

THE EFFECT OF NITROGEN OXIDE
EMISSIONS FROM AUTOMOBILE
TRAFFIC ON THE CONCENTRATION
OF TROPOSPHERIC OZONE IN THE
GREAT SMOKY MOUNTAINS
NATIONAL PARK

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A lush, green forest scene featuring a dirt path that winds through the trees. The ground is heavily covered in vibrant green moss, particularly on large, rounded rocks and tree stumps. The trees are tall and thin, with some evergreens and some bare deciduous trees. The lighting is soft and dappled, creating a serene and natural atmosphere. The text "THE PROJECT" is overlaid in the center of the image in a white, sans-serif font with a slight shadow effect.

THE PROJECT

GREAT SMOKEY MOUNTAINS NATIONAL PARK

- Most visited national park in the United States of America (~9,000,000 visitors/year).
- The park has been known to have dense smog within it, due to the dense traffic that comes through the area.
 - A primary component of smog is ozone (O_3), which can be damaging to plants, animals, and humans.
- The primary goal of our project is to try to predict the concentrations of tropospheric (i.e., ground level) ozone that will occur when there is a certain amount of traffic present in the park.

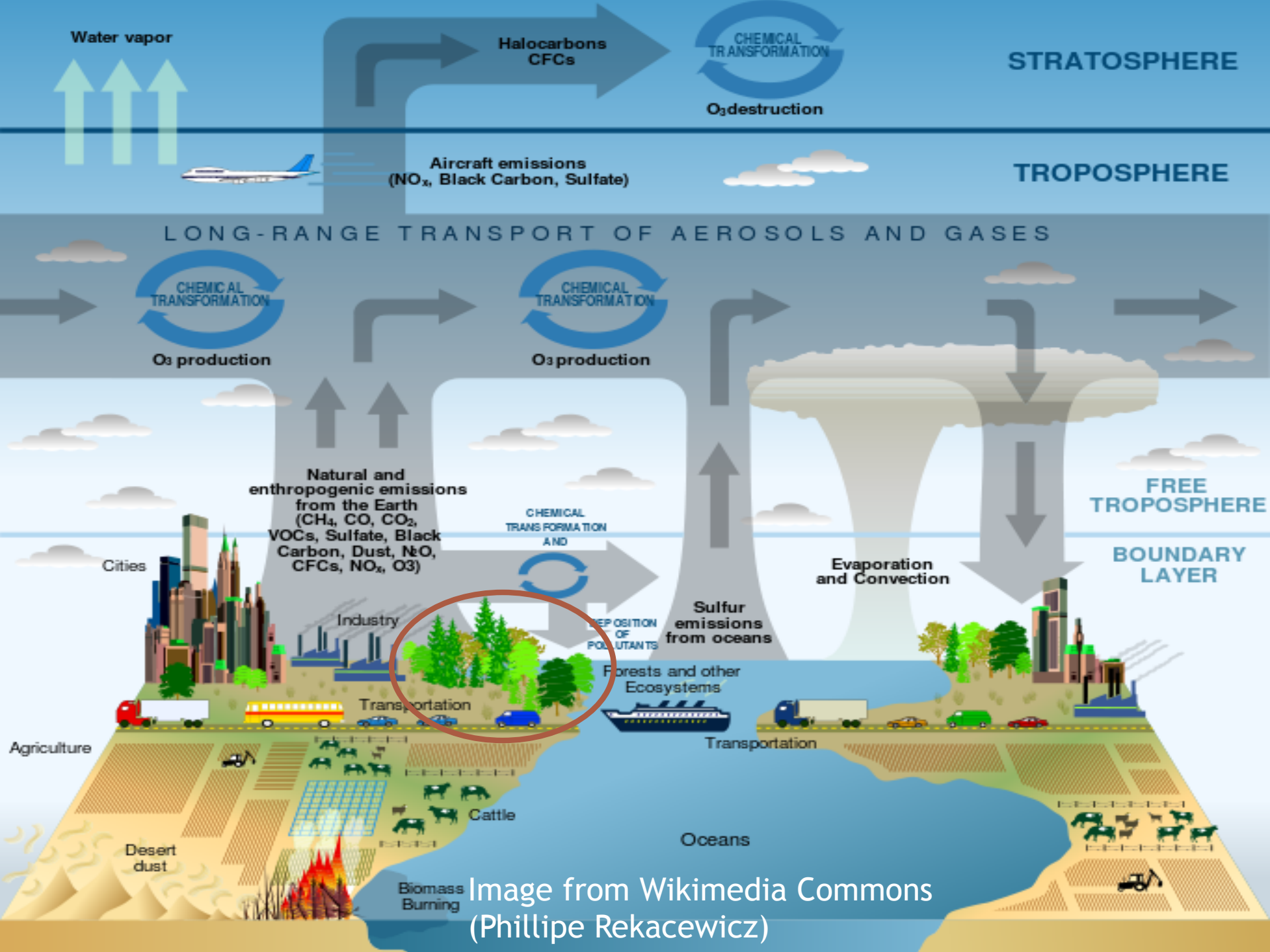
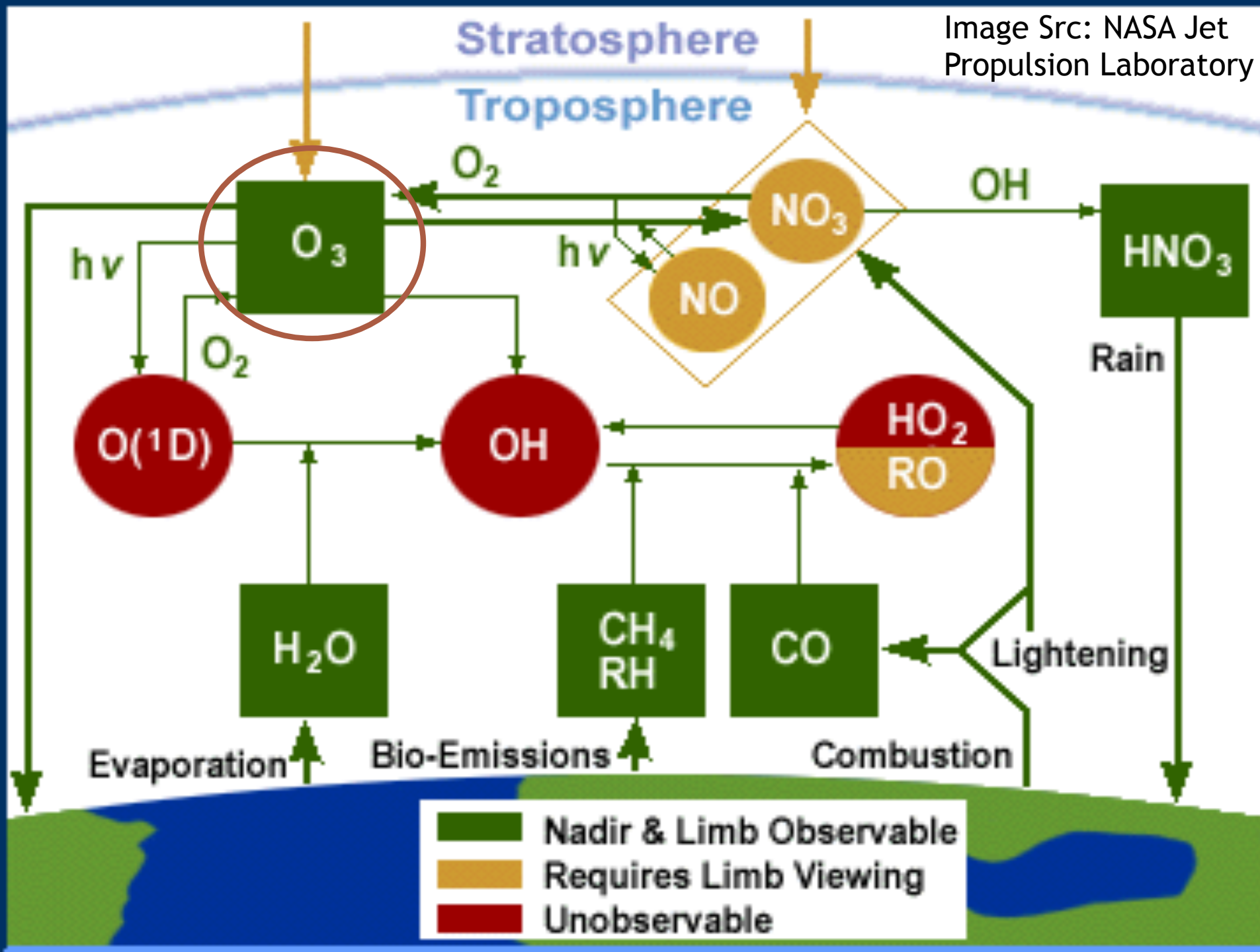



Image from Wikimedia Commons (Phillipe Rekacewicz)



A lush forest scene with moss-covered rocks and a dirt path. The foreground is dominated by large, rounded rocks covered in vibrant green moss. A narrow dirt path winds through the forest, leading towards the background. The trees are tall and thin, with dense foliage. The overall atmosphere is serene and natural.

