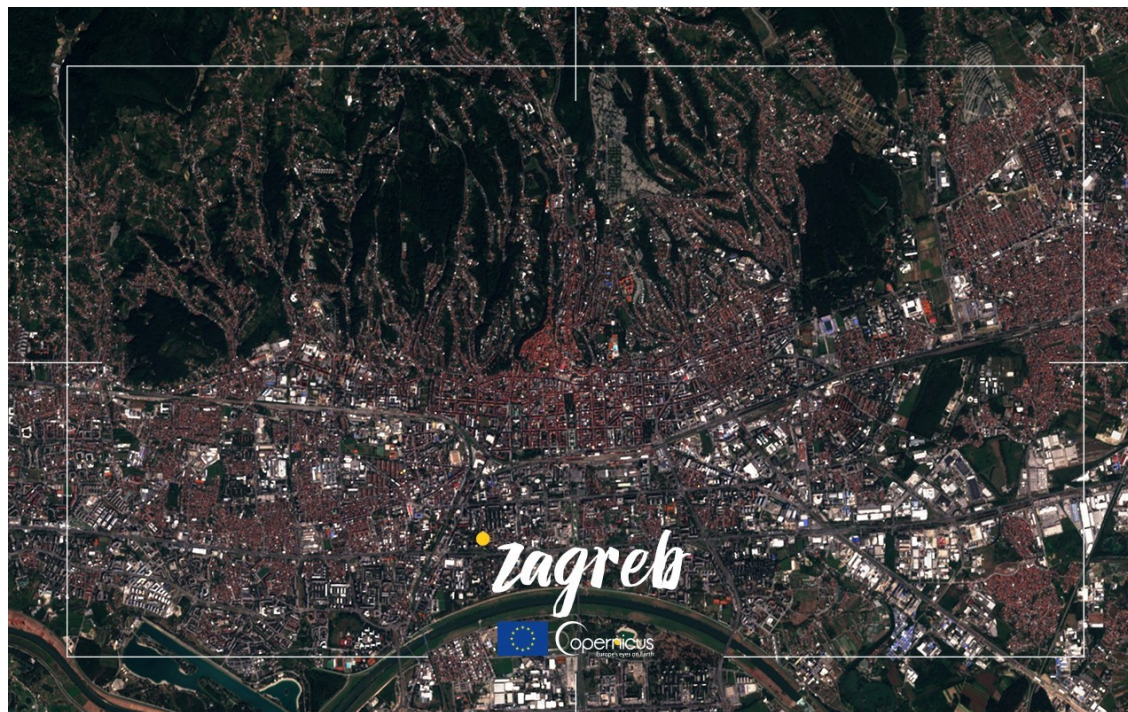
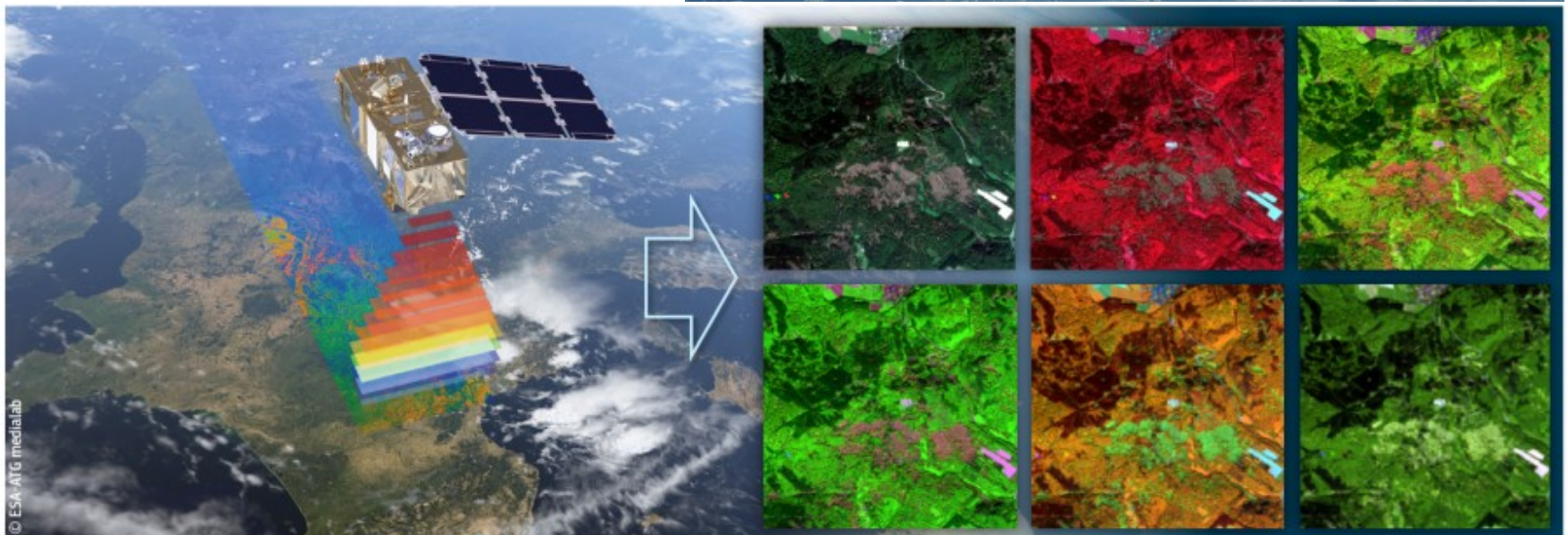
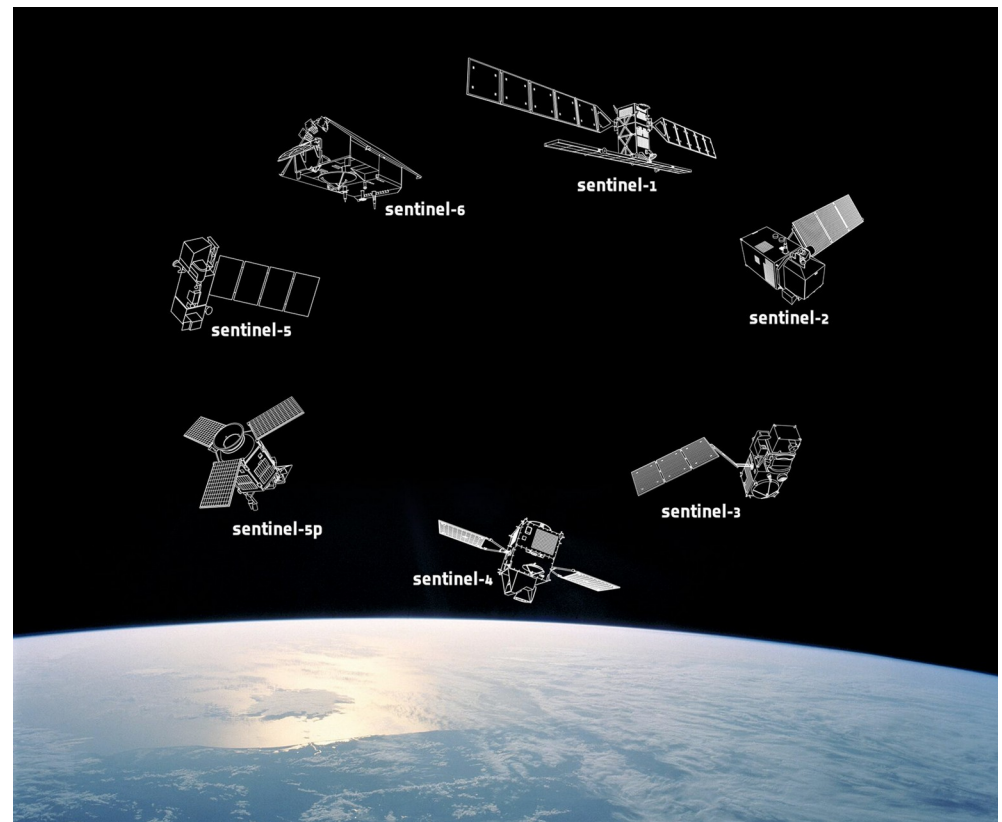


Satelitski sustavi kao alat u praćenju klimatskih promjena

Festival znanosti, Velika Gorica, 26.04.2023.



