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The boost of environmental study on last decades

Dineva Snejana

Trakia University, Faculty of Technics and Technologies, Food Technology, Yambol, Bulgaria; e-mail: snezhana.dineva@trakia-uni.bg

Abstract

The lockdown of COVID-19 has many severe influences worldwide on different spheres of social life, including education, business, economics, and the environment. Many ecologists prior to the virus pandemic disaster had warned about the high crisis levels of air and water contamination and evidence of climate changes.Immediately, after the first month of social isolation with the decreasing transport intensity and the industrial emissions, the registered results were harmful components reducing in the atmosphere, as well as in the water. The pandemic situation boostcollaboration of scientists and researchers all over the world with the common goal to reduce the negative impact of that human tragedy.The experience that was gained giving hope that with the common efforts the humankind can find the proper way to put the effort in the right direction for its development. The paper introduces and reveals the new sources base on the big Data services gathering information from satellites that are useful for researchers and further education.

Keywords: *air and water quality, Earth observations, COVID-19*

Introduction

The last decade is remarkable with the enormous attention growth to climate change and urgency appeals addressed to global warming and the importance to combat with those impacts for the protection and survival of animal species, oceans, food supply, and public health (King et al 2015). The scientists from NASA and NOAA noticed that the last five years were warmest in recorded history (Ebbs 2019a). EPA administration mentioned that the quality of water and the ocean is even in a greater environmental crisis than climate change (Ebbs 2019b). Scientists from all over the world agree that actions to prevent the threatens from climate change must be immediately taken (King et al 2015). In relation to that, the boost of environmental observations and actions toward mitigation of climate change took place and escalation of social opinion supporting government engagements was registered (Ebbs 2019b). There are also registered a growing literature on environmental technology dispersal and policies that encouraging their use (Popp 2019). For example, the Trump admin invested $1.2B in oceans to support a "sustainable blue economy" and to slow down climate change (Finnegan & Ebbs 2019). Thus, the technology progress happening at a notable speed but still not fast enough to meet the 2˚C constraint (King et al 2015).

The Paris agreement has been adopted from almost every nation in the world, April 22, 2016 (Jacobo et al 2019), giving remarkable incitement toward the environmental observations and research, the full ecological effect is expected in 2020 (Andresen et al., 2016), that overlapping the COVID-19 pandemic effect on the environment.

Gathering data and decision making

Gathering data is an essential stage for science, policymakers, management, and economic well-being (https://www.ecoinformatics.org.au/our_data). Nowadays, huge information exist in collecting data from remote observations. Numerous web sites supply vast earth and biological data, available free for research and education. For instance, USGS is a science agency that

collects, monitors, analyses, and provides science about natural resource conditions, issues, and problems to decision-makers (https://www.usgs.gov/about/about-us/who-we-are).

The validation of computer simulations includes an assessment of the predictions, estimated as a probability and ability (Borrellia et al 2020). The data and information are accessible both spatially and geographically including The National Map, Earth Explorer, GloVIS, Landsat Look, and much more (https://www.usgs.gov/products/data-and-tools/gis-data). During the last decade, the environmental science research community, with the support of NSF settled various environmental observing systems, as EarthScope, the National Ecological Observatory Network, and the Oceans Observatory Initiative (Montgomery et al 2020).

The environmental data for consumers are accessible through the global internet search services. On fig.1 are represented Google searching inclinations for documents containing words “air pollution”, “water pollution” and “global warming”, which reflect social interest.

