Responses to Sli.do Questions

**Question: How will the lockdown effects be disentangled from the environmental effects on COVID-19 infection rates, recovery and mortality?** *(Susheel Unninayar)*

Answer: This is a tremendous challenge. In principle, with adequate data on policies, mobility, and social distancing guidance across time and across locations, as well as data on demographics, co-morbidities, and health system reporting and treatment practices, one can begin to separate out environmental effects. In practice, this has been difficult to do. As we accumulate data through lockdowns and reopenings around the world, and, crucially, as we get enough data to control for differences in testing rates and practices, the hope is that we will begin to find consistent patterns that reveal the character of environmental influence. We aren’t there yet.

*(responded by Ben Zaitchik)*

**Question: Given the massive engagement with different data sources and presentations related to COVID-19, what surprises have emerged related to public interest in the data?** *(Karl Benedict)*

Answer: Overall, the most surprising outcome for me has been the extent to which COVID-19 case data has captured the world’s imagination. Multiple dashboard apps (in addition to the Johns Hopkins University dashboard) have gone viral. Anecdotally, I have spoken with many people who check case data first thing when they awake in the morning and last thing before bed. We have an entire world of engaged consumers of data. Amazing!

*(responded by Este Geraghty)*

**Question: I saw the images of concentration of pollutants from remote sensing in Europe. Kudos! Do you have similar images for the Americas and for Africa? If so, where?** *(Lucia Lovison)*

Answer: Many thanks, Lucia! The images in our presentation are derived from the Sentinel-5P/Tropomi satellite instrument, which provide a global coverage of the areas that have no clouds (or very little cloudiness) at the time of overpass every day (13h30 Mean Local Solar Time). As it is the case for all Copernicus products, this is freely available.

You can start here (*https://apps.sentinel-hub.com/eo-browser/*) in order to visualise the observations: select “Sentinel-5P” among the data sources and you can then see the list of pollutants available; you can select a date or range of date and then “Search” to see the data on the map.

ESA has also made a simple tool for COVID-19, which only has NO\textsubscript{2} regarding air quality (but a range of other EO-based indicators): *https://race.esa.int/*. It provides maps similar to the ones that were shown, which are averages over a few weeks.

If you want to access the data itself and make your own plots for instance, you can go here (*https://scihub.copernicus.eu*) and look for “Sentinel-5P” or “S-5P” (there is an online user guide).
There are two main limitations to these “direct” satellite products regarding air quality: first, as already mentioned, the products are limited to cloud-free areas, so you need to accumulate data over at least 1 or 2 weeks if you want to see a “map with no gaps”; second, the products are a vertically integrated amount (column) and not a near-surface value, which is what people actually breathe. In the Copernicus programme, we also have Services and in particular the Copernicus Atmosphere Monitoring Service, which combines EO data and numerical models to provide full daily maps and estimates of surface concentrations (as well as forecasts up to 5 days in advance). You can look at these here: https://atmosphere.copernicus.eu/charts/cams/nitrogen-dioxide-forecasts?facets=undefined&time=2020061600,3,2020061603&projection=classical_global&layer_name=composition_no2_surface. The data is available from: https://confluence.ecmwf.int/display/CKB/Access+to+CAMS+global+forecast+data. In case of any issue, you can contact our user support team at: copernicus-support@ecmwf.int.
There are also links in our presentation to our COVID-related information webpages.

