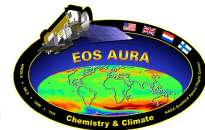




# Observing & Understanding Inform Mitigation Policy

## Aura's Ozone Monitoring Instrument (OMI) & Microwave Limb Sounder (MLS)



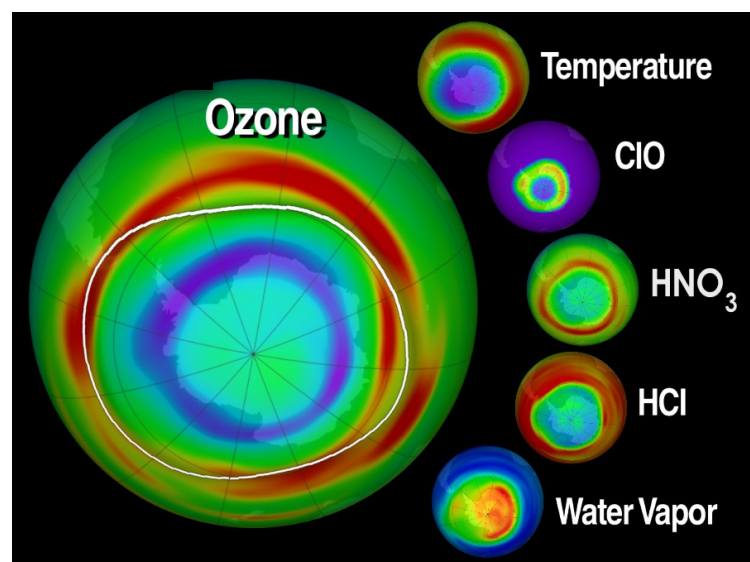
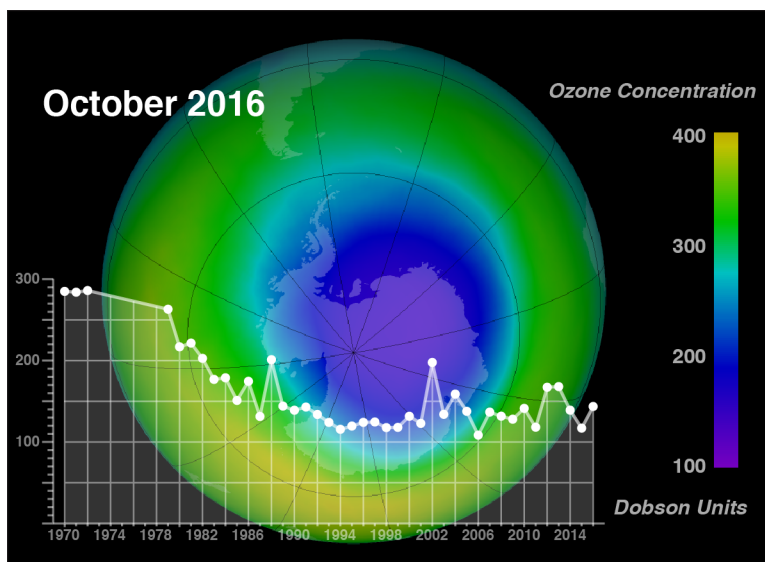
### NASA Data & Research Informing Policy Decisions:

The success of the **Montreal Protocol**, an international treaty designed to protect the ozone layer, is emerging in NASA satellite data. The size and depth of the ozone hole have stabilized. Important questions remaining: When will it begin to recover? Will it recover fully to pre-1970 levels? Time will tell.

**Observing:** Aura/OMI continues to observe stratospheric ozone, a record begun in 1970 with Nimbus-4/Backscatter Ultraviolet (BUV).



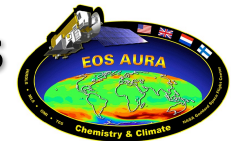
**Understanding:** Aura/MLS makes vital contributions to our understanding of the chemical & dynamical processes that affect the stratospheric ozone layer. Many of the MLS products are now unique with the loss of ESA's Envisat in 2012.



