Public Health Agency of Canada | Agence de la santé publique du Canada

Canada

Epidemiological measures for COVID-19 and search for proxies to improve modelling and support public health surveillance tools development

Serge Olivier Kotchi, National Microbiology Laboratory, Public Health Agency of Canada
Mireille Bedirian, Canadian Space Agency

PROTECTING AND EMPOWERING CANADIANS
TO IMPROVE THEIR HEALTH

Epidemiological measures for COVID-19 and search for proxies to improve modelling and support public health surveillance tools development

- **Direct metrics**
  - Number of cases (confirmed, resolved, new cases);
  - Number of persons tested daily, number of tests;
  - Number of deaths;
  - Source of exposition (international travel, local acquisition);
  - Number of hospitalizations and ICU admission;
  - Hospital bed and ICU occupancy;
  - Critical care utilization (e.g. PPE and ventilator usage);
- **Environmental factors that could influence the spread of COVID-19**
  - Climate and weather conditions (temperature, humidity, wind, precipitation, etc.);
  - Air quality (aerosol optical depth, PM10 and PM2.5 concentrations, NO2 concentrations, O3 concentrations, UV radiation, etc.);
- **In-situ measurements of the presence of the virus in the environment**
  - Presence of the virus in the air;
  - Presence of the virus in water (e.g. sewer);
- **Indirect measures of the population's degree of adherence to confinement measures**
  - Cell Phone Geolocation;
  - Seismic noise;
  - Vehicle Traffic Data and density;
  - Air Quality and green house gas emissions;
  - Hydroelectric power consumption load profiles;
  - Petroleum consumption;
  - Public transportation ridership;
  - Radiance of night-time illumination ;
  - High Resolution Imagery (visible/IR);
- **Stringency Index of government measures**

Environnement et Changement climatique Canada | Environment and Climate Change Canada

COVID-19 IMPACT ON AIR QUALITY - HIGHLIGHTS FOR GEO HEALTH COP

TROPOMI analysis by Chris McLinden and Debora Griffin

Canada

ASSESSING THE COVID IMPACT OF NO2 IN CANADA – AQRD APPROACH

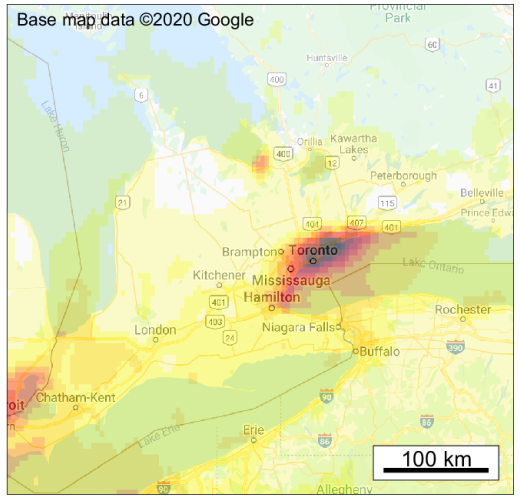
1. Improve the original TROPOMI (Tropospheric Monitoring Instrument) NO_2 data product using algorithms developed at ECCC to better account for spatial gradients and snow cover
2. Compare pre-COVID and COVID periods (i.e., Feb. 16-March 15 2020 vs. March 16-April 30 2020)
3. Use the GEM-MACH operational air quality forecast model output in exactly the same way as TROPOMI measurements in order to determine the expected distribution, which can be compared with the observed

→ This will account for natural meteorological variability and seasonal effects (both in meteorology and emissions)

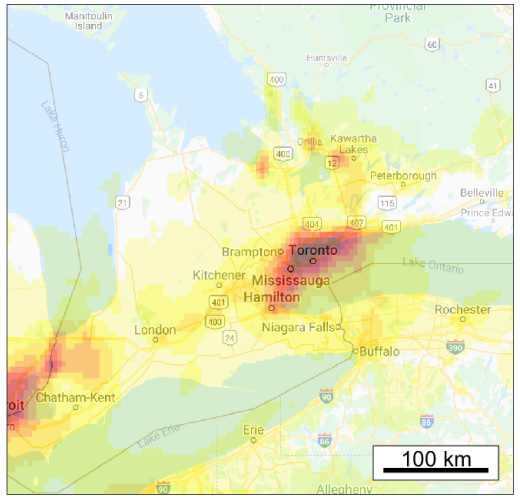
Posted to twitter https://twitter.com/MclindenChris