Copernicus sateliti

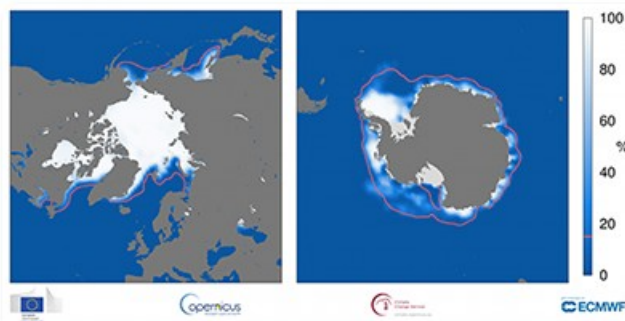


Klimatske promjene i okoliš

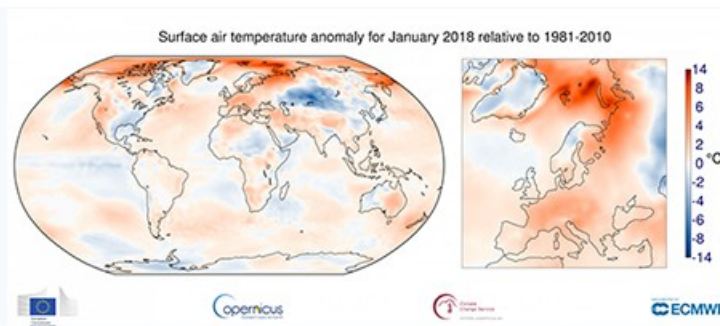


Temperatura i cjelokupno zdravlje našeg planeta rezultat su delikatne ravnoteže više fenomena, kao što su kretanje morskih struja, transformacija ugljika pri prelasku između kopna, mora i zraka te količina Sunčeve svjetlosti koja se apsorbira ili reflektira od površine Zemlje. No sve je jasnije da se ta ravnoteža može lako poremetiti.

Program Copernicus omogućuje praćenje ključnih pokazatelja uzročnika klimatskih promjena (npr. ugljikova dioksida) i procjenu njihova utjecaja na okoliš (npr. otapanje ledenjaka i morskog leda, podizanje morske razine), što se odražava u europskim politikama u brojnim sektorima koje se odnose na prilagodbu klimatskim promjenama i ublažavanje njihovih posljedica.



Morski ledeni pokrov za siječanj 2018.
(izvor: C3S)



Anomalija površinske temperature zraka za siječanj 2018.
(izvor: C3S)

Usluge Copernicusa

Copernicus Atmosphere Monitoring Service

<https://atmosphere.copernicus.eu/>

Copernicus Marine Services

<https://marine.copernicus.eu/>

Copernicus Land Services

<https://land.copernicus.eu/>

Copernicus Climate Services

<https://climate.copernicus.eu/>

Copernicus Emergency Services

<https://emergency.copernicus.eu/>

Copernicus Security Services

<https://copernicus.eu/main/security>

Copernicus Services



Atmosphere
(CAMS)



Marine
(CMEMS)



Land
(CLMS)



Climate
(C3S)

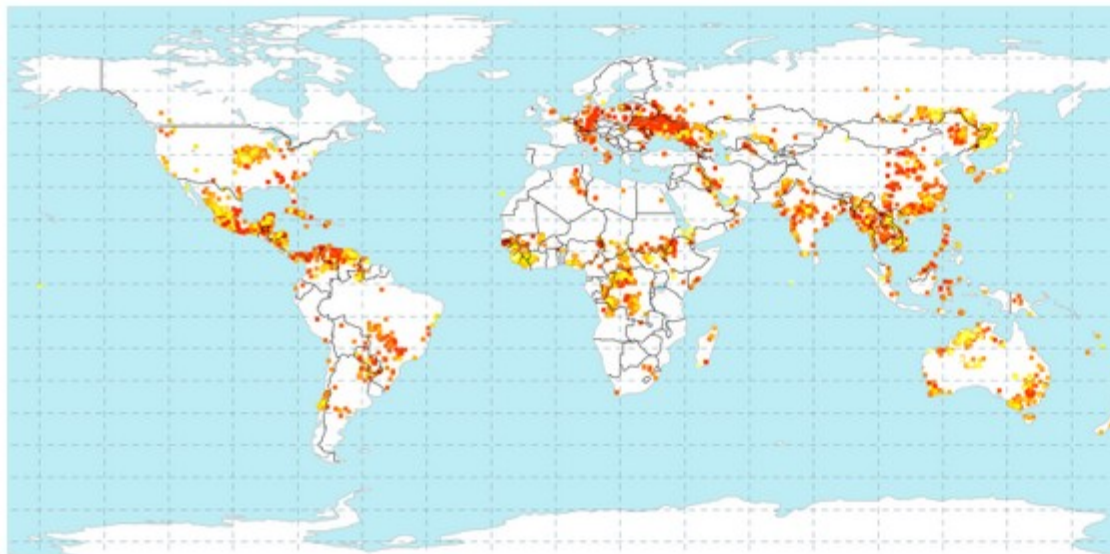


Emergency
(EMS)



Security

Copernicus Atmosphere Monitoring Service



Daily analyses and forecasts

Forecast charts:

[Reactive gases](#)

[Aerosols](#)

[European air quality](#)

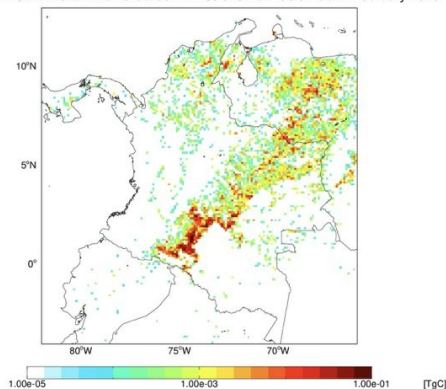
[Ozone layer](#)

[CO₂](#)

Analyses charts:

[Fire monitoring](#)

