GEO VIRTUAL SYMPOSIUM 2020

Session: GEO Health Community Response to the COVID-19 Pandemic

COPERNICUS ACTIVITIES IN SUPPORT OF INVESTIGATING COVID-19, AIR QUALITY AND CLIMATE CONNECTIONS

15 June 2020

GROUP ON EARTH OBSERVATIONS

#EO4Impact

BIO

Dr. Vincent-Henri Peuch, a native of France, obtained his PhD from Ecole Normale Supérieure de Lyon in 1996. Before joining ECMWF in 2011 to lead the precursor R&D European project of the Copernicus Atmosphere Monitoring Service (CAMS), Vincent-Henri was a scientist and then the Section Lead for Research on atmospheric composition data assimilation and forecasting at France's National Meteorological Service, Météo-France for 15 years. He has been involved in the design and development of Copernicus (formerly known as GMES, Global Monitoring for Environment and Security) since 2003.

He is an internationally respected scientist on atmospheric environment issues and has over 85 international peer reviewed publications to his credit. He is a member of several international scientific and advisory committees, including for the European Environment Agency and the World Meteorological Organisation.

Dr. Vincent-Henri Peuch
Director of Copernicus
Atmosphere Monitoring Service

ECMWF

European Commission

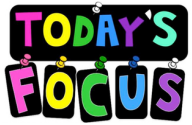
Copernicus Europe's eyes on Earth

ECMWF

Atmosphere Monitoring Service
atmosphere.copernicus.eu

The questions under investigation:

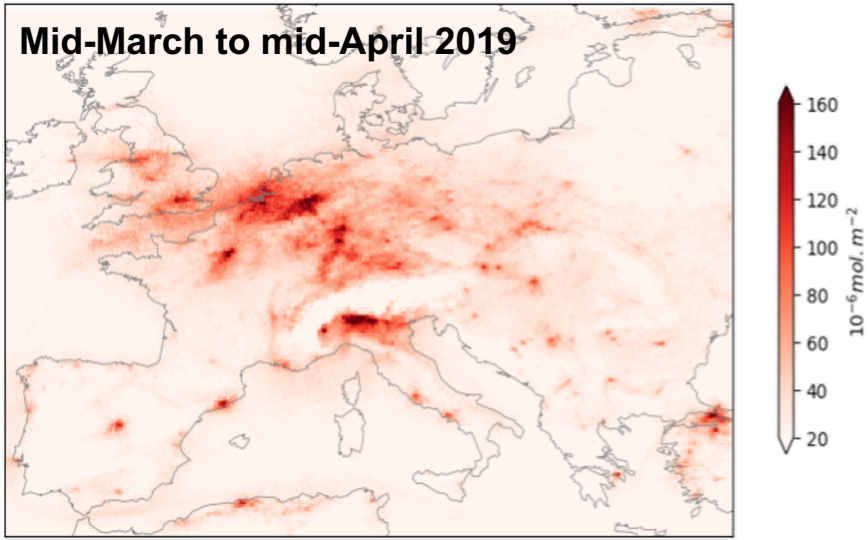
- cause-effect relationship between **long-term** / **short-term exposure** to air pollution and COVID-19?
- can Particulate Matter act as a **vector** for the SARS-CoV-2 and can this play a role in COVID-19 transmission?
- what are the **changes in emissions and concentrations** of key pollutants and greenhouse gases induced by lockdown measures?

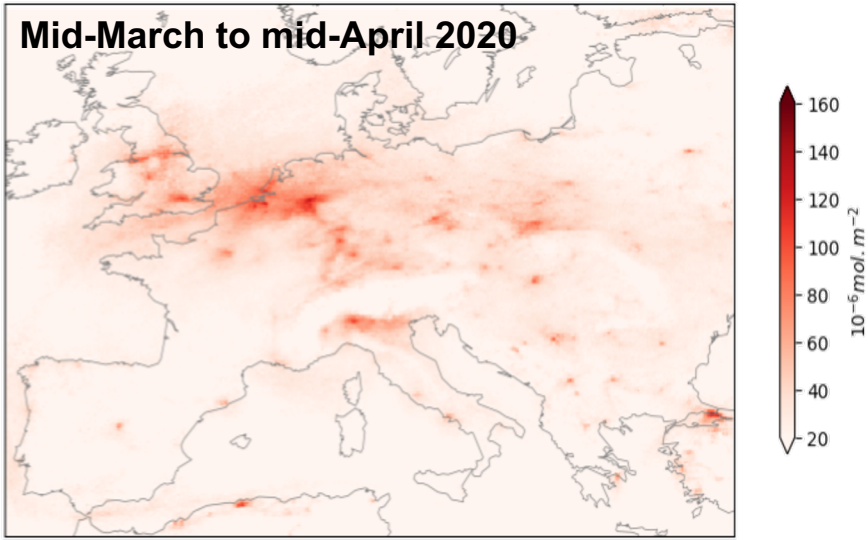


- have temporary changes in concentrations had an impact on **reducing morbidity and mortality due to air pollution**?

