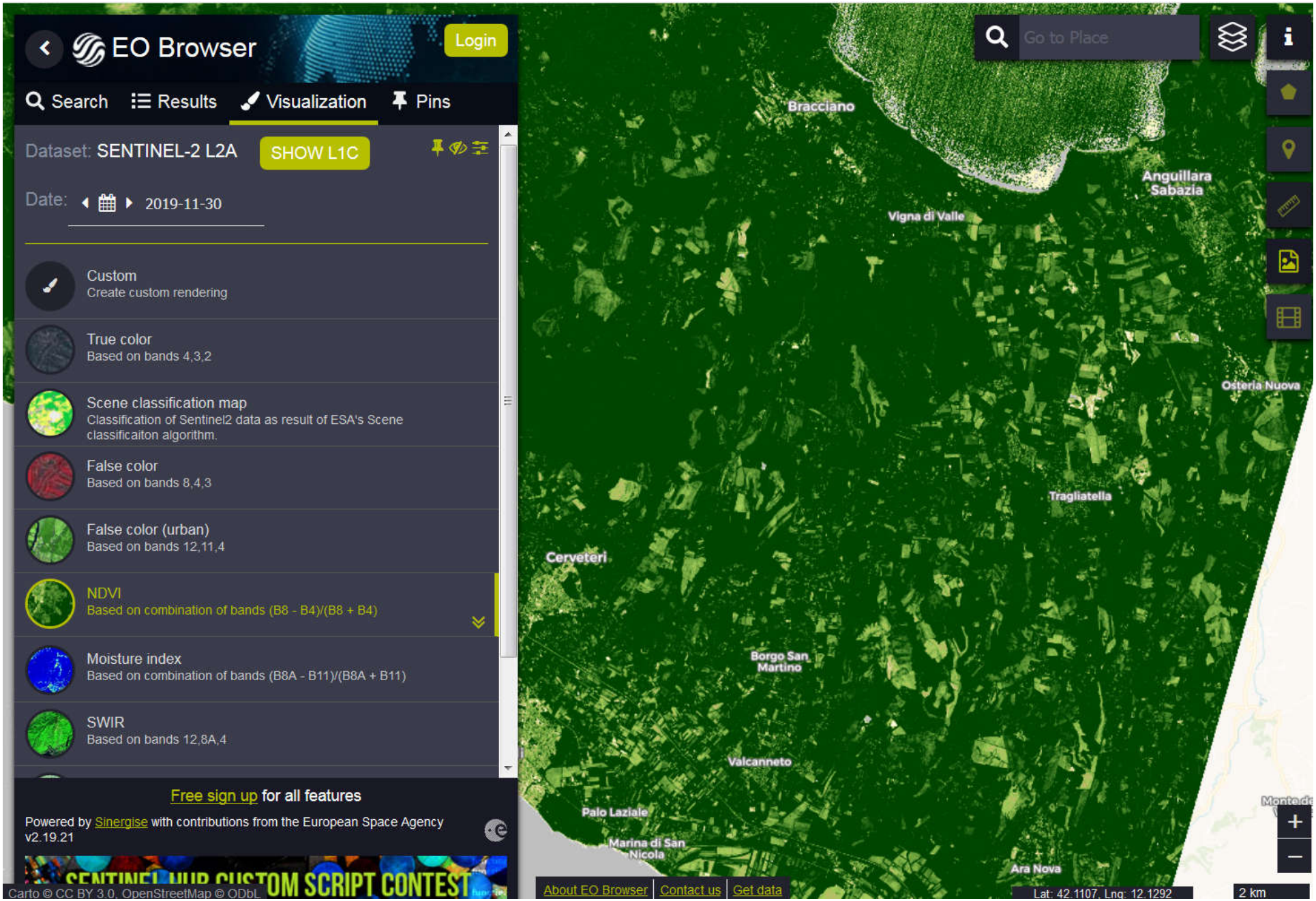
Lat: 51.487, Lng: 6.339
10 km


EO Browser
Login
Search
Results
Visualization
Pins
Dataset: SENTINEL-2 L2A
SHOW L1C
Date: 2019-11-30
Custom
Create custom rendering
True color
Based on bands 4,3,2
Scene classification map
Classification of Sentinel2 data as result of ESA's Scene classificaiton algorithm.
False color
Based on bands 8,4,3
False color (urban)
Based on bands 12,11,4
NDVI
Based on combination of bands (B8 - B4)/(B8 + B4)
Moisture index
Based on combination of bands (B8A - B11)/(B8A + B11)
SWIR
Based on bands 12,8A,4
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Bracciano
Anguillara Sabazia
Vigna di Valle
Osteria Nuova
Tragliatella
Cerveteri
Borgo San Martino
Valcanneto
Palo Laziale
Marina di San Nicola
Ara Nova
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Lat: 42.1107, Lng: 12.1292
2 km

CODE-DE Phase 2 data availability

Shared Computing Ressources are avaliable, predominately for public services

Guidelines need to be developed how to use the cloud ressources!

- GDI-DE
- CCM
- Copernicus Dienste

Datasets	Products	Instrument	Locally Held in Warsaw Zone
Sentinel-1A & Sentinel-1B	GRD	SAR C-BAND	Full archive
	OCN		
	RAW		Last 6 months
	SLC		- Europe: full archive - Last 6 months / orderable
Sentinel-2A & Sentinel-2B	L1C	MSI	Full archive
	L2A		- Orderable */** - Cached ***
Sentinel-3A & Sentinel-3B	L1 SLSTR	SLSTR	Full archive
	L1 OLCI	OLCI	
	L1 SRAL	SRAL	
	L2 SLSTR (LST/WST)	SLSTR	
	L2 OLCI	OLCI	
	L2 SRAL	SRAL	
Sentinel-5P	L1B	TROPOMI	Full archive
	L2		
Landsat-5	L1G, L1T, L1GT	TM	Coverage of Europe, (1984-2011)
Landsat-7	L1G, L1T, L1GT	ETM	Coverage of Europe, (1999-2017)
Landsat-8	L1T, L1GT	OLI, OLI TIRS	Coverage of Europe, (2013- present)
Envisat	L1	MERIS	Global, (2002-2012)

* Can be ordered from ESA via EO Finder
** If L2A does not exist in ESA archive, it can be processed by CF with sen2cor
*** Kept in rolling cache of 1PB

DLR