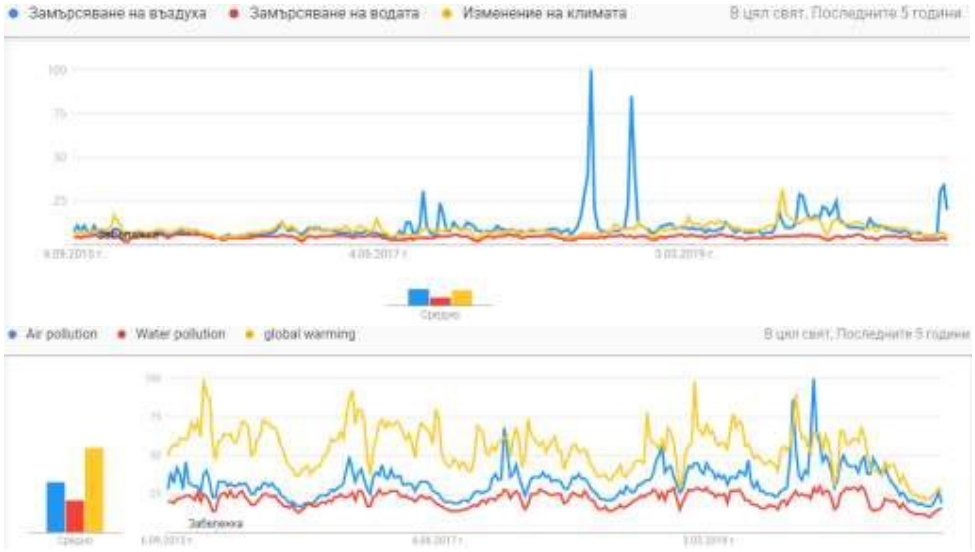

Figure 4Google trends in gathering information about “air pollution”, “water pollution” and “global warming”

According to Anderegg and Goldsmith (2014), tools such as Google Trends can be useful and with great value for assessment of public activities toward different subjects, as they are based on big data accumulation from observations and revealed the research interest and education efforts.

The last 5 years are remarkable with picks toward air pollution and global warming (fig.1). Cellphone data, satellite imagery, and news stories may complement Internet data to address some of the limitations for forecasting and to provide additional information for researchers (Del Valle 2020).

a. Covid-19 Earth Observation Dashboard

On June 25, 2020, "Covid-19 Earth Observation Dashboard" has been released as a collaboration between NASA (the US, National Aeronautics and Space Administration), ESA (European Space Agency), and JAXA (Japanese Aerospace Exploration Agency) to unveil the global consequences of Covid-19 (Gorey 2020; IANS 2020; India Education Diary 2020). That collaboration is a notable opportunity for researchers and educators, which with the help of

different economic, agriculture, and environment indicators, applying proper analytical tools can monitor air and water quality, climate changes, disasters, economic and agriculture activities by using current and historical data from satellites observations (Gorey 2020; IANS 2020). Moreover, that can directly reveal how the Covid-19 pandemic affects all areas of human life, and to serve as a tool for assessment of hypothesizes, to evaluate forecasting computer simulation models, to build and submit a proper prophesies for the future generation.

NASA and its partner space agencies have unique capabilities in different areas of science and technology. ESA contributed data from the Sentinel missions (Sentinel-1, Sentinel-2, and Sentinel-5P) in the context of the European Copernicus program with a focus on assessing the impact on climate change and greenhouse gases, as well as impacts on the economic sector. JAXA is making Earth-observing data available from its satellite missions, including ALOS-2, GOSAT, GOSAT-2, GCOM-C, GCOM-W, and GPM/DPR.

b. NASA's Earth science missionsand Space Apps COVID-19 Challenge

NASA uses airborne and ground-based monitoring, develops new ways to observe and study Earth, and shares this knowledge with the global community around the world that contribute to understanding and protecting the planet (Cole 2019).

The Space Apps COVID-19 Challenge is a special edition of NASA's annual Space Apps Challenge to examine the human and economic response to the virus. Since 2012, NASA organized every October online virtual meeting of specialists and innovators from all over the world, which have unordinary thinking and huge ideas willing to share with humanity. During a period of 48 hours, more than 15,000 participants from 150 countries created more than 2,000 virtual teams that by used Earth observations and other open data sets were proposed solutions to challenges related to the COVID-19 pandemic (https://covid19.spaceappschallenge.org; Cole et al 2020).

