FIELD PROJECT FACT SHEET #4
DC3 :: Deep Convective Clouds and Chemistry

SCIENCE MISSION

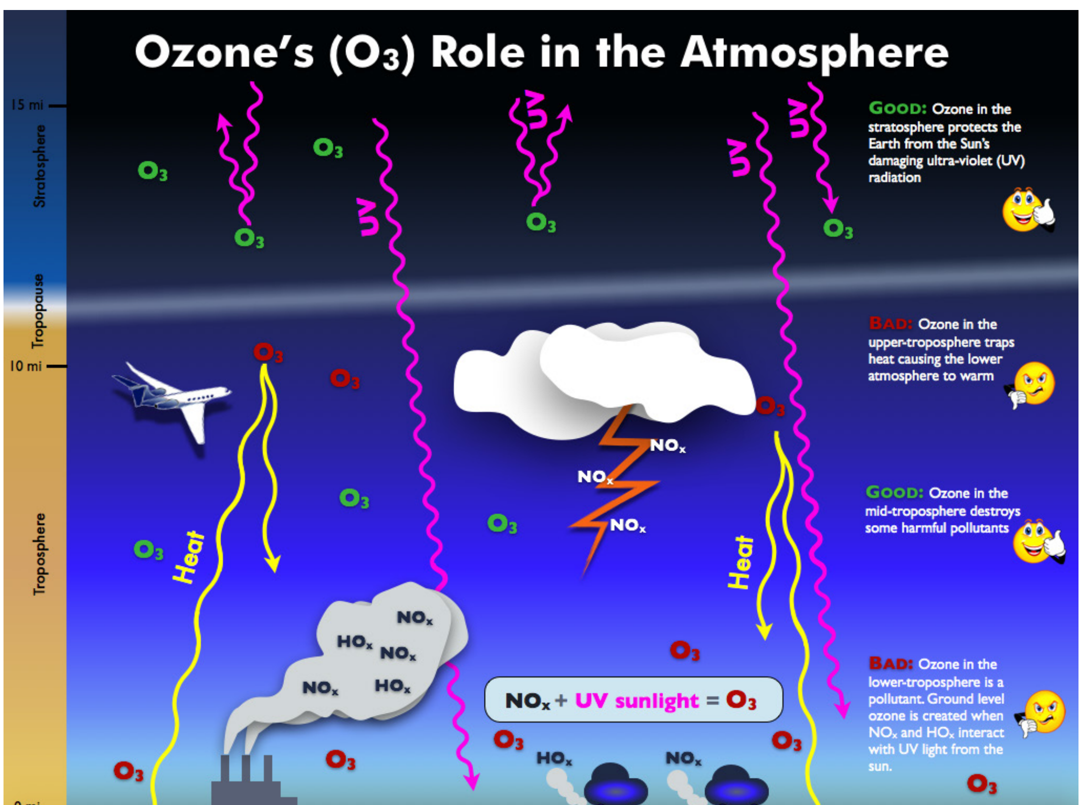
Studying the influence of thunderstorms on air just beneath the stratosphere, a region high in our atmosphere that influences both Earth's climate and weather patterns.

The high quantities of upper tropospheric pollution, a direct result of the increased quantities of low laying pollution produced from biomass burning, has effects on cloud production and upper tropospheric heat trapping gasses, resulting in changes in climate and weather around the globe.

ABOUT DC3

The Deep Convective Clouds and Chemistry (DC3) field campaign is investigating the impact of large-scale thunderstorms on upper tropospheric composition and chemistry. The DC3 field project will make use of extensively instrumented aircraft platforms and ground-based observations.