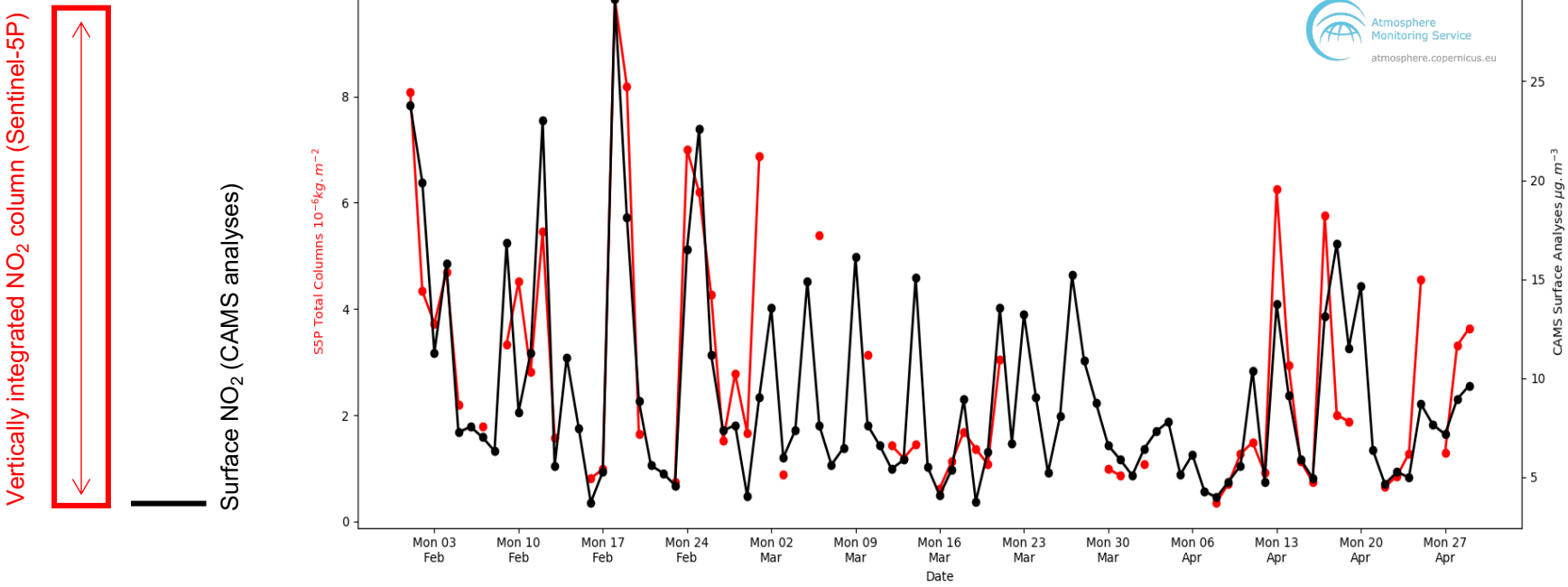
Extraordinary societal impact of “before/after” images of changes in concentrations