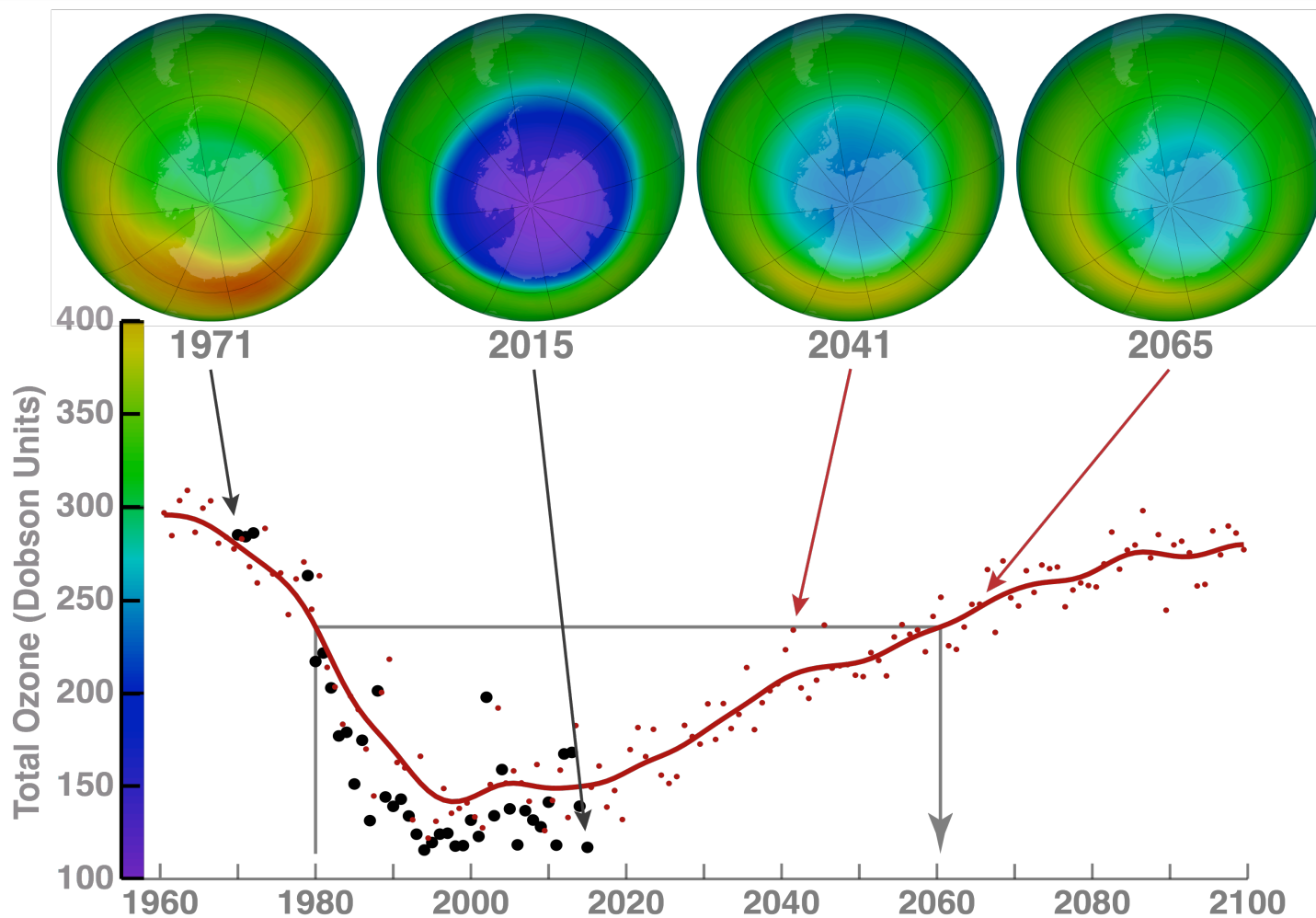


# NASA Satellite Data & Research Inform Predictive Models

## *A Process-Based Understanding of the Ozone Hole Phenomenon*



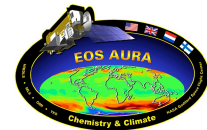
**NASA Data & Research Enable Prediction:** NASA satellites, such as Aura's Ozone Monitoring Instrument (OMI) & Microwave Limb Sounder (MLS), monitor the health of the Earth's ozone layer and provide insight into the complex chemistry and dynamics that influence it. This understanding allows for the development of models, which predict the Antarctic ozone hole will recover in the latter half of this century.





