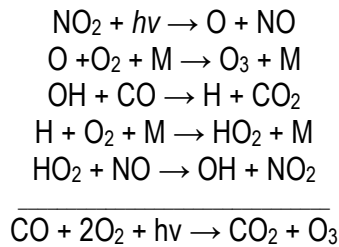


## The Effects of Lightning on Atmospheric Chemistry

- Approximately 77 million lightning bolts strike the U.S. annually
- Measurements show lightning generates Nitrous Oxides (NO<sub>x</sub>) as well as PAN, and HNO<sub>3</sub> in the atmosphere. NO<sub>x</sub> is a catalyst for creating Ozone:



- PAN and HNO<sub>3</sub> are nitrogen reservoir species. HNO<sub>3</sub> consists of ~60-80% of the total increase in nitrogen species concentration due to lightning and is affected the most. PAN is ~20-30% of the nitrogen enhancement.
  - These species can move through the free troposphere and create NO<sub>x</sub> away from the lightning source
- NO<sub>x</sub> reacts with OH to form HNO<sub>3</sub> and directly affects the oxidizing capability of the atmosphere

The amount of NO<sub>x</sub> produced by lightning differs depending on where you look:

- **Book:** "lightning appears to be responsible for less than 10 % of the total NO<sub>x</sub> budget" pg 105
- **NASA:** during the summer months, lightning activity increases NO<sub>x</sub> by as much as 90 percent and ozone by more than 30 percent
  - over the United States lightning accounts for only about 5 percent of the total U.S. nitrogen oxide annual emissions and about 14 percent of the total emissions in July
- **Atm Chem Phys Discuss:** Recent global estimates of NO<sub>x</sub> production from lightning vary from 1 to 20 Tg (N)/yr though 5±3 Tg N/yr is applied in most global modeling (Tg = 1 million metric tonnes)

Lightning different from anthropogenic NO<sub>x</sub> emissions:

- Anthro: emissions released close to surface, undergoes chemical reactions before being transported up
- Lightning: directly releases NO<sub>x</sub> to the free troposphere