CAMS GFASv1.2 Total Wildfire Carbon Emissions from Colombia in February 2018

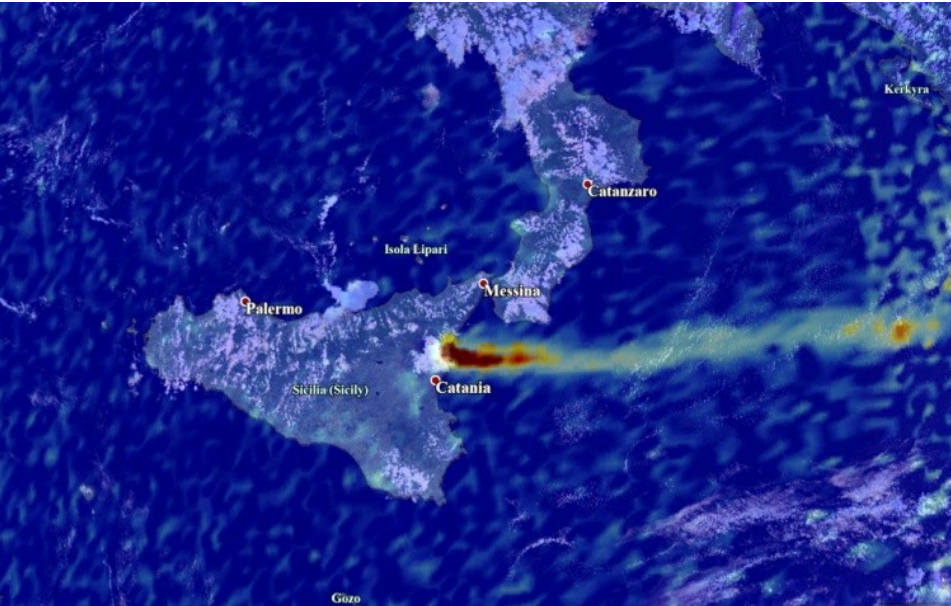
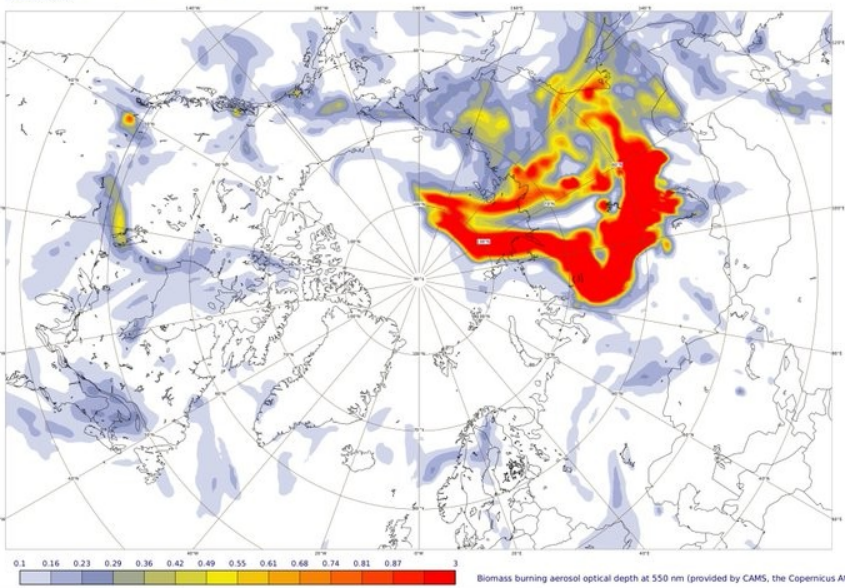


Copernicus



ECMWF

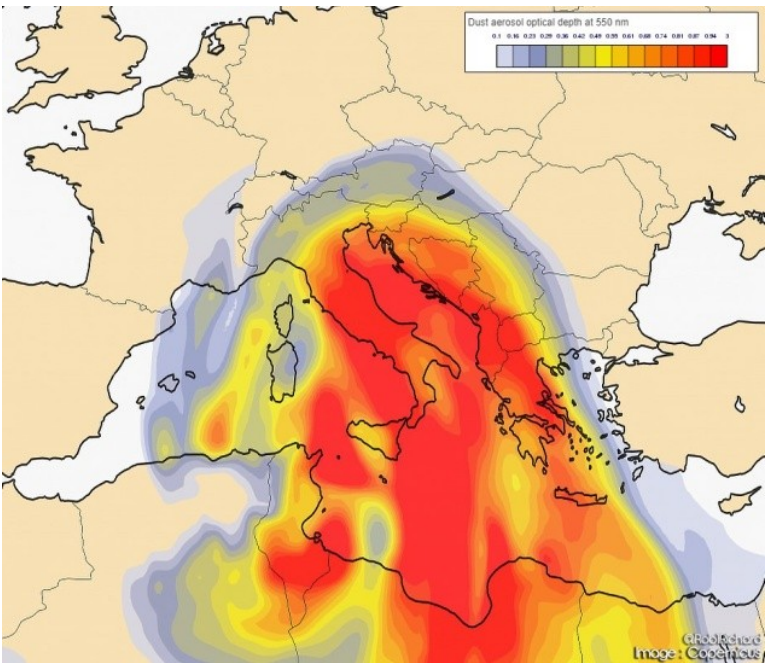
Aerosol forecasts - Saturday 10 Aug 2019, 00 UTC VT Saturday 10 Aug 2019, 12 UTC Step 12
© ECMWF 2019



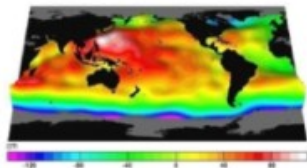
43.99° N, 15.44° E ×
25° @ 16 km/h
147 $\mu\text{g}/\text{m}^3$

earth

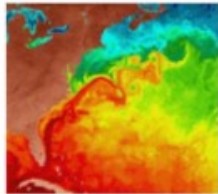
Date | 2017-08-22 12:00 Local ⇄ UTC
Data | Wind + Particulate Matter < 10 μm @ Surface
Scale |
Source | CAMS / Copernicus / EC + ECMWF
Control | Now « - < > » ⊕ Grid ▶ HD
Mode | Air - Ocean - Chem - **Particulates**
Overlay | DUex - PM₁ - PM_{2.5} - **PM₁₀**
| SO₄ex
Projection | A - AE - CE - E - **O** - P - S - WB - W3
about



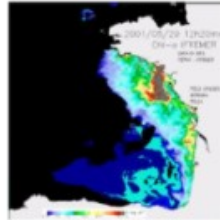
Copernicus Marine Services



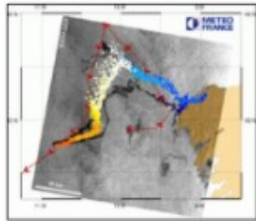
Altimetry and gravimetry
(sea level and ocean currents)



Sea Surface Temperature



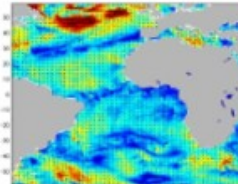
Ocean Colour
(Chl-a, SPM)



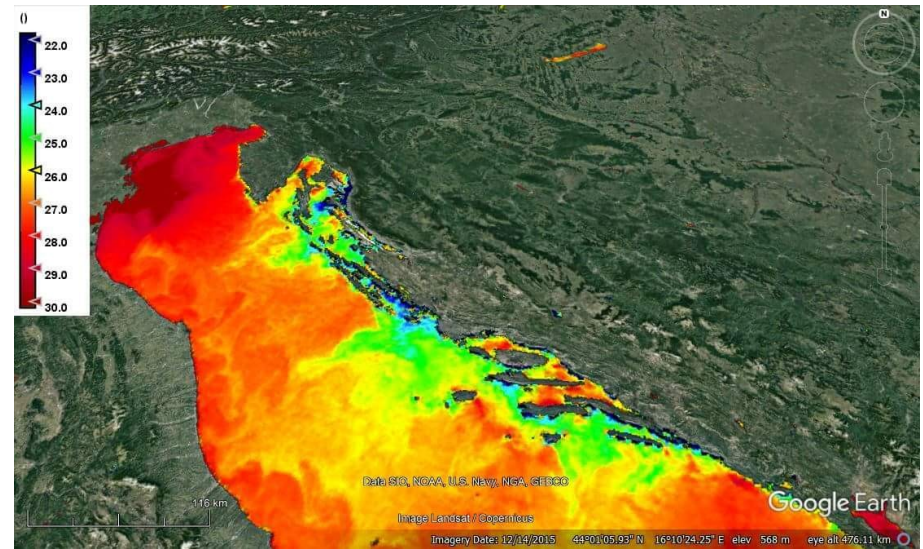
Surface roughness from SAR
(e.g. waves, winds, oil slicks)