# Unprecedented Detail in Air Pollution Changes Revealed by Aura's Ozone Monitoring Instrument (OMI) Nitrogen Dioxide ( $\text{NO}_2$ ) Data

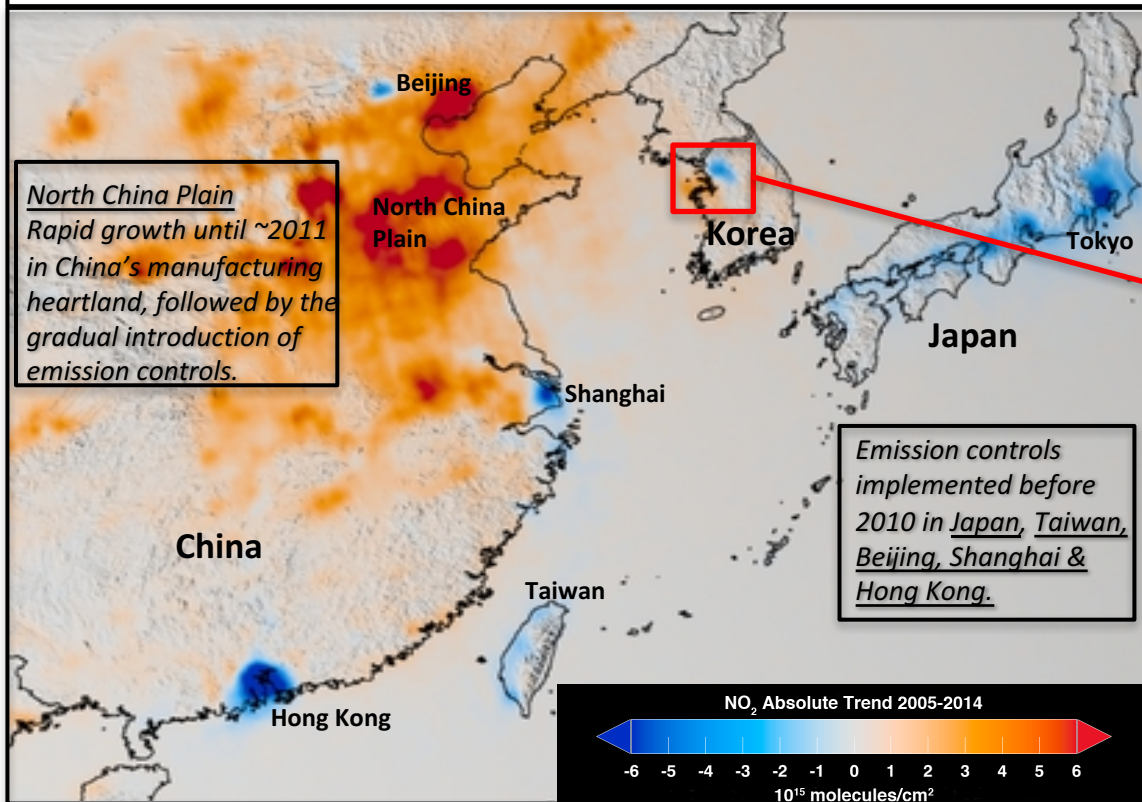
## *Sub-Urban to Global Scales*



The world shows intriguing spatial heterogeneity and changes from 2005 to 2014 in  $\text{NO}_2$ , a common pollutant from power plants and automobiles.

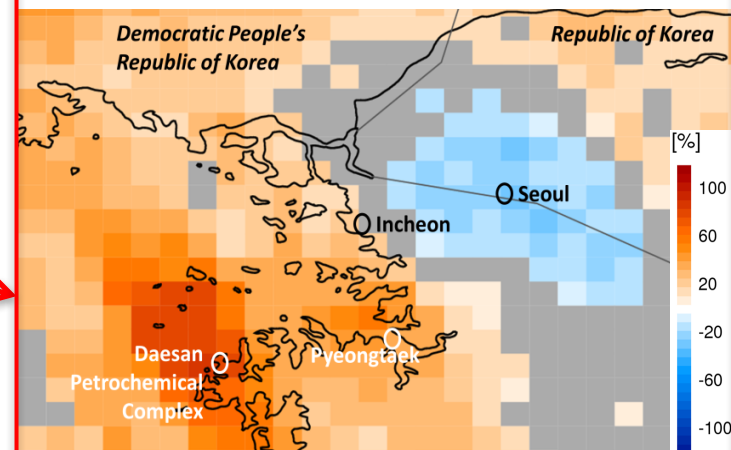
### **East Asia**

**Change in  $\text{NO}_2$  Levels from 2005 to 2014**



### **Seoul Megacity**

**% Change in  $\text{NO}_2$  Levels from 2005 to 2014**

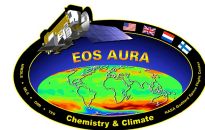


Duncan, B.N., et al., A space-based, high-resolution view of notable changes in urban  $\text{NO}_x$  pollution around the world (2005-2014), J. Geophys. Res., doi:10.1002/2015JD024121, 2016.