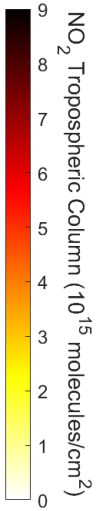
TROPOMI – GEM-MACH – pre lockdown – excellent agreement

TROPOMI Pre-lockdown



GEM-MACH Pre-lockdown

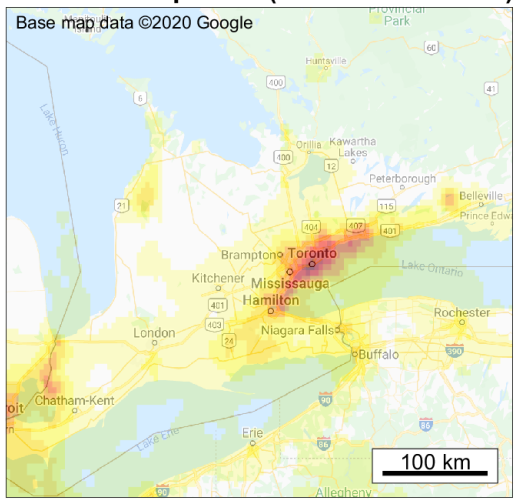




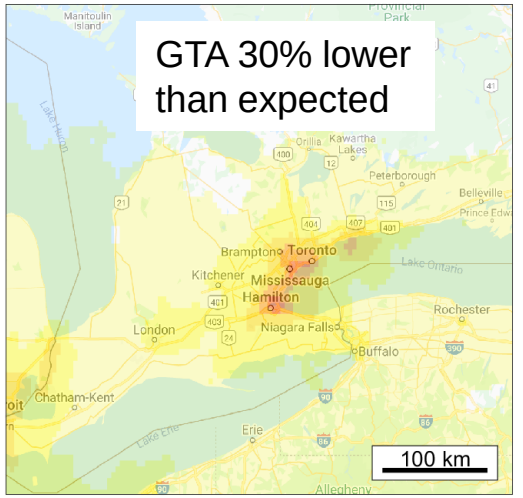
Expected – Observed comparisons

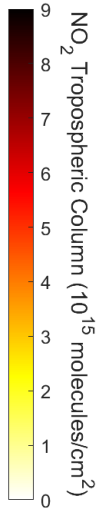
16 March to 30 April

TROPOMI Expected (as if no lockdown)

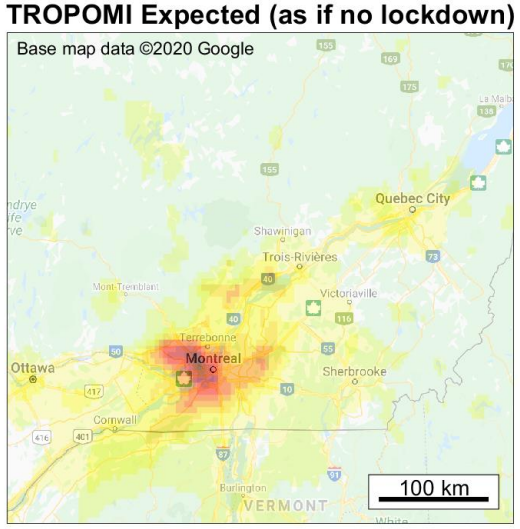


TROPOMI Observed

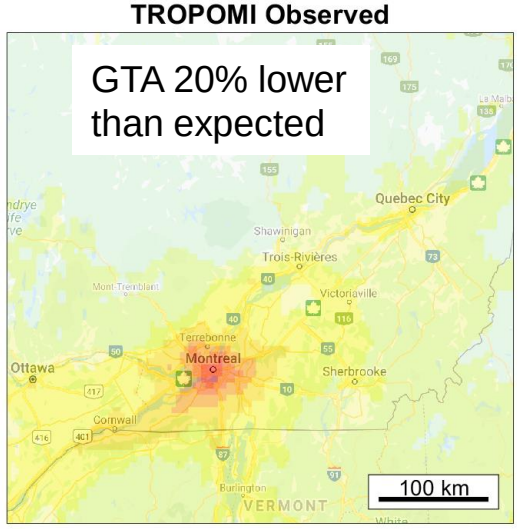


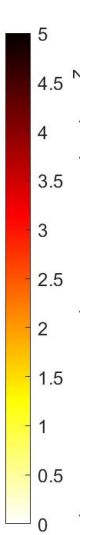


TROPOMI Expected (as if no lockdown)