Sea Ice (concentration, drift, thickness)



Winds
(speed and direction)



YOUR SEARCH



Search by keyword



REGIONAL DOMAIN

Mediterranean Sea

PARAMETERS

TEMPORAL COVERAGE

From 1992-01-01 To 2019-09-26

☐ If checked, the search results will only show products containing the whole selected time range

☐ PRODUCT WITH DEPTH LEVEL

MEDITERRANEAN SEA PHYSICS ANALYSIS AND FORECAST

MODEL ☐ ☐ ☐ ☒

T bottomT S SSH 3DUV

0.042 degree x 0.042 degree (141 depth levels)

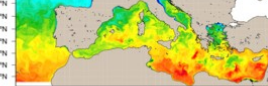
From 2017-01-01 to Present

hourly-mean,daily-mean,monthly-mean



MED

Potential Temperature [°C] 31/12/2016 00:00 UTC



MEDSEA_ANALYSIS_FORECAST_WAV_006_017

MEDITERRANEAN SEA WAVES ANALYSIS AND FORECAST

MODEL ☒ ☒ ☒ ☒

SSH SWH MWP VMDR VSDXY VW SW1 SW2

0.042 degree x 0.042 degree (Surface only)

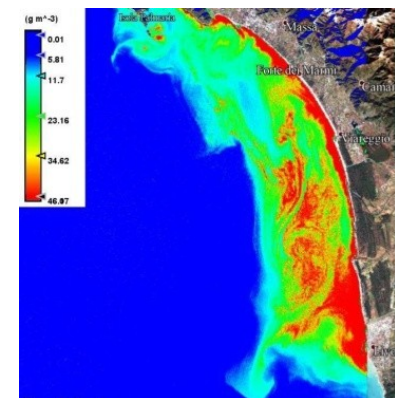
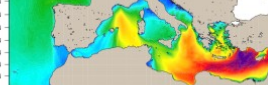
From 2017-01-01 to Present