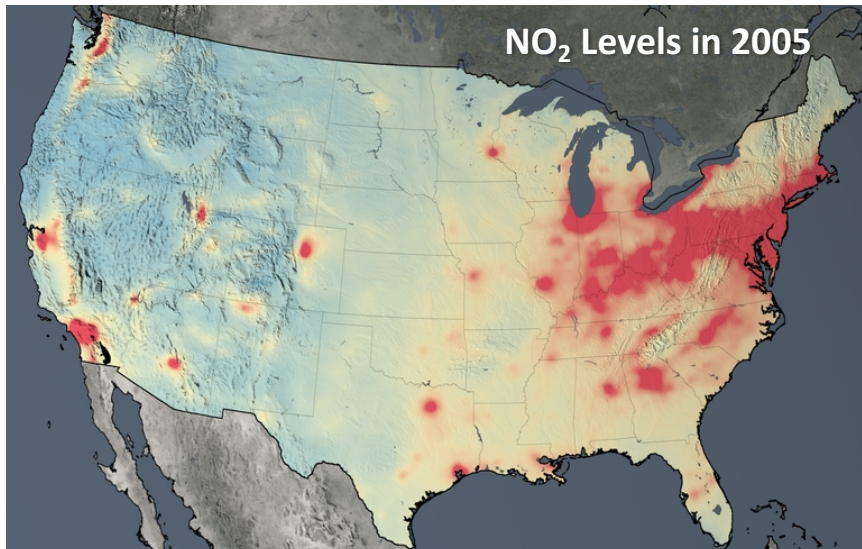




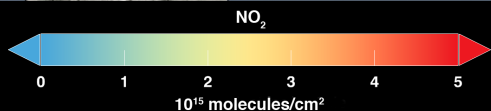
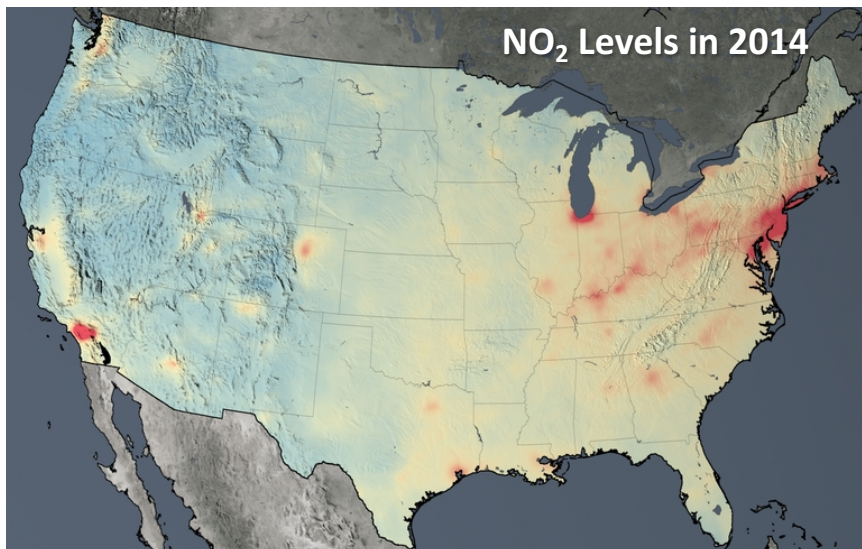
# Aura's Ozone Monitoring Instrument (OMI) Nitrogen Dioxide ( $\text{NO}_2$ ) Data Show the Clean Air Act is Working!



$\text{NO}_2$  Levels in 2005



$\text{NO}_2$  Levels in 2014



$\text{NO}_2$  is a common pollutant from power plants & automobiles. It damages ecosystems via acid deposition & eutrophication and is a precursor to atmospheric particulates & ozone, which damage our lungs. Ozone also affects plants, such as reducing crop yields. Pollutant emission controls have led to a dramatic reduction in  $\text{NO}_2$  (20-60%) and, subsequently, ozone (~15%) over the US from 2005 to 2014.

Explains How Pollution Affects Our Planet



On April 12, 2016, President Obama used OMI  $\text{NO}_2$  data to explain how pollution affects our planet:  
<https://www.youtube.com/watch?v=LKe5FdKInJs>

Lamsal, L.N., et al., *U.S.  $\text{NO}_2$  trends (2005-2013): EPA Air Quality System (AQS) data versus improved observations from the Ozone Monitoring Instrument (OMI)*, Atmos. Environ., doi:10.1016/j.atmosenv.2015.03.055, 2015.