THE ATMOSPHERIC CHEMISTRY AND CANOPY EXCHANGE SIMULATION SYSTEM (ACCESS)

ACCESS

- It is a one-dimensional column model that utilizes a current state-of-the-science, near explicit atmospheric chemistry mechanism to simulate tropospheric ozone (and other compounds) from the ground level to the top of the planetary boundary layer (PBL) (~2 km above ground level).

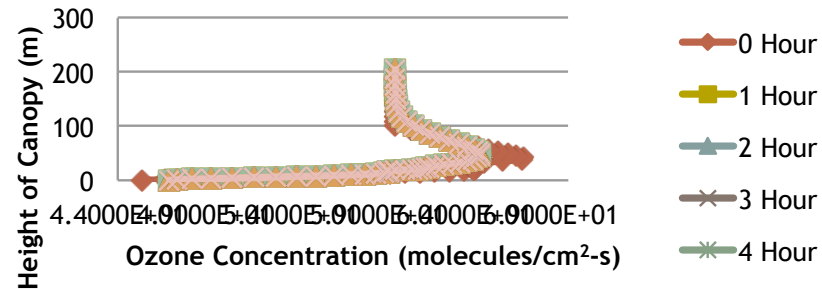
A lush, green forest scene featuring a dirt path winding through moss-covered rocks and dense evergreen trees. The text is overlaid in the center of the image.

WHAT WE HAVE DONE
THUS FAR AND WHAT WE
ARE GOING TO DO

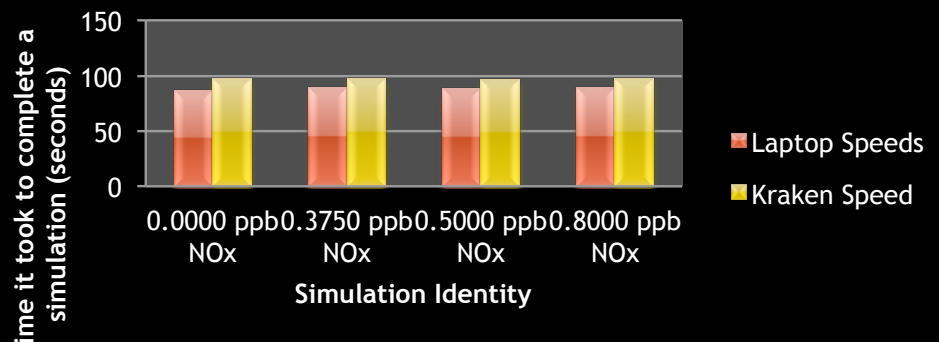
CURRENT PROGRESS

- We have run several simulations using a smaller version of ACCESS to assess results from a personal computer and Kraken, just to be sure the code is running properly.
- We will begin testing the full code shortly, we just need to modify it a bit to make it more efficient before running it.

Ozone Concentrations above Forest Canopy at 0.0000E+00 ppb NOx



Simulation Speed



PLANS FOR THE FUTURE

- Once the program has been made to run efficiently on a high performance computing platform, we will begin do the following:
 - Gather data from atmospheric sensors in the Great Smoky Mountains National Park (GSMNP) on canopy emissions of volatile organic compounds such as isoprene, terpenes, sesquiterpenes, as well as inorganics such as nitrogen oxides (NO_x) and ozone, and add them to the model to better simulate conditions within the GSMNP.
- Run simulations to answer our questions which are:
 - How do NO_x emissions from anthropogenic (i.e., man made) sources within the GSMNP effect the amount of tropospheric ozone formed within the park?
 - In what ways can we lessen the impact of NO_x on the GSMNP?

CREDITS

- ◉ Image on section introduction slides is from Wikimedia Commons and is an image of Baxter Creek Trail in Great Smoky Mountains National Park.
- ◉ All other photos are credited on their slide.