IAF EARTH OBSERVATION SYMPOSIUM (B1)
Interactive Presentations - IAF EARTH OBSERVATION SYMPOSIUM (IP)

Author: Dr. Rochelle Velho
Space Generation Advisory Council (SGAC), United Kingdom, rockyvelho@gmail.com

Dr. Anthony S. Yuen
New York-Presbyterian Hospital / Weill Cornell Medical Center, United States, asl.yuen@gmail.com
Mr. Akash Karri
North Carolina State University, United States, akarri2001@gmail.com
Mr. Bruno Pavletić
DLR (German Aerospace Center), Germany, bruno.pavletic@gmail.com
Dr. Zhen Cahilog
Space Generation Advisory Council (SGAC), United Kingdom, z.cahilog@hotmail.co.uk
Ms. Eleonor Frost
University College London (UCL), United Kingdom, eleonor.frost.16@ucl.ac.uk
Mr. Devjoy Dev
United Kingdom, devjoy.dev@spacegeneration.org
Dr. Peter Ward
United Kingdom Space Biomedicine Association (UKSBA), United Kingdom, pdward@doctors.org.uk
Ms. Lauren Church
Kings College London, United Kingdom, l.e.church24@gmail.com
Dr. Saran Shantikumar
University of Warwick, United Kingdom, Saran.Shantikumar@warwick.ac.uk

AN EVALUATION OF EARTH OBSERVATION DATA AS A POTENTIAL TOOL TO FORECAST AND MANAGE RESOURCES DURING THE COVID-19 PANDEMIC

Abstract

Introduction

The Covid-19 pandemic needs no introduction. Facemasks, hand hygiene and social distancing were employed as key elements of the global public health strategy. Observational studies indicated that areas with increased social distancing measures correlated with a decrease in atmospheric air pollution markers, from Earth Observation (EO) data and therefore air pollution may act as a surrogate marker for population adherence to social distancing. The overall aim was to establish whether EO data could be used to predict the next outbreak of Covid-19.

Methods

Air pollution (Surface and EO datasets) was established as a surrogate marker for social distancing adherence (Google social mobility), using open-source data from 22 European capital cities between February 2020 to June 2020. The correlation between EO air pollution markers for social distancing were then mapped to C-19 cases after a 14-day lag time (r = 0.69). A machine-learning-based model was developed to predict Covid-19 incidence across all included capital cities with various time-delays to correct for the average incubation period of the illness.

Results

As a result of social mobility restrictions, the population in 22 European capital cities spent most of their time at home. The latter led to a continent-wide decrease in two surface air pollution markers (NO2,

CO); this pattern was also observed using EO data (ESA Sentinel-5 and NASA Aura). Surface and EO data also suggested that other pollutants increased with time at home (PM2.5, Total PM, UV).

Air pollution markers at Day 0 were then mapped to the incidence of C-19 after different lag times (Day 0 – 35 days). This was used to ascertain that Day 14 was the optimum lag time (R=0.69), which is in concordance with the C-19 incubation observed in clinical studies. An increase in NO2 concentration (ppm) resulted in a moderately significant increase in the incidence of C-19 cases at Day 14.

A pilot machine learning (ML) algorithm was trained using the data gathered to predict C-19 case incidence at Day 14 from EO air pollution NO2 data from Day 0.

Discussion

There are multiple confounding variables that influence Covid-19 case incidence, however air pollution markers (NO2, CO) were proven to be an indirect indicator of social immobility secondary to population wide public health interventions. We selected NO2 to predict future C-19 incidence across European cities after a 14-day lag time. We hope the lessons learnt from this ML model will enable both individuals and public health bodies to manage future infectious disease outbreaks prior to vaccination.