Space Apps 2019 included around 29,000 participants, and 225 events in 71 countries, more than 2,000 hackathon solutions were developed over one weekend (https://covid19.spaceappschallenge.org/). Space Apps 2016 had 26 challenges in the fields of Technology, Aeronautics, Space Station, Solar System, Earth, and Journey to Mars. The most popular challenges included creating a crowdsourced platform to compare environmental changes with symptoms of respiratory disease, building an educational app to help young students locate the moon, developing an app to support local drone operators (https://2017.spaceapps challenge.org/blog/nasas-international-space-apps-challenge-why-you-should-participate).

The next annual Space Apps Challenge is scheduled for October 2-4, 2020.

c. ESA and Copernicus- Global Monitoring for Environment and Security

Copernicus is a European Programme for Earth Observation for benefit of all European citizens. The Copernicus Services gather a huge amount of information for the Atmosphere; the Oceans; the Land; the Climate change; the Security; and Emergency.

Since July 2015, the Copernicus Atmosphere Monitoring Service (CAMS) provides continuous data in five main areas: air quality and atmospheric composition; ozone layer and ultra-violet radiation; emissions and surface fluxes; solar radiation; and climate forcing. In the context of the worldwide COVID-19 crisis, there was increased interest in changing air quality, and CAMS was continually monitoring air quality in Europe and around the world using satellite and ground-based observations and advanced numerical models (https://www.copernicus.eu/en/services/atmosphere).

The CAMS is a part of the Copernicus EU Programme managed by the European Commission (EC) and implemented in partnership with the Member States, the European Space Agency (ESA), and the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT),

the European Centre for Medium-Range Weather Forecasts (ECMWF), and the EU Agencies and Mercator Océan.

The Copernicus EU Programme is a set of European information services based on satellite Earth Observation and in-situ (non-space) data. CAMS monitoring and forecast systems, global and regional (Europe), combine information from detailed numerical models of the atmosphere with satellite and ground-based (in situ) observations through a process called data assimilation. The main aim of this approach is to combine the strengths of observations and models, and to minimise the weaknesses of the information sources.

CAMS provides estimates of climate forcings separately for carbon dioxide, methane, tropospheric ozone, stratospheric ozone, interactions between anthropogenic aerosols and radiation, and interactions between anthropogenic aerosols and clouds.

d. JAXA for Earth – Earth Data Collection by JAXA Satellites

JAXA monitoring area covers Global; Around Japan; Asia; and Polar Region, with research field of observation: Land; Ocean and Sea; Atmosphere; Forest; Forest fire; Earthquake; Tsunami; Volcano; Rainfall; Typhoon Hurricane and Cyclone; Flood; Landslide; Drought; Ice and Snow; Climate; Greenhouse gases. The applications vary, as Disaster; Infrastructure; Weather; Agriculture; Fishery; Logistics; Energy; Public health; Education; Design.

AMSR Earth Environment Viewer provides global observation images and data by Advanced Microwave Scanning Radiometer (AMSR) series on-board GCOM-W etc.,available in near-real-time, visualization and download with user customize. JAXA for Earth on COVID-19 monitors the earth's surface to detect the changes on global environment and human society that related to COVID-19. This site introduces the latest observation and analysis results.

G-Portal allows users to search and download products acquired by JAXA's Earth observation satellite. JAGMAP provides environmental data for agriculture observed by using JAXA earth observation satellites. JPMAP delivers environmental data for public health observed by using JAXA earth observation satellites. JASMES for water cycle provides the images on global water cycle observed by GCOM-W etc.

Environmental impact of COVID-19 isolation

e. Improved air and water quality

Greenhouse gases in the air as carbon dioxide and nitrogen oxide (NO_2) were the first registered obvious changes after first three months of quarantine,as nearly half the world was told,"stay at home" (fig.2).The new dashboard brings together current and historical for comparison air pollution datafrom two NASA and ESA satellites (Gorey 2020).