Copernicus Sentinel-5P / Tropomi NO_2 Total Column



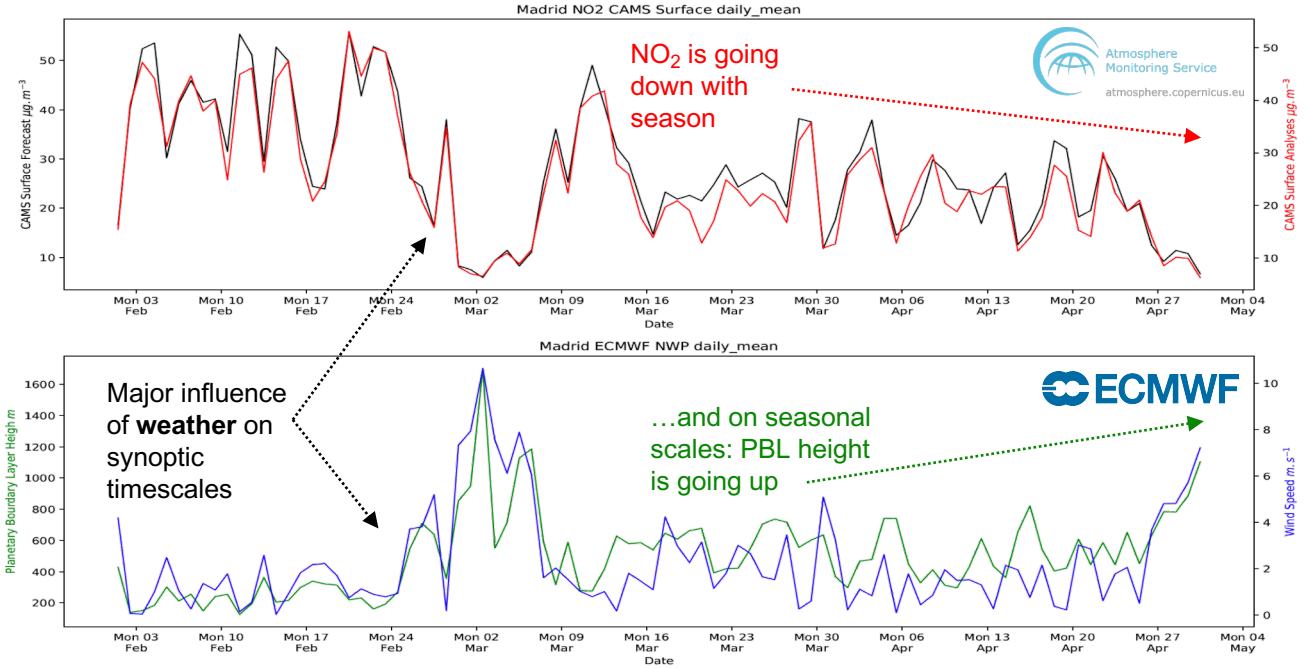


Another great thing: consistency of Sentinel-5P and CAMS analyses using surface observations (Europe)



Caution: all that goes down is not the effect of COVID-19 lockdown measures…

CAMS forecasts (business as usual emissions)

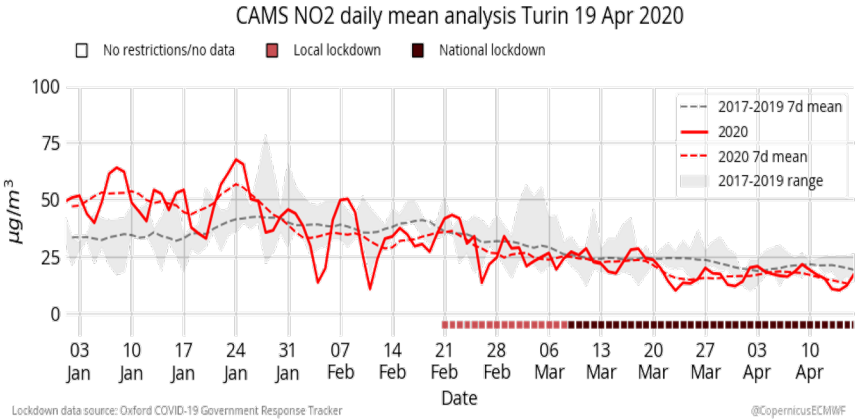


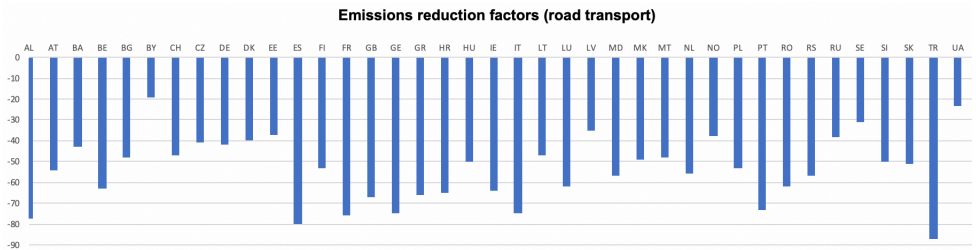
CAMS analyses (includes observations)

ECMWF Planetary Boundary layer height

ECMWF Wind speed

https://atmosphere.copernicus.eu/european-air-quality-information-support-covid-19-crisis





Providing resources to address this complex "changes" question in complementary ways:

- climatological anomalies (2020 vs 2019, 18…): **is this year different?**
- data assimilation increments (analysis vs control run): **what observations tell that is not in BAU models?**
- daily scenario runs (BAU emissions vs COVID emissions): **estimate emissions and run models to compute delta's**

Finally, we're working closely with the WMO/GAW community: ~100 teams active on these questions!

BIO

Carlo Buontempo is the Director of Copernicus Climate Change Service (C3S) at ECMWF. He coordinates the activities of a large number research teams working on the generation of climate data and its interface to decision and policy makers.