(responded by Vincent-Henri Peuch & Carlo Buontempo)

Question: Individual hydrometerological parameters have no clear influence on the COVID-19 pandemic. Do you know of any studies combining these data with other factors (e.g. number of hospital beds, pollution, people mobility)? (Ivan Petiteville, ESA)

Answer: It is essential to combine these types of data to get meaningful estimates of environmental sensitivity, and many researchers are attempting to do so. I hesitate to recommend specific studies, as most are not yet peer reviewed and I do not want to imply that one is right and others are wrong. But to offer some representative examples: Xu et al. (https://doi.org/10.1101/2020.05.05.20092627) and Carleton & Meng (https://doi.org/10.1101/2020.03.26.20044420) both attempt to control for non-environmental factors when estimating hydrometeorological sensitivity of COVID-19 transmission. The fact that these two manuscripts reach very different conclusions speaks to the difficulty of the problem and to its sensitivity to the choice of data and methods. A complementary set of studies test hydrometeorology hypotheses by running epidemic models fit to best estimates of COVID-19 characteristics, and then seeing how sensitive these simulations are to plausible formulations of hydrometeorological influence. Since the epidemic model already includes (implicitly or explicitly) many of the factors you are asking about, this approach can be considered a controlled estimate of hydrometeorological effects. An example of this method is Baker et al. (https://doi.org/10.1101/2020.04.03.20052787).

(responded by Ben Zaitchik)

Question: How has the unfortunate COVID-19 pandemic helped the GEO Health CoP and EO4Health Initiative help countries and custodian agencies use Earth observations for SDG Goal 3? (Lawrence Friedl, NASA)


(responded by Jorge Cabrera Hidalgo)
**Question:** Due to the COVID-19 pandemic, several organizations have collaborated to model the community impact. How can data accuracy and privacy be maintained? (Ari Cahyono, UGM)

**Answer:** Let me begin by addressing the data accuracy question. Overall, I strongly believe that data providers should ensure that proper metadata (in whatever form is appropriate) accompany their information products. While this does not speak to providing accurate data, it does speak to the responsibility to communicate the vital stats associated with a data resource, making sure consumers of the data are fully informed. To some extent, this could decrease the potential spread of inaccurate data. In the big picture of COVID-19, the question of data accuracy is complex. With a novel virus, much is unknown and sometimes assumptions must be made in modelling community impacts. Being transparent about those assumptions is vital to future credibility – especially if the assumptions need to change as the crisis evolves. Further efforts to maintain data accuracy should include making decisions about the required refresh cycle for data inputs and the geographic scale required for the question being asked.

Regarding the maintenance of privacy, I will focus on the geographic perspective for protected health information. First, if an organization has a right to view/use protected health information, then their trusted/approved agents should use the most granular level data for their own internal analysis (behind their firewalls and aligning with local laws). When that organization wants to share results, they should use cartographic techniques to obfuscate the data. Those may include heat maps or different aggregation methods (lat/long manipulation, adjacent polygon combining, tessellation) or blurring the data (by combining variables into larger categories – like 10-year age cohorts versus 5-year age cohorts). If one wants to display or share point data, it is possible to use geomasking techniques to move data points by a random distance, in a random direction, in a way that does not significantly alter spatial patterns. An Esri business partner, GISinc, has developed a tool called MapMasq that works as an extension to ArcGIS Pro and helps users to geomask or aggregate data in a way that makes the risk of re-identification very low. Here is their website (https://info.gisinc.com/mapmasq). If you would like more information about navigating health privacy in a geospatial world, please see my webinar here (https://www.youtube.com/watch?v=IZnvM0YoHSE).

(responded by Este Geraghty)

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**Questions Answered during the Live Session 1:**

- For aerosol optical thickness (AOT), presented by JAXA, how can we be sure that the change of aerosol is caused by the “lockdown”, not “natural sources” – especially since AOT contains both elements? (Linlu Mei, Uni-Bremen) (responded by Osamu Ochiai)
- How can the influence of seasonality be related to the growing number of COVID-19 cases in Brazil? (Monika Kuffer) (responded by Francois Engelbrecht)
• Really nice work from South Africa on seasonality impacts on COVID-19! Would the team be willing to work with West Africa (Ghana) to check the validity of the model? (Amos T. Kabo-bah, Ghana) (responded by Francois Engelbrecht)
• Which types of air quality Earth observation datasets can be used for COVID-19 research applications? (Linlu Mei, Uni-Bremen) (responded by Vincent-Henri Peuch & Carlo Buontempo)