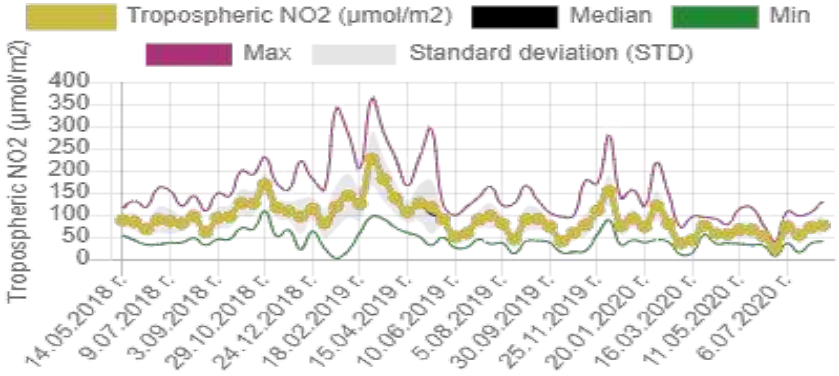

Figure 5Paris (TROPOMI), Air Quality

In Madrid, Milan, Rome, and Paris, for example, TROPOMI data show about a 50% reduction in NO2 from March 13-April 13, 2020 compared to the same months the year before. These reductions coincide with the implementation of strict quarantine measures across Europe. According to Le Quéré et al 2020, daily global CO_2 emissions decreased by –17% (–11 to –25% for ±1σ) by early April 2020 compared with the mean levels of 2019, and mostly from registered surface transport pattern changes, as well as, at their peak, the emissions in different countries reduced by –26% on average (Le Quéré et al 2020). Sulphur dioxide concentrations in India have been decreased by around 40% between April 2019 and April 2020, according to data from the Copernicus Sentinel-5P satellite (https://maps.s5p-pal.com/cases/).

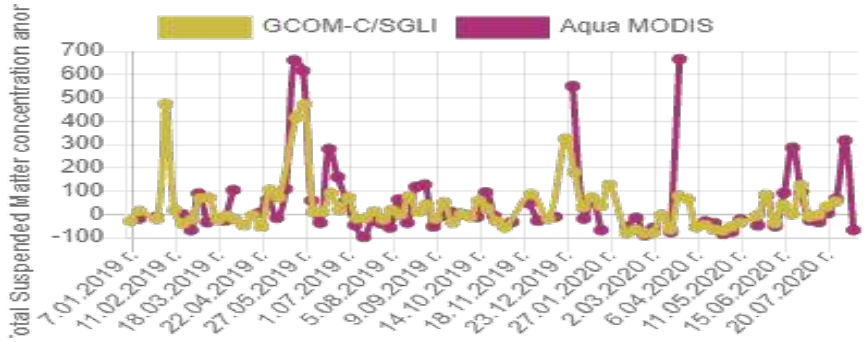

Figure 6 Total Suspended Matter concentration anomaly - Venice, TSM, Water Quality Time Series

The Water Quality Index (fig.3) are designed to assess the effect of the lockdown and the subsequent recovery on inland and coastal waters by monitoring the Total Suspended Matter concentration measured from optical sensors onboard the three agency's satellites, namely Sentinel-3 (ESA), GCOM-C (JAXA) and Aqua (NASA). Water quality changes are associated mainly with human activities, such as industry and tourism. The dashboard presents targeted satellite observations from all three agencies of total suspended matter and chlorophyll concentrations (Gorey 2020).

Conclusions

Humanity faced the global ecological crisis and many researchers alarmed that we are very close to the "point non-return". Many innovations and technologies took placed in education, collection of data, monitoring the ecological systems and in the decision-making process. Hence, the last decade those circumstances boost the environmental observations, executing the innovative technologies to diminish the consequences of long-scale improper use nature and arrogant politics.

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