hourly-instantaneous



MED

Spectral Significant Wave Height [m] 15/01/2019 12:00 UTC



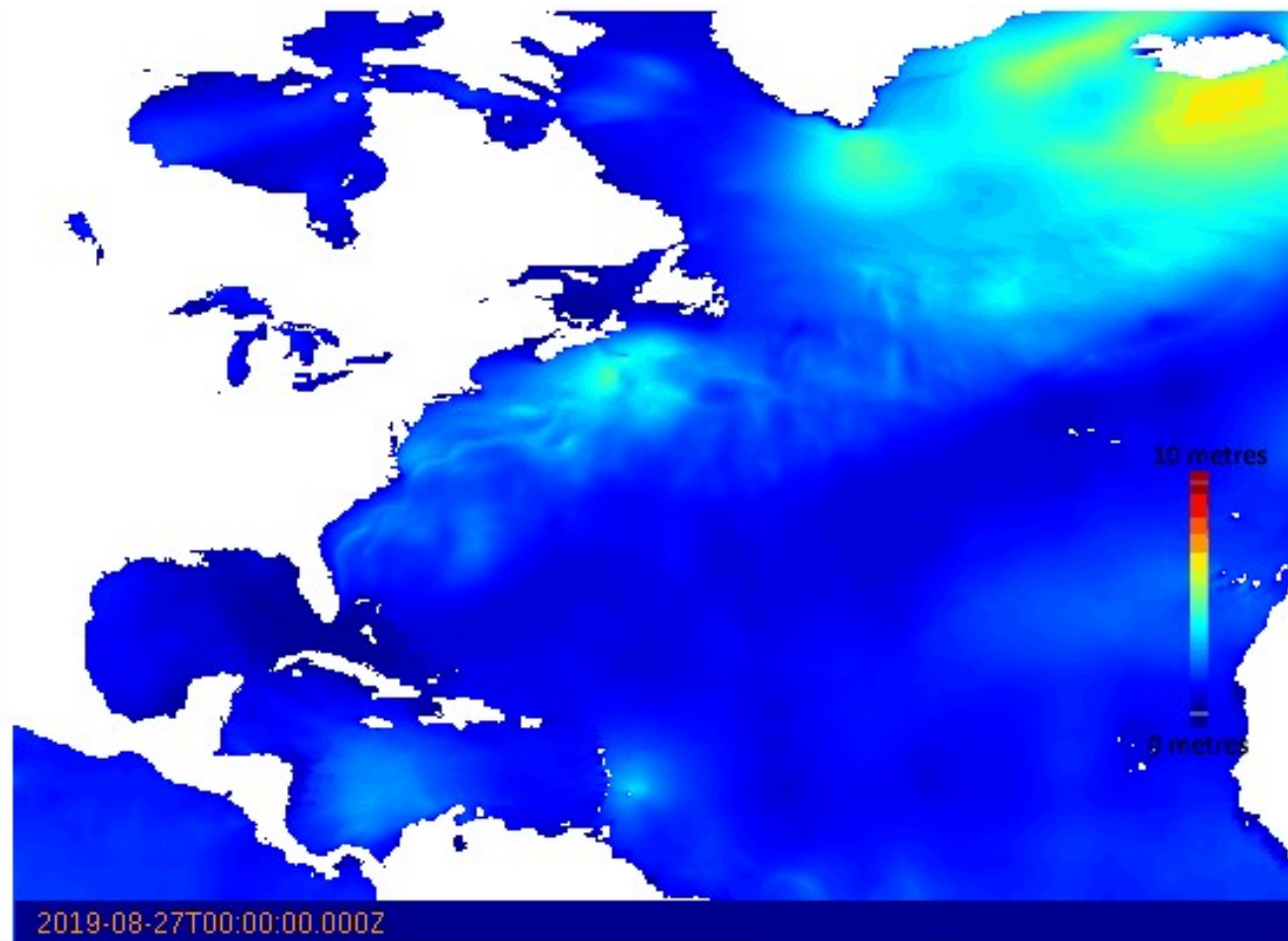


Copernicus
Marine Service

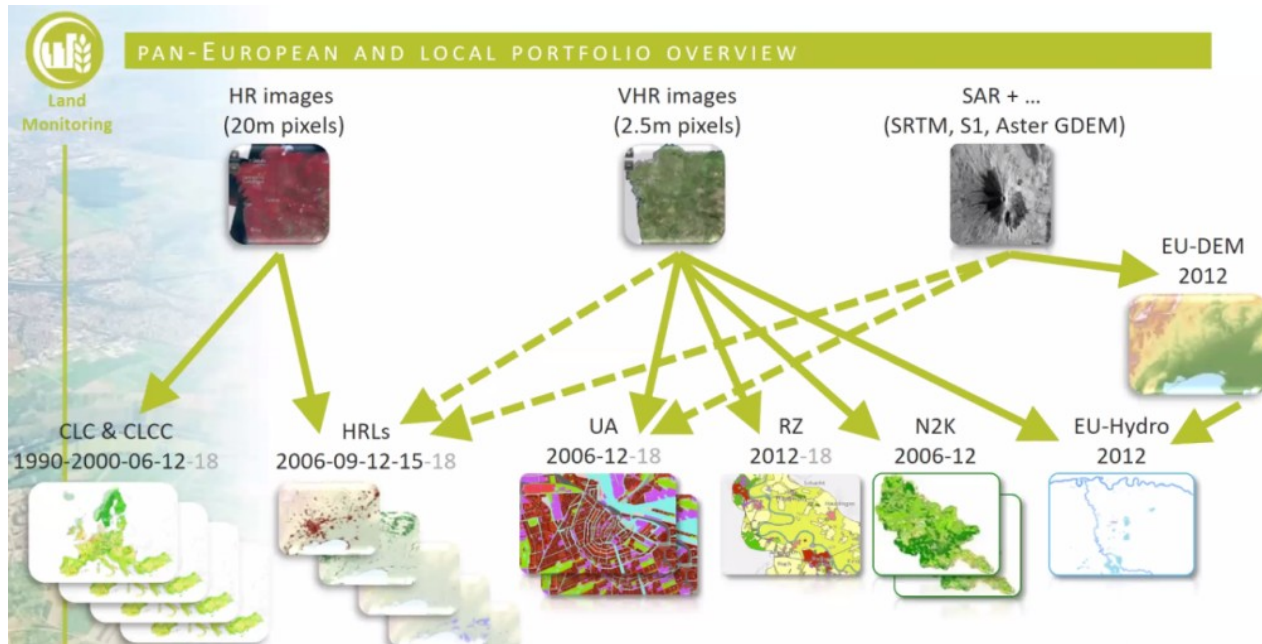
HURRICANE DORIAN: WAVE HEIGHT

Significant wave height (in metres) hindcast from August 27th, 2019 with a forecast to September 7th, 2019.

Source: *Copernicus Marine Service model - Global Ocean Waves Analysis and Forecast updated Daily*