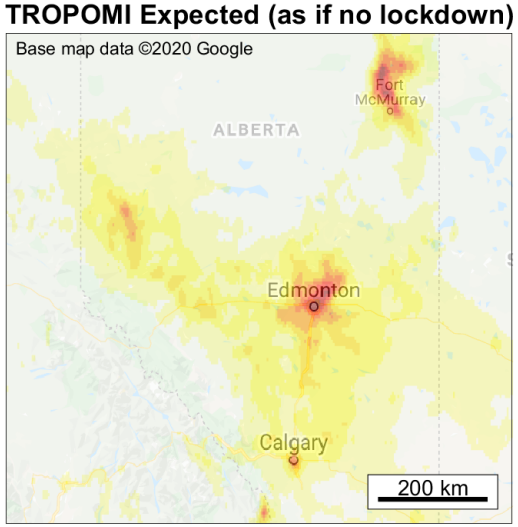


TROPOMI Observed

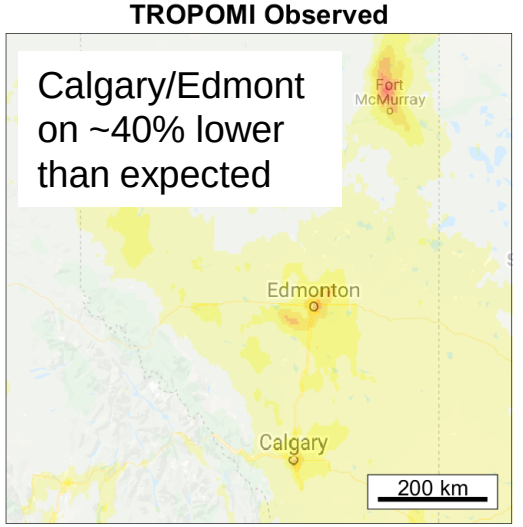


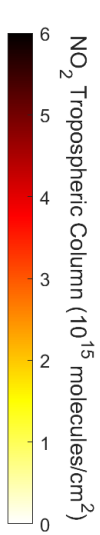


TROPOMI Expected (as if no lockdown)



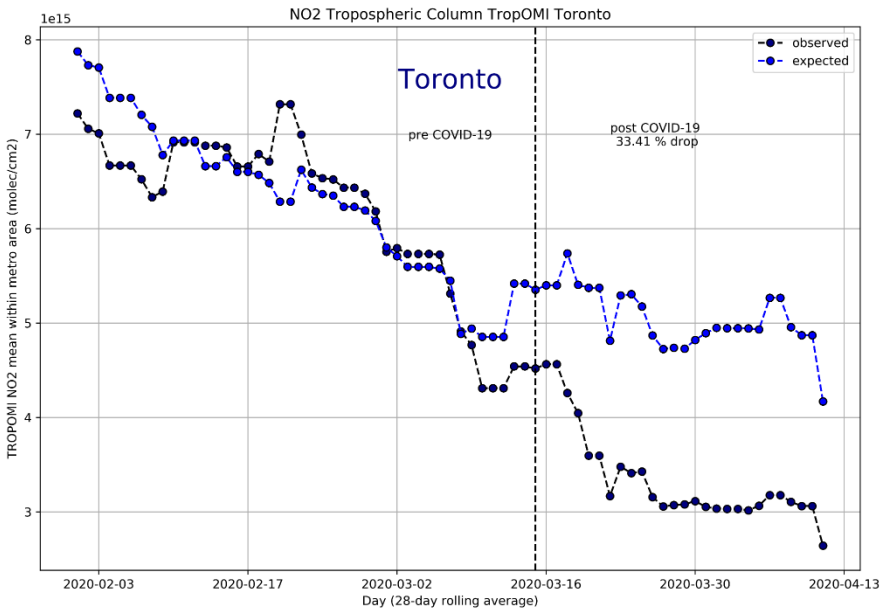
TROPOMI Observed





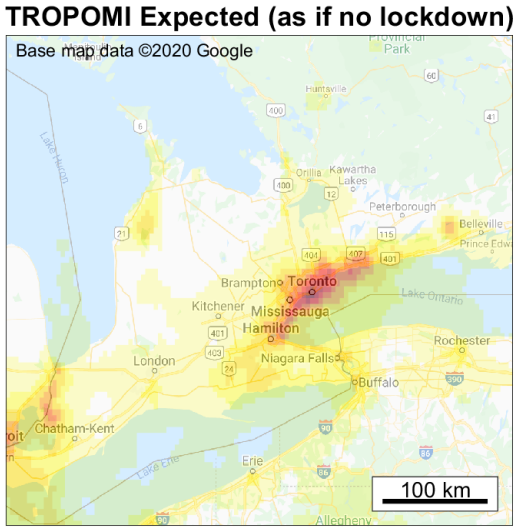
To confirm the method works, the same procedure was applied to 2019, where ‘expected’ and ‘observed’ should be the same, and indeed they are in close agreement