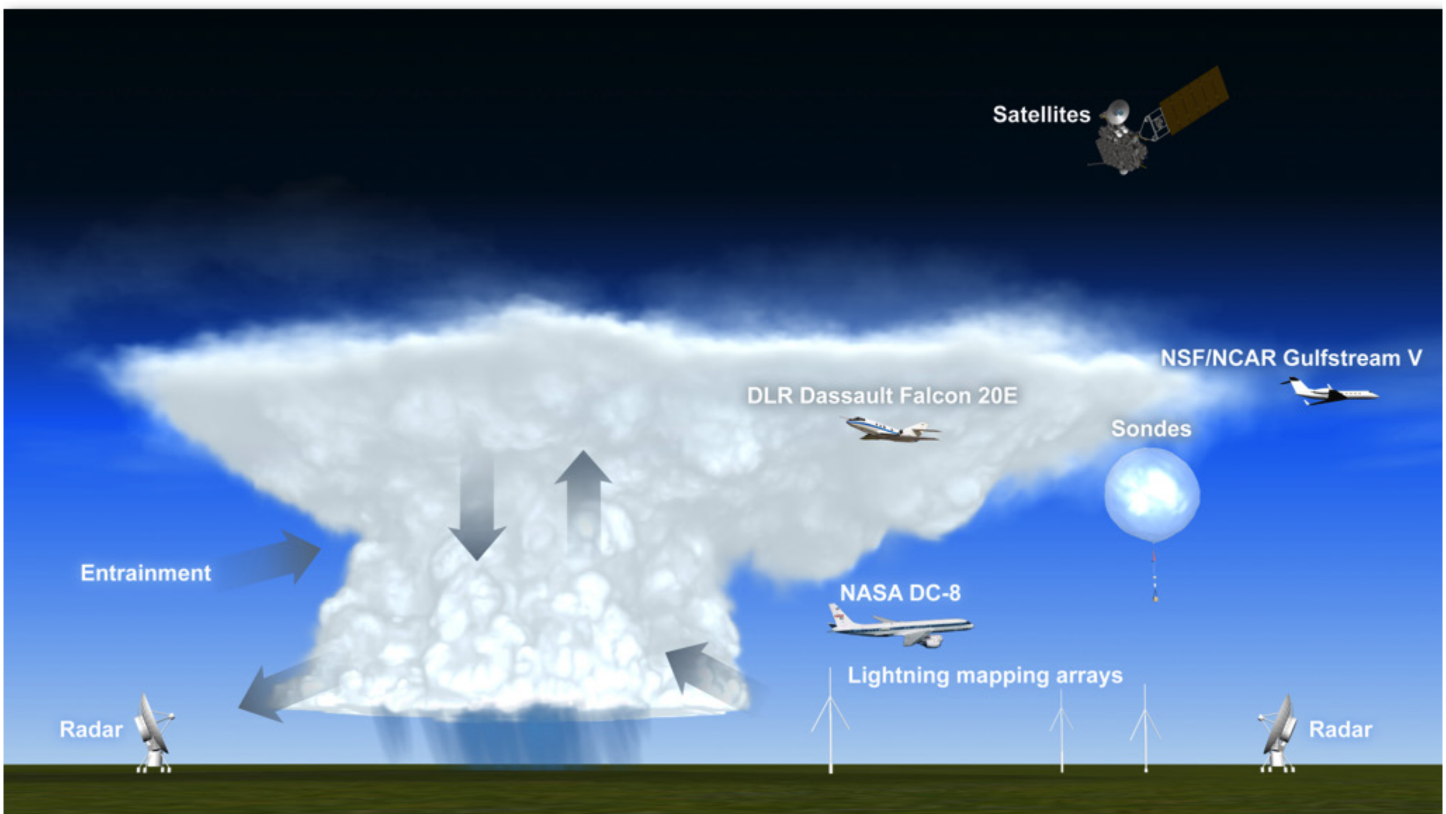
Thunderstorms are convective clouds that form when warm moist air from near the surface of the Earth, heats up and rises. When the air mass rises, it acts like a giant vacuum cleaner "sucking up" chemicals and pollution, most of which were generated my combustion (i.e., vehicles and factories) and biomass burning. The transported chemicals react with sunlight and lightning to produce ozone and other heat trapping gasses, altering temperature and cloud production high in the troposphere.