Copernicus Land Services



Imagery and reference data



EU-DEM



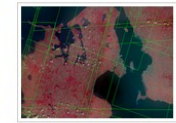
EU-Hydro



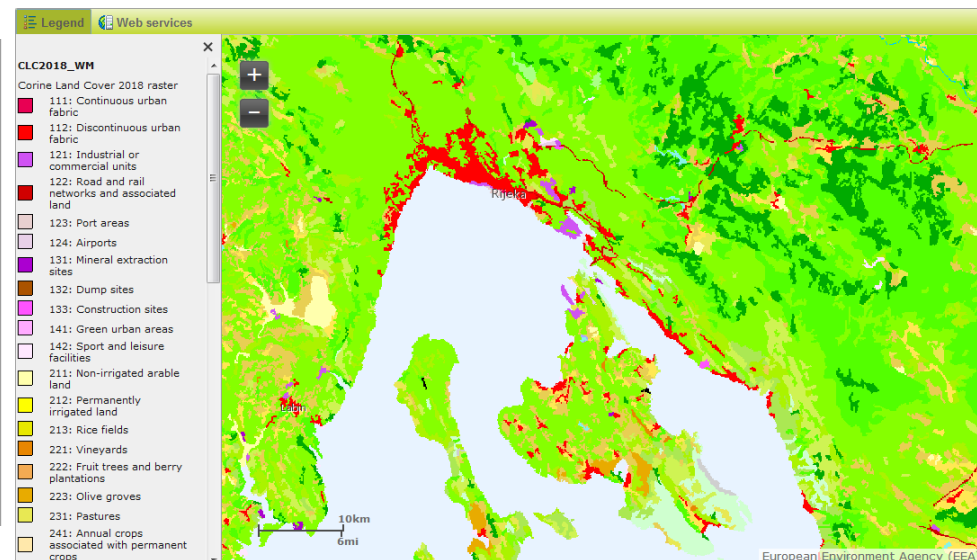
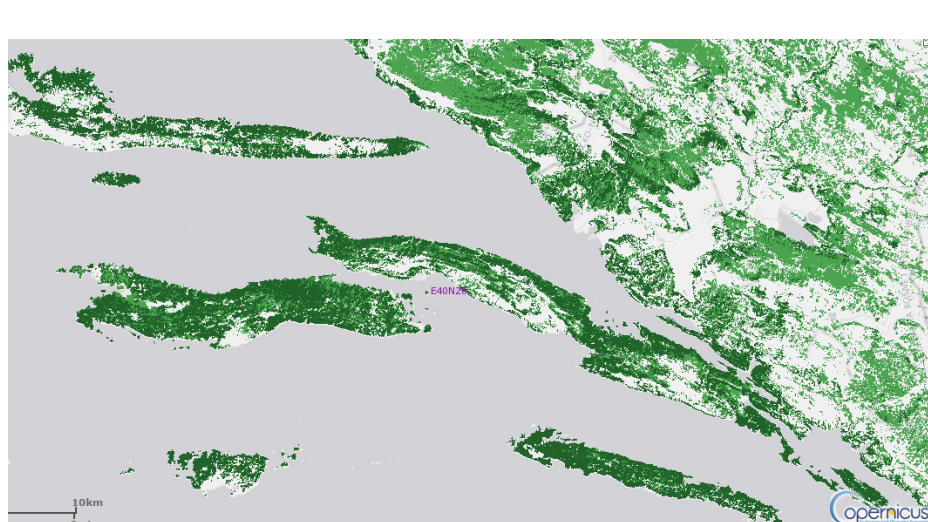
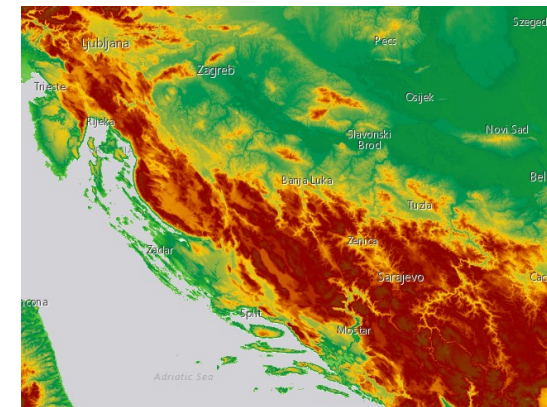
LUCAS



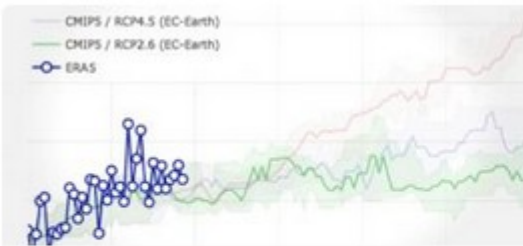
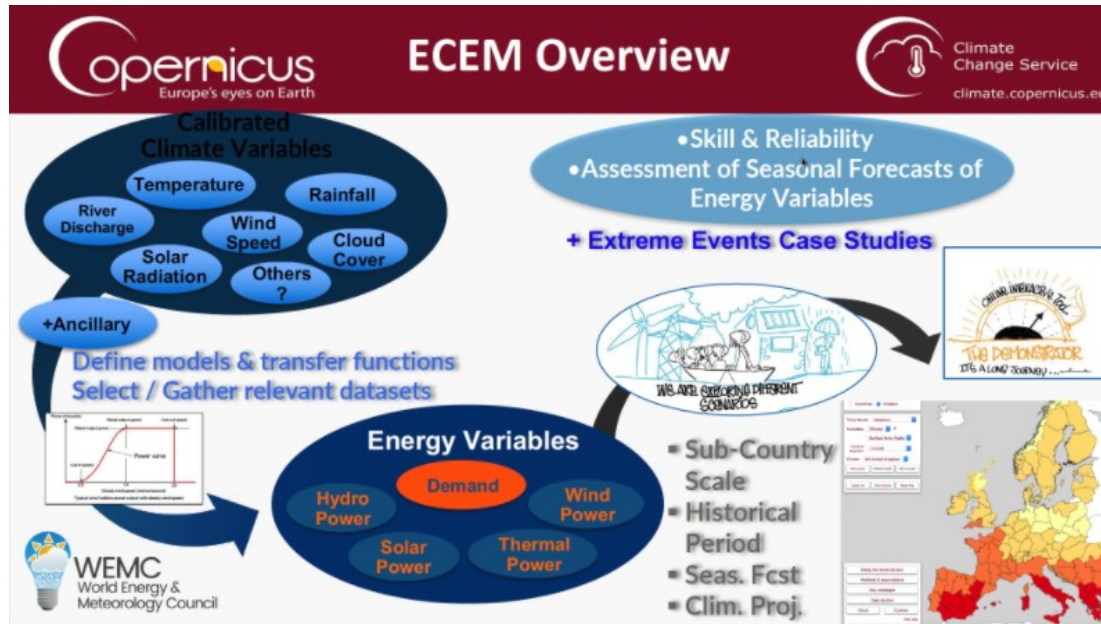
European Image