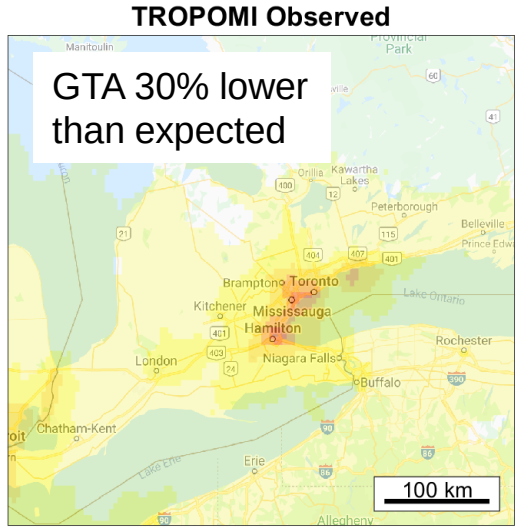
We are also looking at time series of expected and observed. Here we are using a 28 day running aver

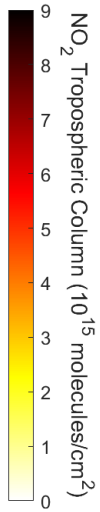


16 March to 30 April

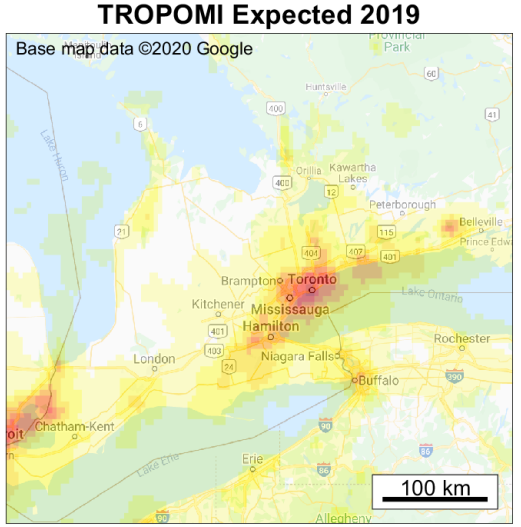
2020

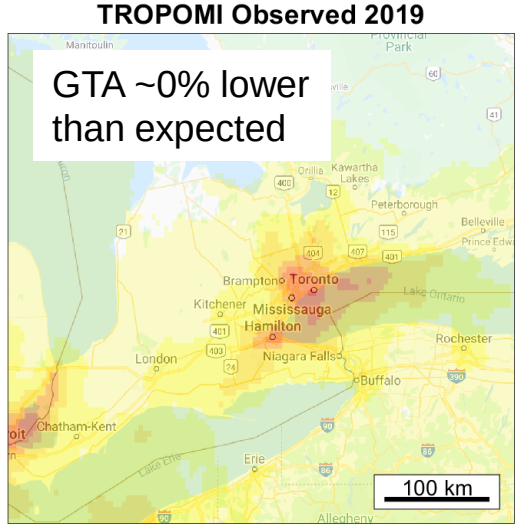


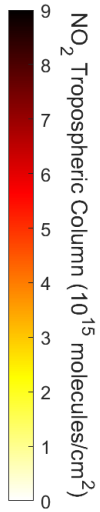




2019







ASSESSING THE COVID IMPACT OF NO2 IN CANADA – AQRD APPROACH

$$TROPOMI(Expected) = TROPOMI(pre\text{-}covid) \times [1 + \Delta_{GEM\text{-}MACH}]$$

where

$$\Delta_{GEM\text{-}MACH} = [\, GEM\text{-}MACH(covid) - GEM\text{-}MACH(precovid) \,] \,/\, GEM\text{-}MACH(precovid)\,]$$

In essence GEM-MACH is used to project the pre-covid observations forward in time assuming standard emissions scenarios