# SENSITIVITY ANALYSIS OF NOx EMISSION ESTIMATES

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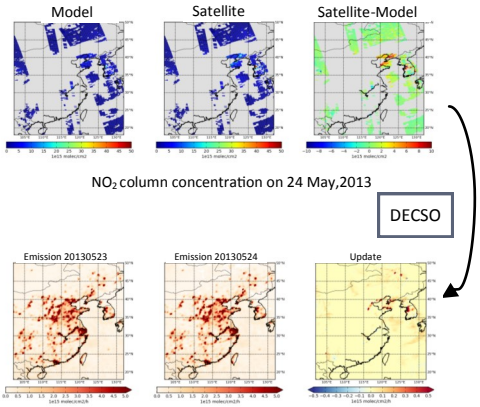
**Abstract:** To study the sensitivity of the emission estimates algorithm DECSO to the type of model, we implemented two versions of CHIMERE, V2013 and V2006, in DECSO using OMI satellite observations from January 2013 to August 2014. We have also run DECSO with GOME2 satellite observations for the same period to check the sensitivity of DECSO to satellite observations. The comparisons of model results with measurements indicate that CHIMERE V2013 is better performing than CHIMERE V2006. The $NO_X$ emission estimates with OMI can detect more and smaller emission spots than GOME2.

## Introduction

KNMI has developed the Daily Emission estimates Constrained by Satellite Observations (DECSO) algorithm (Mijling and van der A, 2012) for NOx emissions.

**DECSO**

- A chemical transport model
- Satellite observations of $NO_2$ concentrations
- Inversion method based on extended Kalman filter



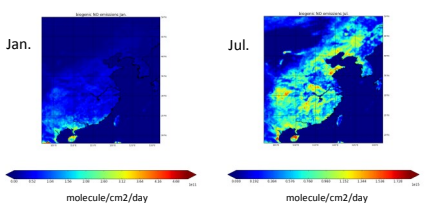

In this research, we study the performance of different models used in the DECSO algorithm.

Two models:

→ CHIMERE v2006: Validated by Mijling et al. (2009)

→ CHIMERE v2013: Biogenic emissions, new transport schemes, secondary organic aerosol chemistry, updated chemical reaction rates (Menut et al., 2013)

Biogenic NO emission in CHIMEREv2013




## Methods

### $NO_2$ satellite observations:

OMI:

- overpass time: 13:30 local time
- spatial resolution: 24x13 $km^2$ in nadir till 64x14 $km^2$ at the end of the swath

GOME2-B:

- overpass time: 9:30 local time
- spatial resolution: 80x40 $km^2$

### Ground observations

Hourly observations at Tianjin (aqicn.org) of July and August 2014

### Emission estimates of $NO_x$

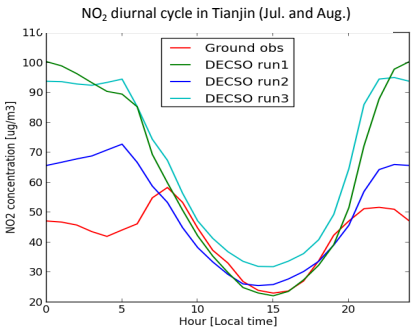
DECSO runs:

1) DECSO with CHIMERE v2006 and OMI
2) DECSO with CHMIERE v2013 and OMI
3) DECSO with CHIMERE v2013 and GOME2-B

Time period: Jan. 2013 to Sep. 2014

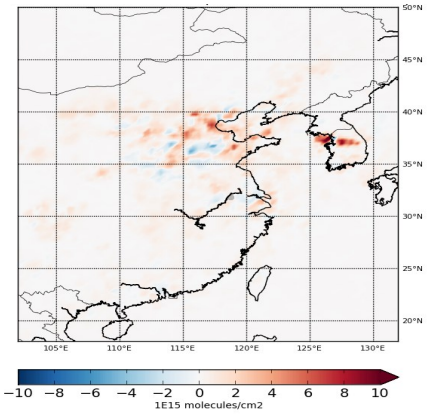
MEIC emission inventory is the starting point for DECSO. The first four months of DESCO results are spin-up time.

## Results

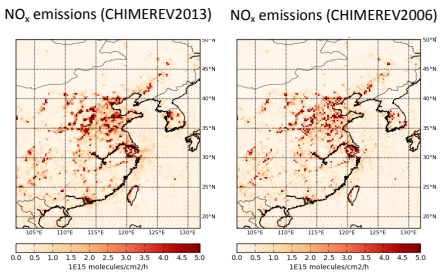



CHIMERE v2013 gives better results during night time.

Difference of RMS OmF in 2013 summer
(CHIMEREV2006—CHIMERE V2013)

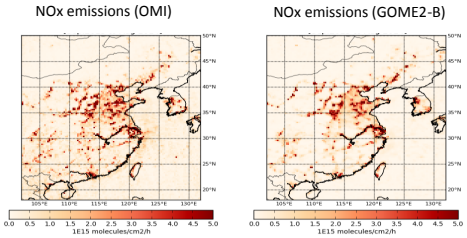



A lower RMS OmF (Root Mean Square of Observation minus Forecast) of CHIMERE v2013 (red color) means that $NO_2$ column concentration simulated by CHIMERE v2013 is closer to the satellite observations than CHIMERE v2006.




Average $NO_x$ emissions from Aug.2013 to Jul. 2014

The estimated $NO_X$ emissions of DECSO with CHIMERE v2013 on average are **14% higher** than the results with CHIMERE v2006.




DECSO with OMI can distinguish more details in the emission spots.

**Main references:**

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