Global Image Mosaics



Copernicus Climate Services



Climate Data Store Toolbox

```

    session.auth = Tuple(self.key, self.secret)

    # info: sending request to Na, url1
    result = session.get("POST %s Na" % url1, json.dumps({"key": self.key}))

    result = self.rebuild(session.post)(url1, json.dumps({"key": self.key}))
    reply = None

    # ...

    result.raise_for_status()
    reply = result.json()
    # exception:

    # reply is None
    try:
        reply = session.get(url1)
    except:
        pass

```

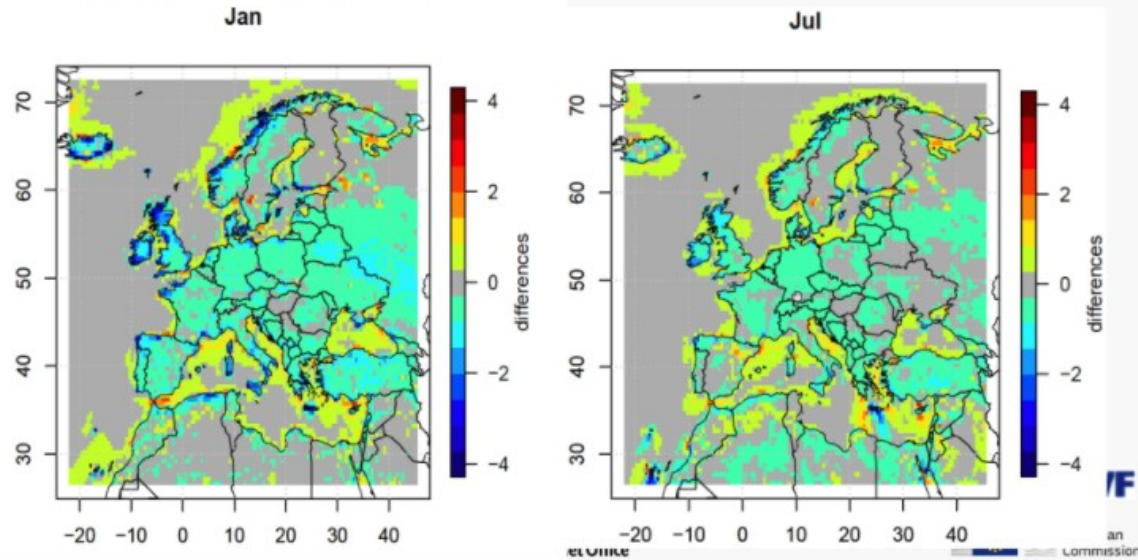
Climate Data Store **API**



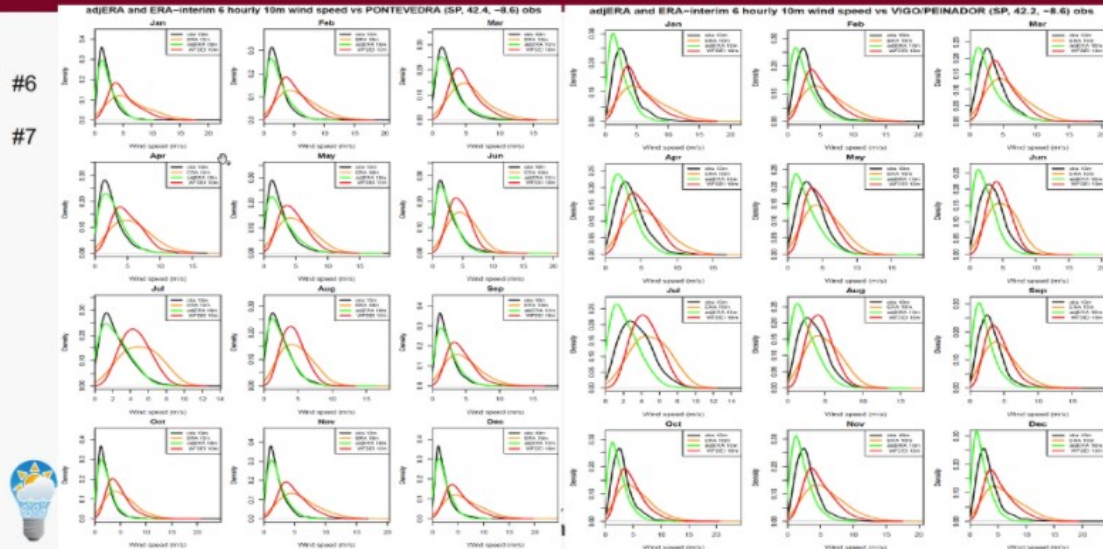
Access the **C3S Forum**

Differences ERA5 and ERA-Interim

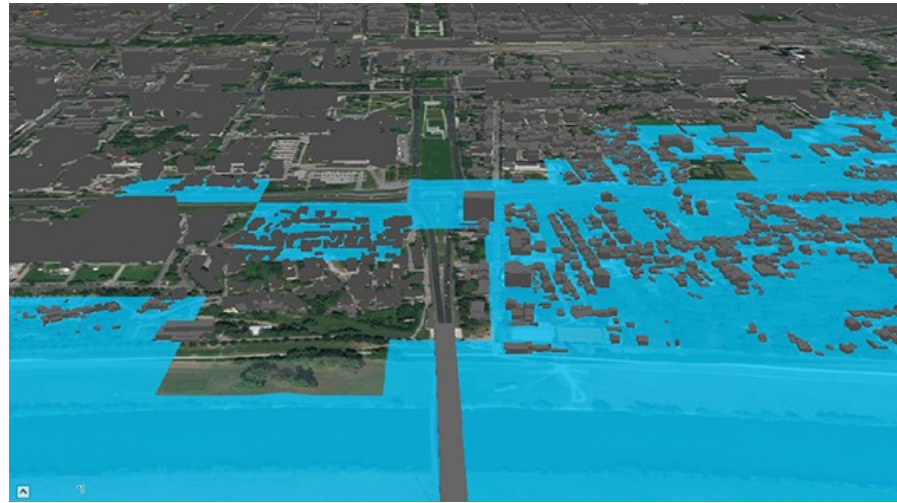
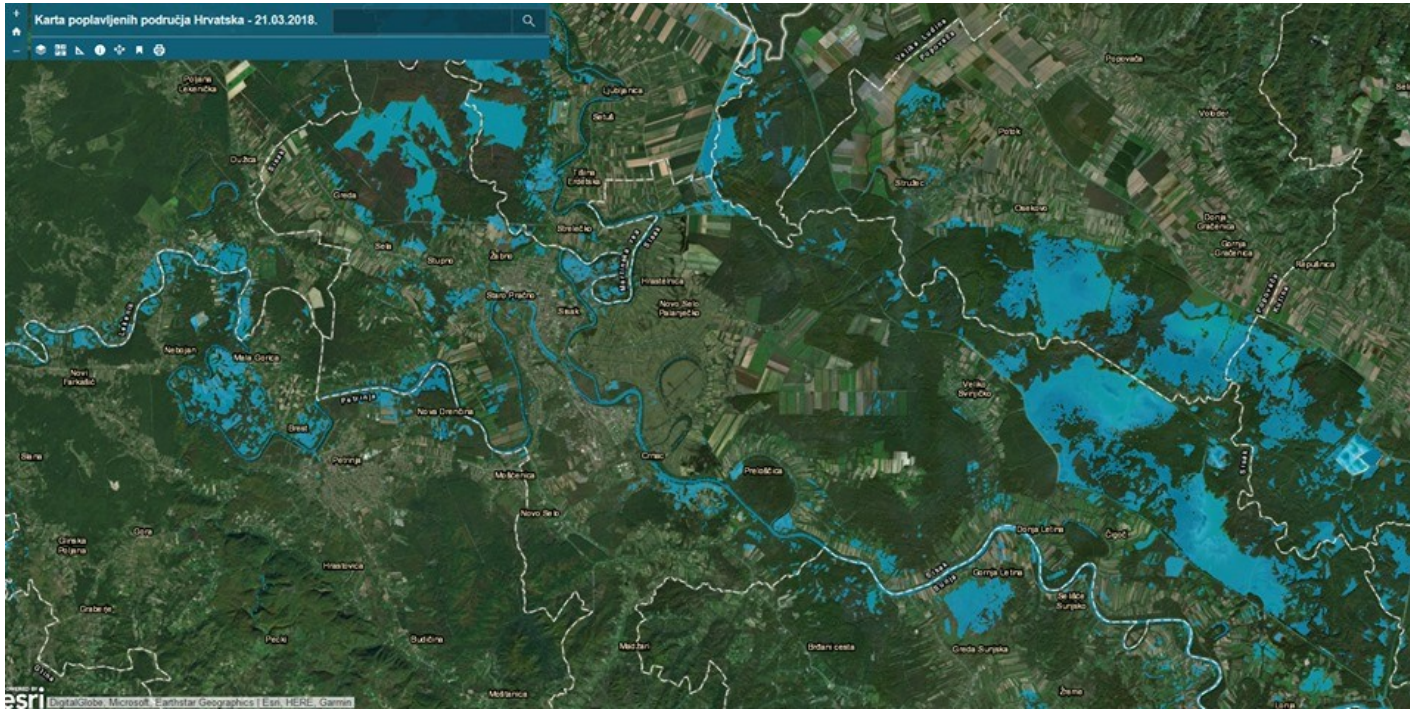
ERA5 – ERAI monthly mean difference 2010–2016

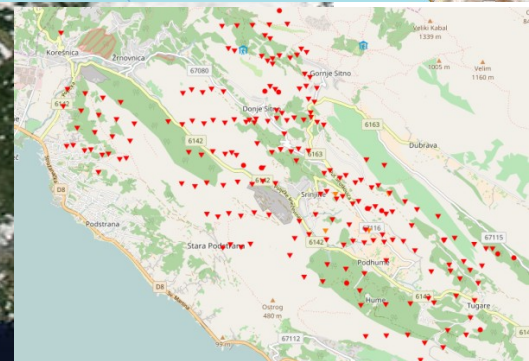
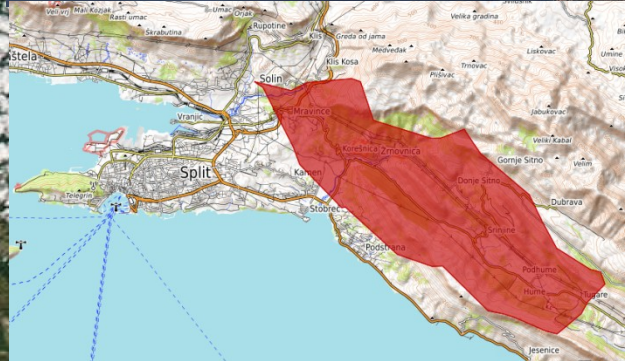


Distributional Comparisons (Wind Speeds)