MORE ABOUT DC3

A Low-flying Research Aircraft would sample air as it was drawn up into the storm cloud, to see what chemical went into the storm. The High-flying Research Aircraft flew at the tail end of the storm to see what chemicals were coming out of the storm. Many chemical reactions and changes happen to the chemicals that were first drawn up into the cloud. Ground based radars and weather balloon would research the same storm from the ground. The objective was to research and observe the targeted storm from as many angels as possible with several types of equipment.

Low level pollutants get “sucked-up” by convective clouds...



...then react with sunlight to produce ozone.

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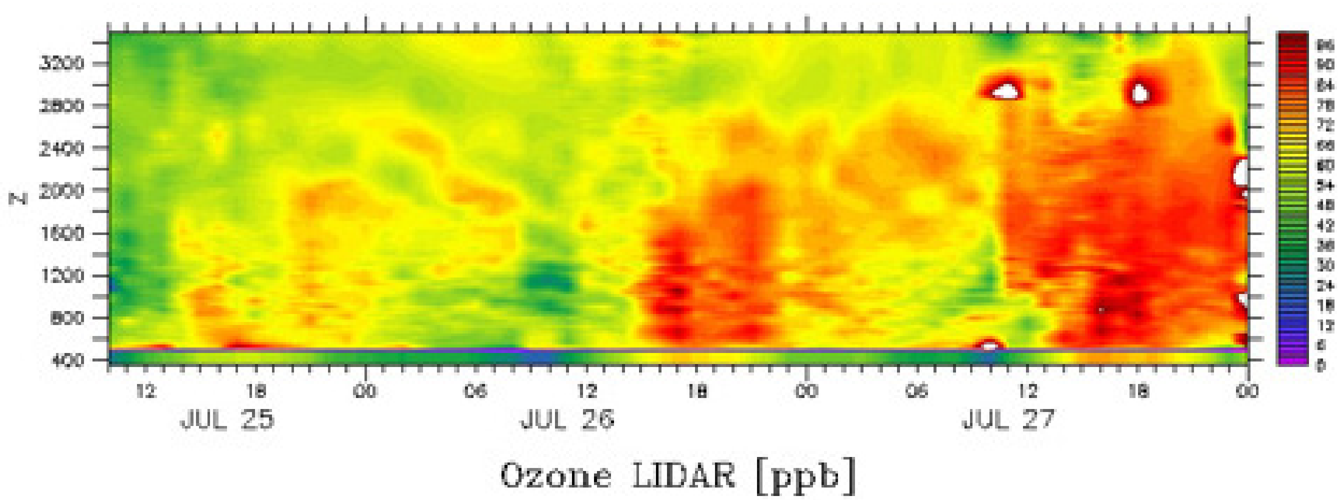
INSTRUMENTS & PLATFORMS

- Low-flying Research Aircraft
- High-flying Research Aircraft
- Research Truck
- Greenhouse Gas Sensors
- Fixed Ground-based Radar
- Truck-mounted Radar
- Weather Balloon
- Lightning Mapping Array

SAMPLE DATA FROM DC3



Ozone data from an aircraft-mounted lidar show daily fluctuations over a three-day period. (24-hour time scale; 00 = 12:00am; 06 = 6:00am; 12 = 12:00pm; 18 = 6:00pm). The y-axis is altitude in meters; the x-axis is time. Ozone is produced by engine emissions mixing with sunlight. Red represents high concentration of ozone in parts per billion (ppb), green represents low concentrations, and white represents missing data.

Data Discussion Questions:

1. What time of day are ozone concentrations the highest?
2. At what altitudes are ozone concentration the highest and why do you think that is?
3. Why are ozone levels low at night?

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RESEARCH SUMMARY OF DC3

DC3 flew 19 coordinated flights with the High-flying and Low-flying Research Aircraft, and the ground based research equipment around 15 active thunderstorms over the mid-Western Plains of the U.S., during the June - July 2012. These data will provide scientists valuable information about greenhouse gases affect the chemical composition of the troposphere, and apply the data to weather. It will take several years to analyze all of the data and integrate them into weather and climate models.

It can take up to five to ten years to organize, analyze, and examine the relationships, patterns, trends, etc of these millions of data points that are collected during this huge field project. Scientists are still in the process of analyzing the data from this research project.