Carlo completed a PhD in physics at University of L'Aquila in 2004 then he moved to Canada for his post-doc before joining the Met Office.

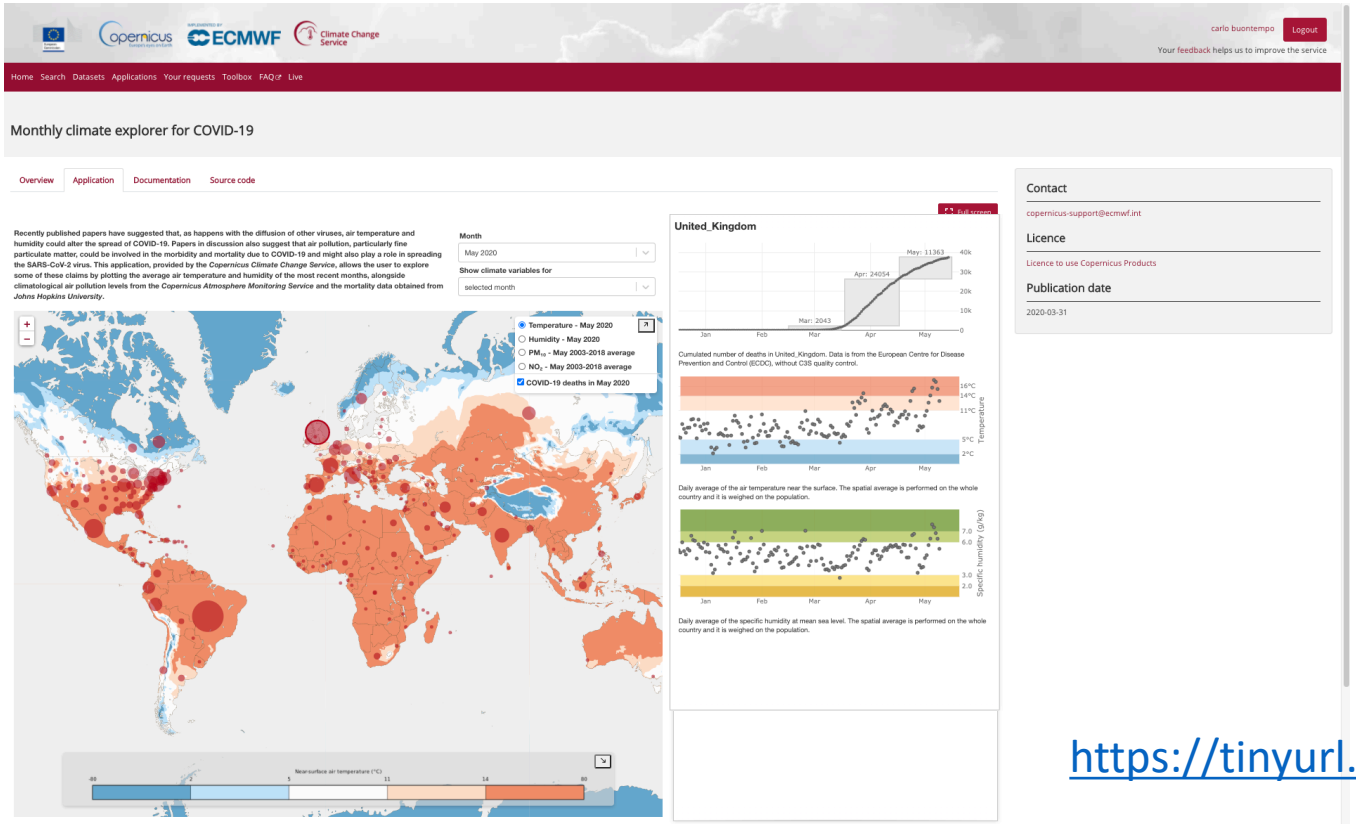
Carlo worked at the Hadley Centre (Met Office) for nearly a decade where he led the climate adaptation team and then the climate service development team. In this role he led numerous projects involving climate change adaptation and regional modelling in Europe, Africa, Asia and North America.

In 2012 Carlo became the scientific coordinator of EUPORIAS, and project funded by the European Commission through the 7th framework programme.