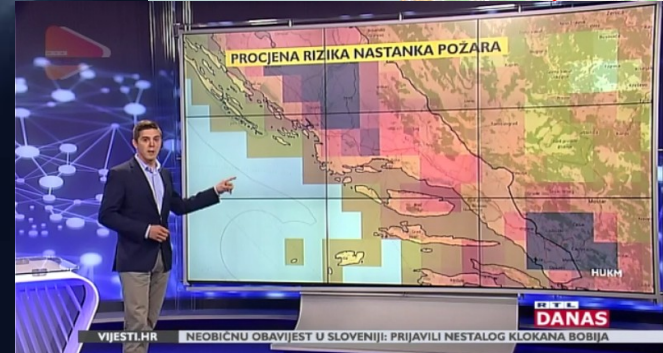


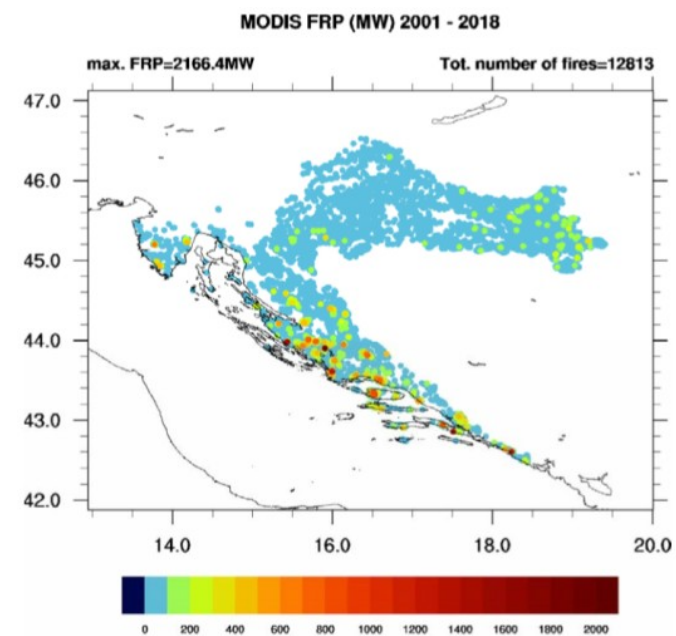
Praktični primjeri

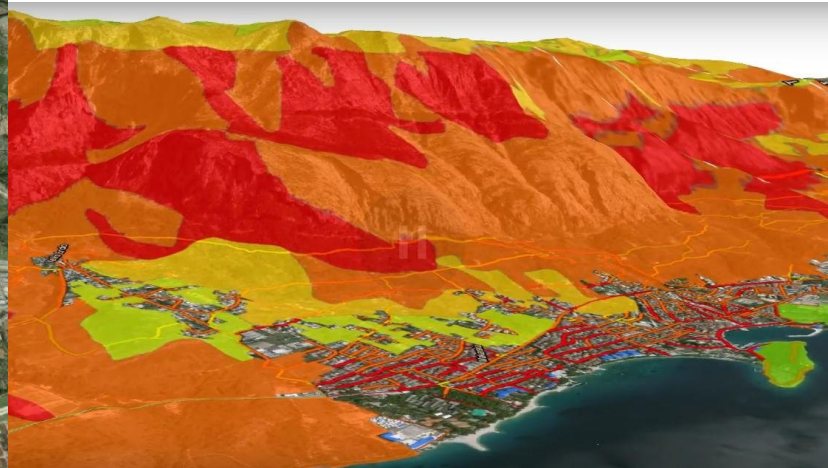
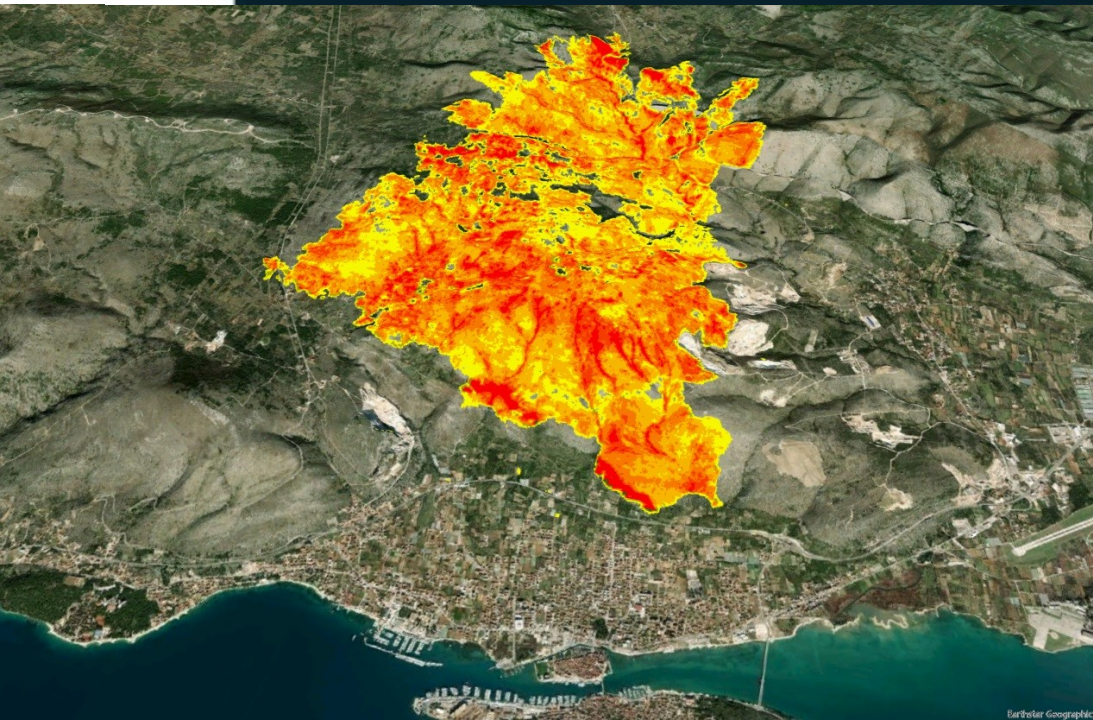
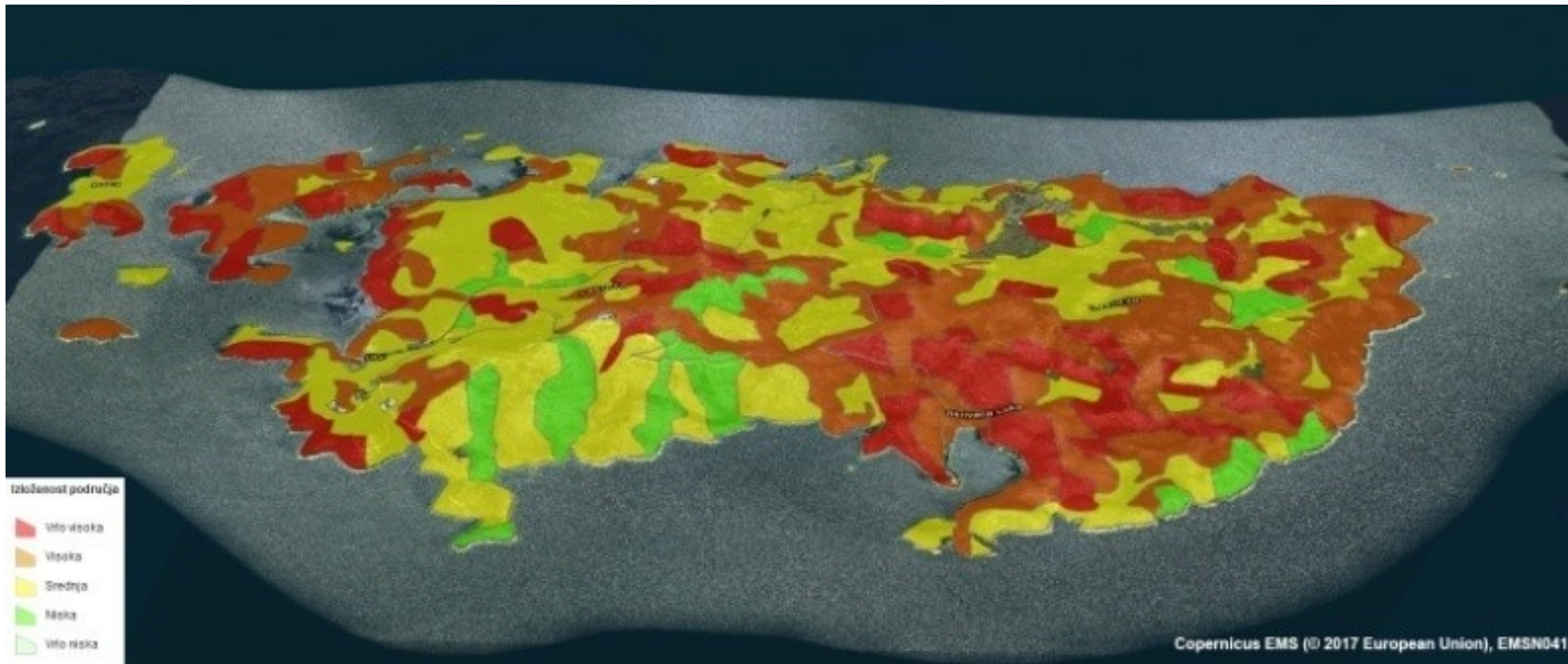




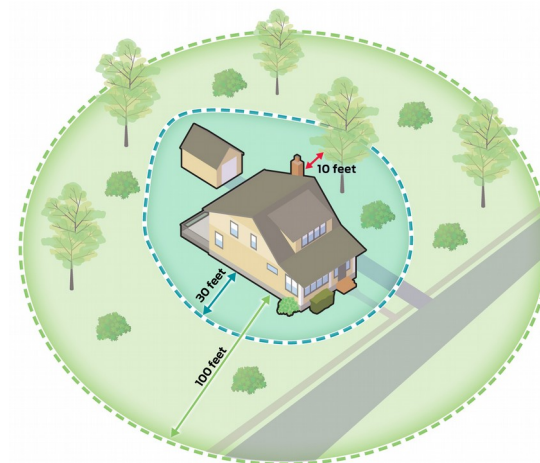
gorenost
niska izgorenost
visoka izgorenost
gorenost







- područja uređenja vegetacije



Hvala na pažnji!

Igor Magdalenić
hukm@hukm.hr