Dr. Carlo Buontempo
Director of Copernicus
Climate Change Service

The question under investigation:

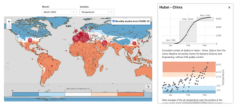
- Do environmental conditions (temperature and humidity) have an impact on COVID-19 transmission?



https://tinyurl.com/yd5bllvq

Monthly climate explorer for COVID-19

Overview | Application | Documentation | Source code



This application provides visualizations of data related to the COVID-19 virus spread along with climate information from the C3S Climate Data Store. An interactive world map shows time averages of air temperature and humidity over selectable predefined periods. Circles, representing the number of deaths related to COVID-19, are placed on regions where the virus has spread. Clicking on each circle, the time evolution of the number of fatalities in the corresponding region is shown, together with information on the local temperature and humidity for the selected period.

This application is inspired by a series of research studies exploring the diffusion efficiency of the COVID-19 and the Influenza virus in different atmospheric stable conditions (e.g., see Sajadi et al., 2020; Lowen et al., 2007; Tamerius et al., 2013). Given the novelty of the COVID-19 virus and the lack of confirmed relationships between the infection and the relevant climate variables, the application should only be considered as an exploratory tool.

For simplicity, the map shows meteorological variables averaged over the same periods which fatalities numbers refer to, without taking into account any delay between infection and eventual death. While the white regions in both the map and the time series correspond to the values identified in Sajadi et al. (2020) as the most favorable ones for the spread of the virus, the other ranges used for the color palettes have been chosen arbitrarily. The number of fatalities has been chosen as indicator for the virus spread given its robustness with respect to the other available data (number of confirmed cases and number of recovered patients). The values represented in the meteorological time series refer to single points located approximately at the center of each circle.

COVID-19 related data are provided by Johns Hopkins University Center for Systems Science and Engineering (JHU CSSE), and are available at the following GitHub repository. These are used in the application without any prior quality control by C3S. Meteorological data are from ERA5 reanalysis: hourly data on single levels and pressure levels and monthly averages on single levels and pressure levels.

The designations employed and the presentation of material on the map do not imply the expression of any opinion whatsoever on the part of the European Union concerning the legal status of any country, territory or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

List of user-selectable parameters

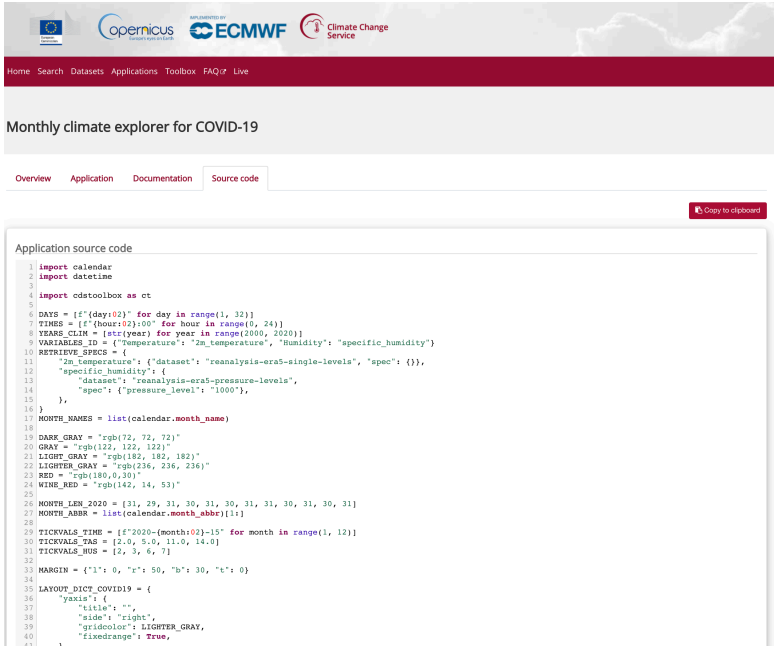
- Variable: temperature and humidity;
- Month;

Description of the graphical output

The application presents an interactive world map showing time averages of one variable, selectable via a drop-down menu, between air temperature and specific humidity. The averaging month can be selected: for months since the beginning of 2020, values for 2020 are shown; for the remaining months of the year, a climatological average (2000-2019) is presented. On the map, circles are placed in the centre of regions where the virus has spread; their size is proportional to the number of the deaths related to COVID-19 occurred in that region during the selected month. Clicking on a circle, a side window appears showing a plot of the daily time evolution of the local number of fatalities attributed to the virus, and plots of air temperature and specific humidity at a grid-point close to the centre of the circle, for the same time steps.

More details about the products are given in the Documentation section.

INPUT VARIABLES			
Name	Units	Description	Source
Daily cumulated number of deaths attributed to COVID-19 virus	Counts	Daily cumulated number of deaths attributed to COVID-19 virus	CSSEGISandData



Thank You!

Vincent-Henri Peuch & Carlo Buontempo / 15 June 2020
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#EO4Impact

Collaborate and communicate with GEO: