Observing Clouds and Contrails for GLOBE and NASA

Dr. Lin Chambers

NASA Langley Research Center

Hampton,VA

Our Objectives

- Obtain contrail and other cloud information from the largest possible network of ground observers
- Use to:
  - Validate satellite retrieval algorithms
  - Improve contrail prediction methods

Outline

- What are contrails?
- Why is NASA involved?
- Why and how are students important to this study?

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What are Contrails?

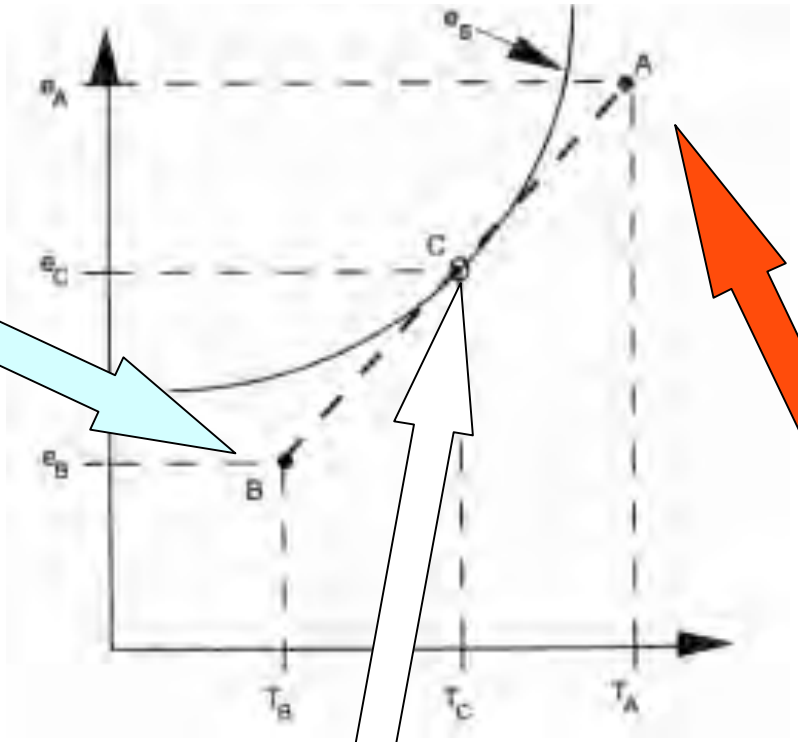
- Contrails are **CLOUDS** that form in the wake of aircraft.
- Contrail is a shortened name for condensation trails.
- Also known as vapor trails, jet trails, “chemtrails”

Contrails have been around for a long time!

- They were first described in the scientific literature in 1919.
- During WWII, contrails sometimes littered the skies during aerial combat.

What is a Mixing Cloud?

B. Cold, dry air in upper atmosphere



The cloud that forms on your breath during a cold day is a mixing cloud

C. If you cross the line … contrail!

A. Hot, moist air from plane exhaust

Do Contrails Affect Cloud Cover?

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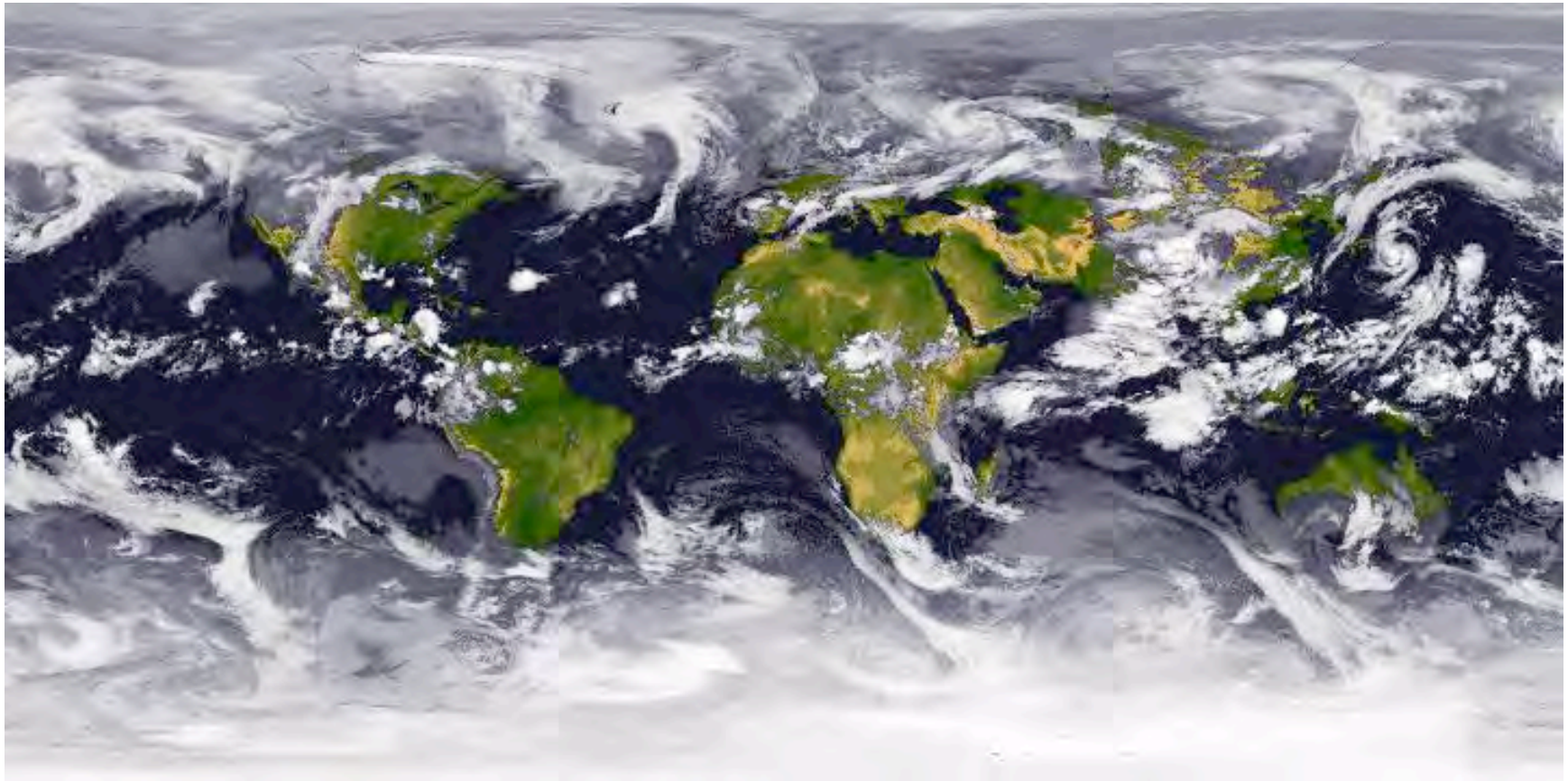
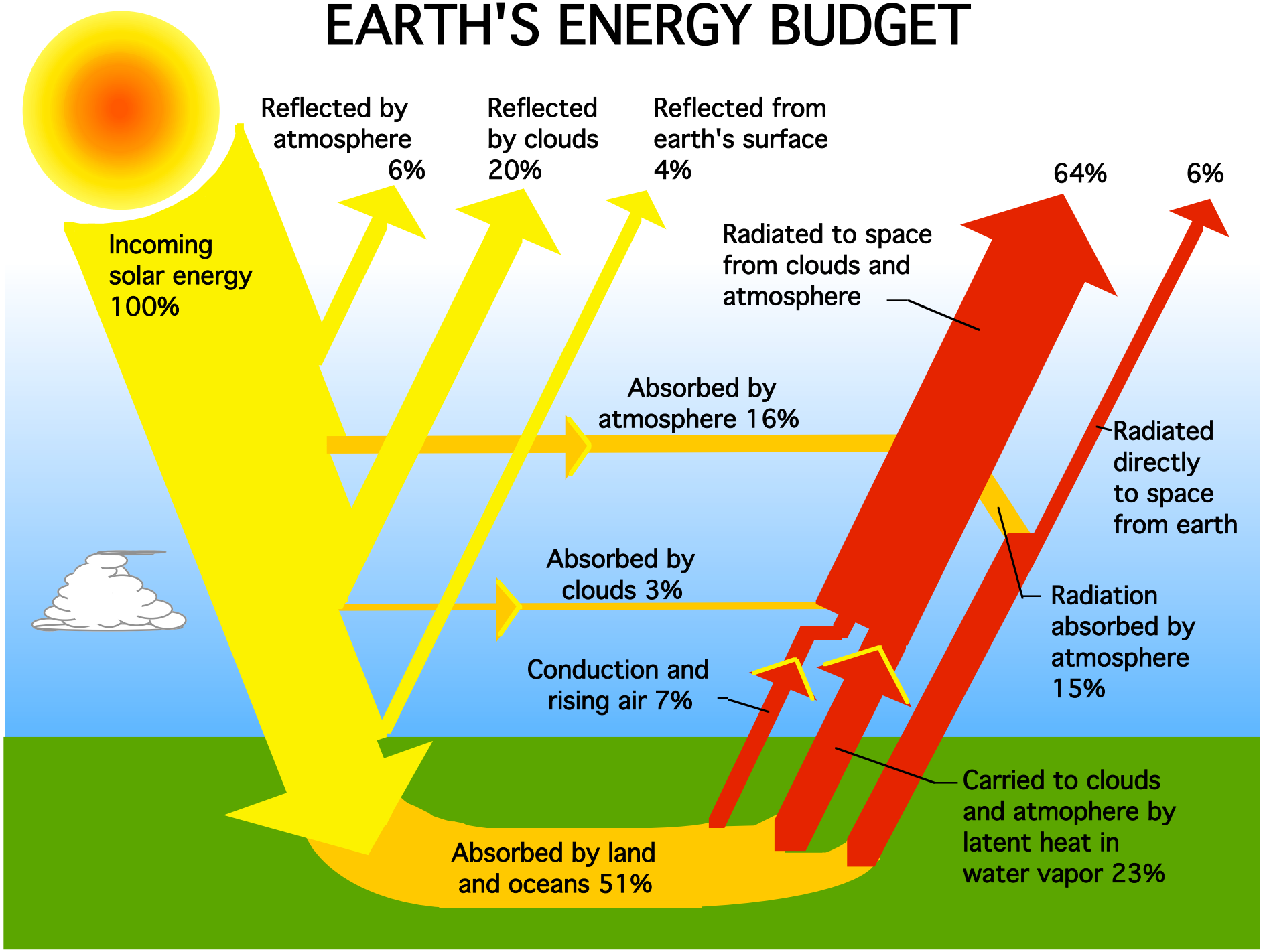
Global Cloud Cover

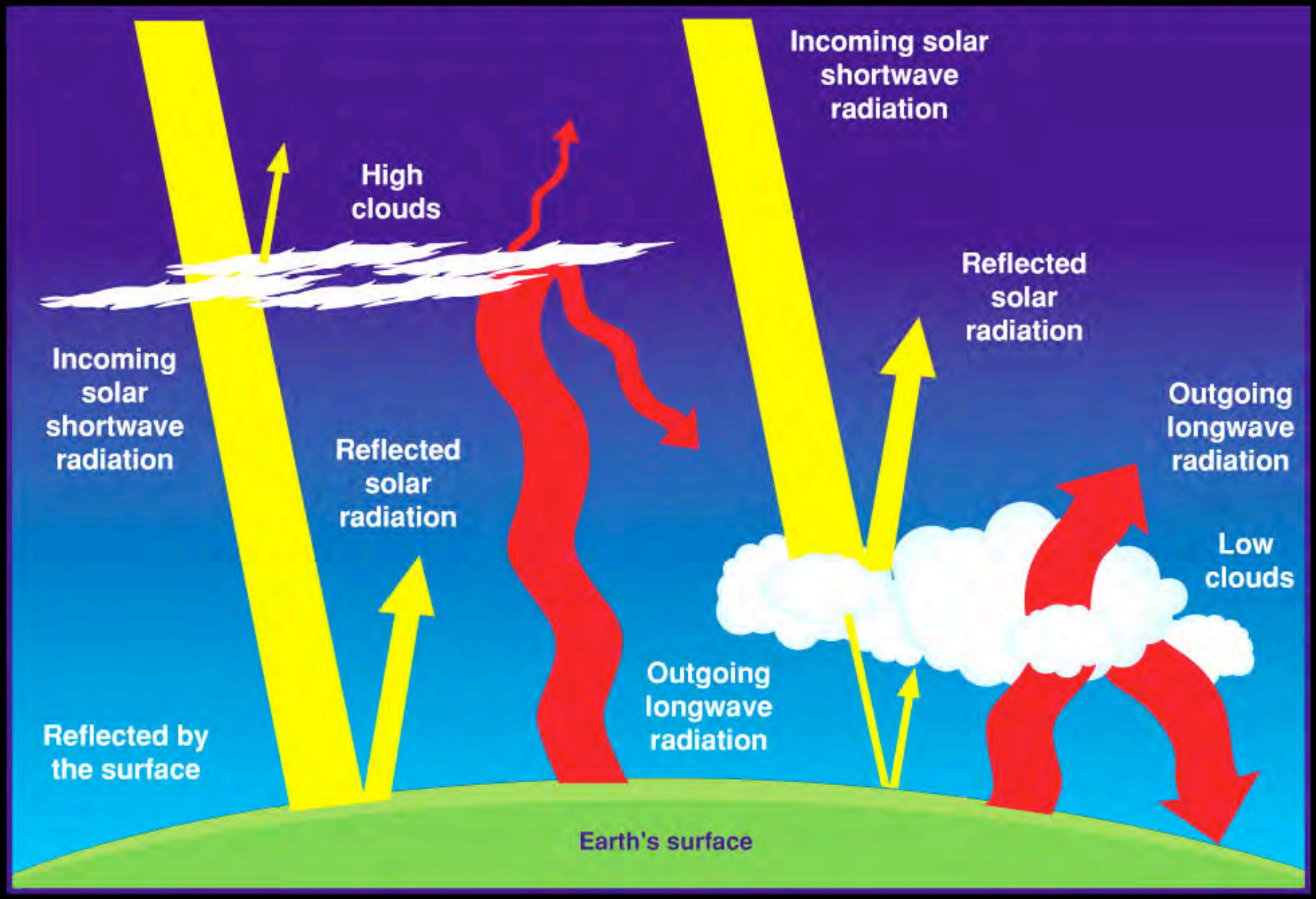
August 26, 1993



EARTH'S ENERGY BUDGET



Cloud Effects On Earth's Radiation



Derived Product

Requires Cloud Detection and Cloud Property Retrieval

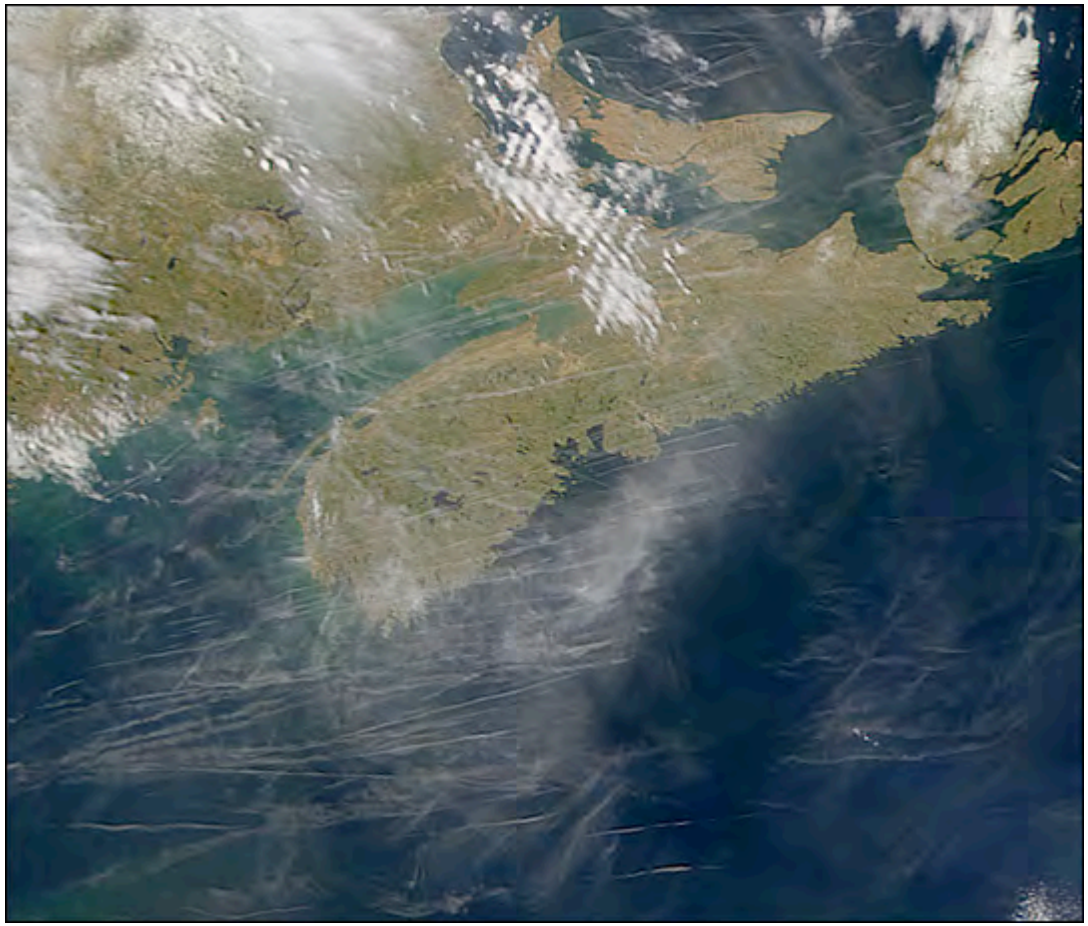
Why Do We Study Contrails?

When the upper atmosphere is moist enough, the contrails continue to grow.

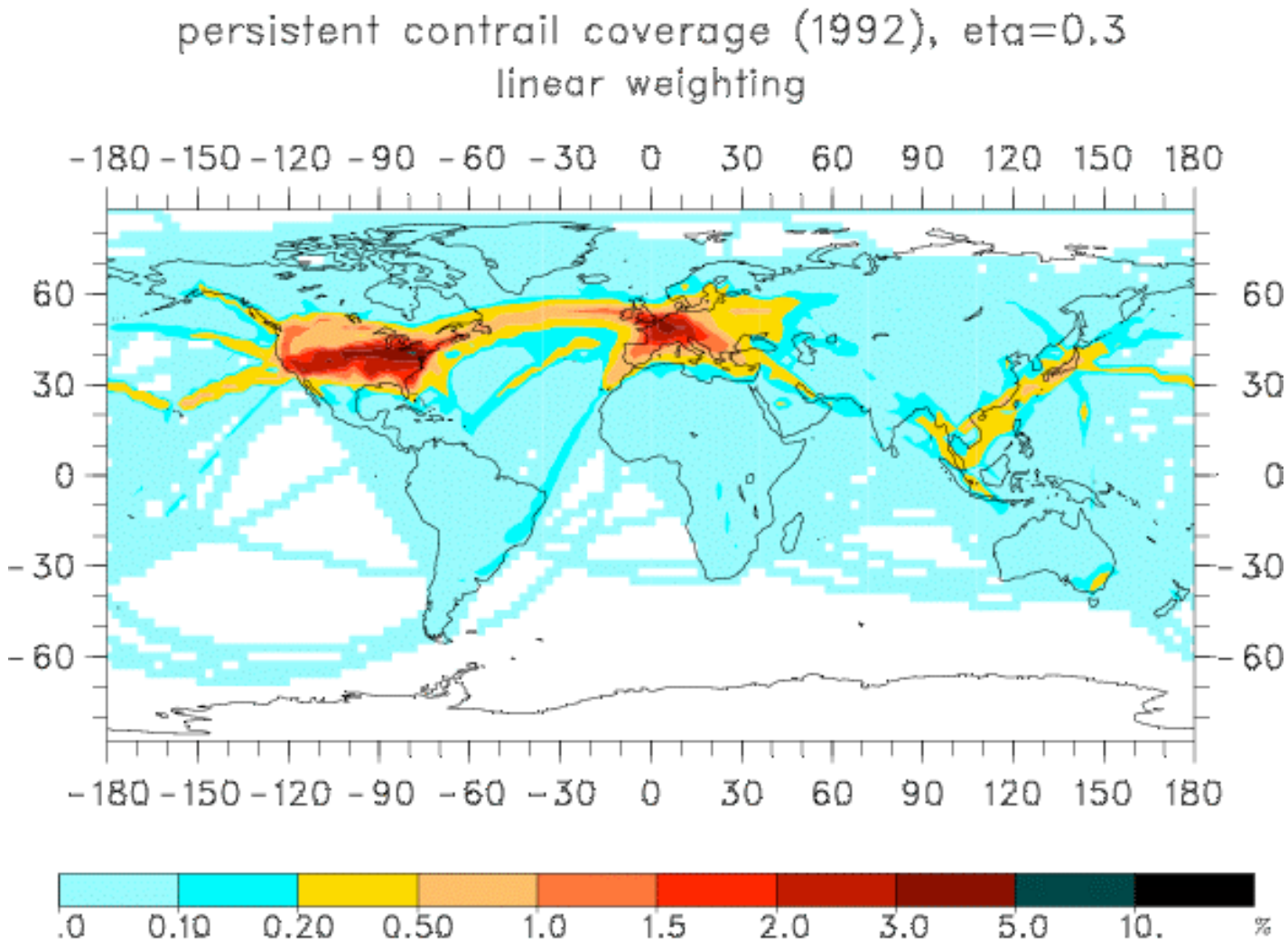
Under these conditions, the contrails become *persistent.*

Persistent contrails occasionally cover large areas.

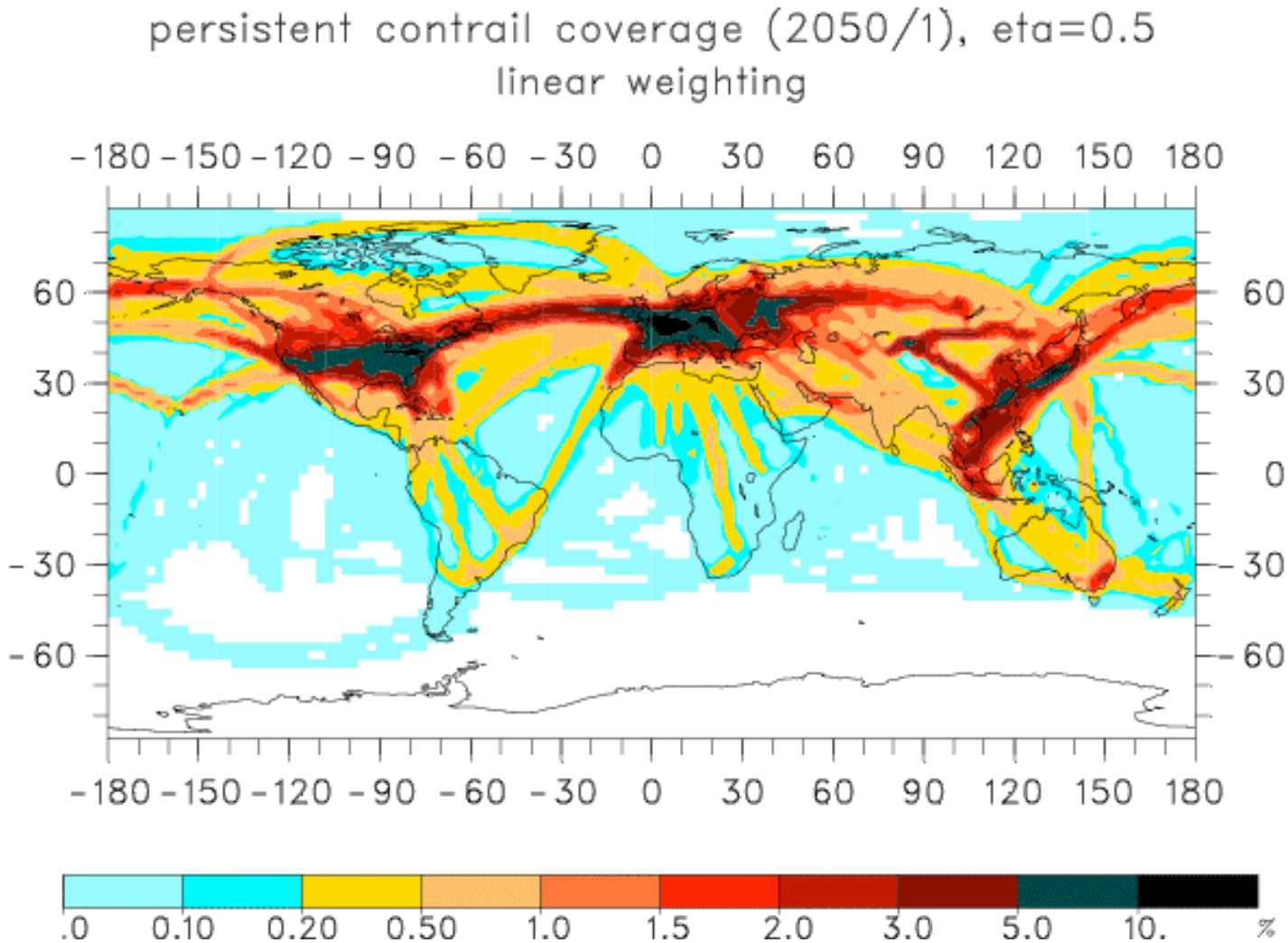
Like cirrus clouds, contrails likely contribute to global warming.



We currently estimate that contrails add an additional 0.5 to 5 % warming to the greenhouse gas effect.



Air traffic and persistent contrail coverage will continue to increase.



By 2050, warming due to contrails may be 2.5 to 25 % of the current greenhouse gas warming.

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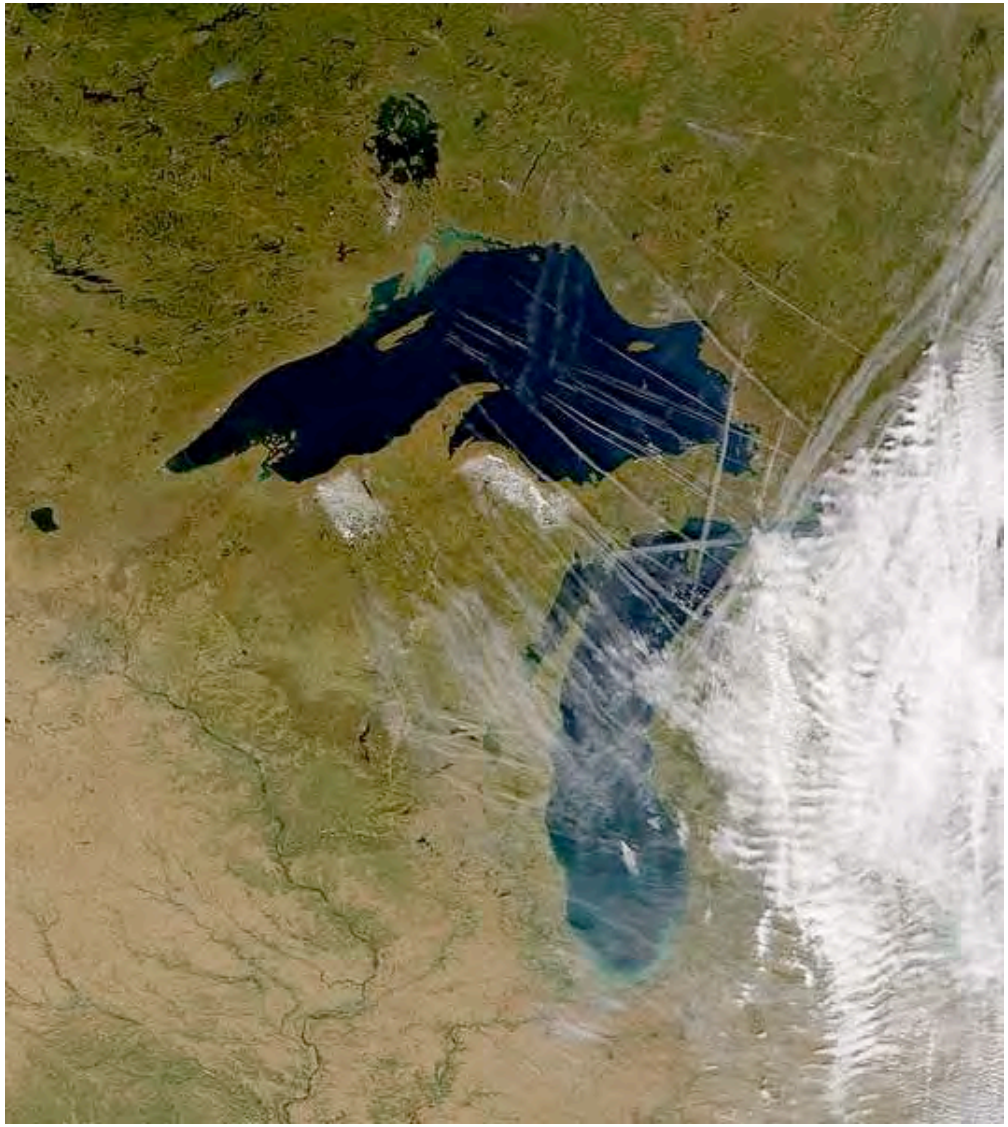
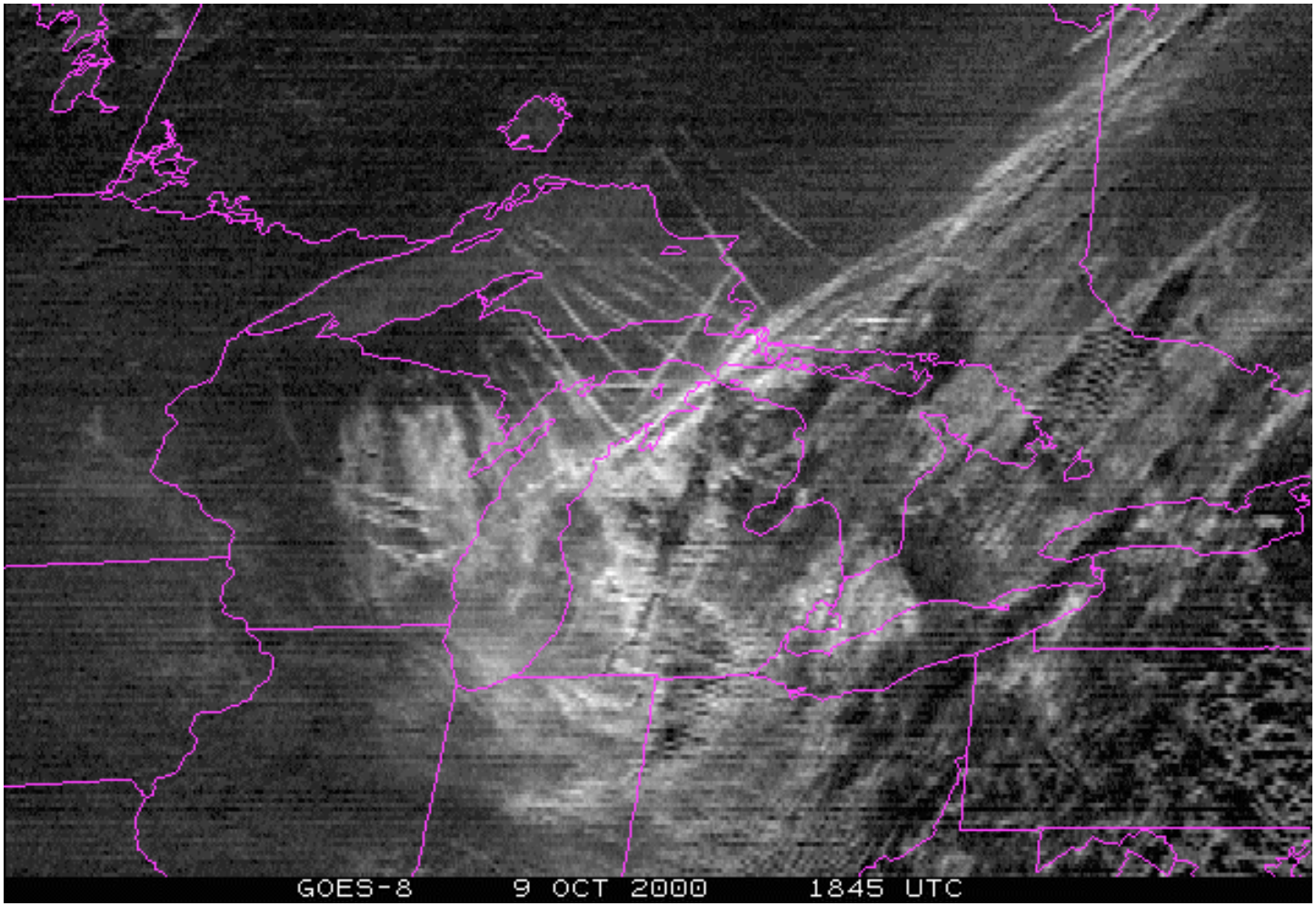
Why can students help?

Our estimates of the climatic effects of persistent contrails are still uncertain.

We still have trouble estimating contrail coverage.



Why can students help?



Most contrails are still smaller than the resolution of most satellites.

Data Sheet

Atmosphere Investigation

Clouds 1-Measurement Data Sheet

School Name: _____

Observer names: _____

_____

Date: Year_____ Month_____ Day_____ Study Site: ATM-_____

Local Time (hour:min):_____ Universal Time (hour:min):_____

Cloud Type

High (in the sky):
(Check all types seen)

❑ Cirrus

❑ Cirrocumulus

❑ Cirrostratus

Middle (of the sky):
(Check all types seen)

❑ Altostratus

❑ Altocumulus

Low (in the sky):
(Check all types seen)

❑ Stratus

❑ Stratocumulus

❑ Cumulus

Rain or Snow Producing Clouds:
(Check all types seen)

❑ Nimbostratus

❑ Cumulonimbus

Contrail Type (Record the number of each type observed)

Short-lived Contrails
How many do you see? _____

Persistent Non-Spreading Contrails
How many do you see? _____

Persistent Spreading Contrails
How many do you see? _____

Three-quarters or More of the Sky is Visible:
Cloud Cover (Check One)

No Clouds
❑ 0%-No Clouds

Clear
❑ <10% Clouds

Isolated
❑ 10-25% Clouds

Scattered
❑ 25-50% Clouds

Broken
❑ 50-90% Clouds

Overcast
❑ >90%

Contrail Cover (Check one)
❑ No Contrails (0%) ❑ 0-10% ❑ 10-25% ❑ 25-50% ❑ >50%

View of more than one-quarter or more of the sky is blocked: Obscured ❑ Check here

Why is the view of the sky blocked? (Check all that apply)

❑ Blowing Snow

❑ Heavy Snow

❑ Heavy Rain

❑ Fog

❑ Spray

❑ Volcanic Ash

❑ Smoke

❑ Dust

❑ Sand

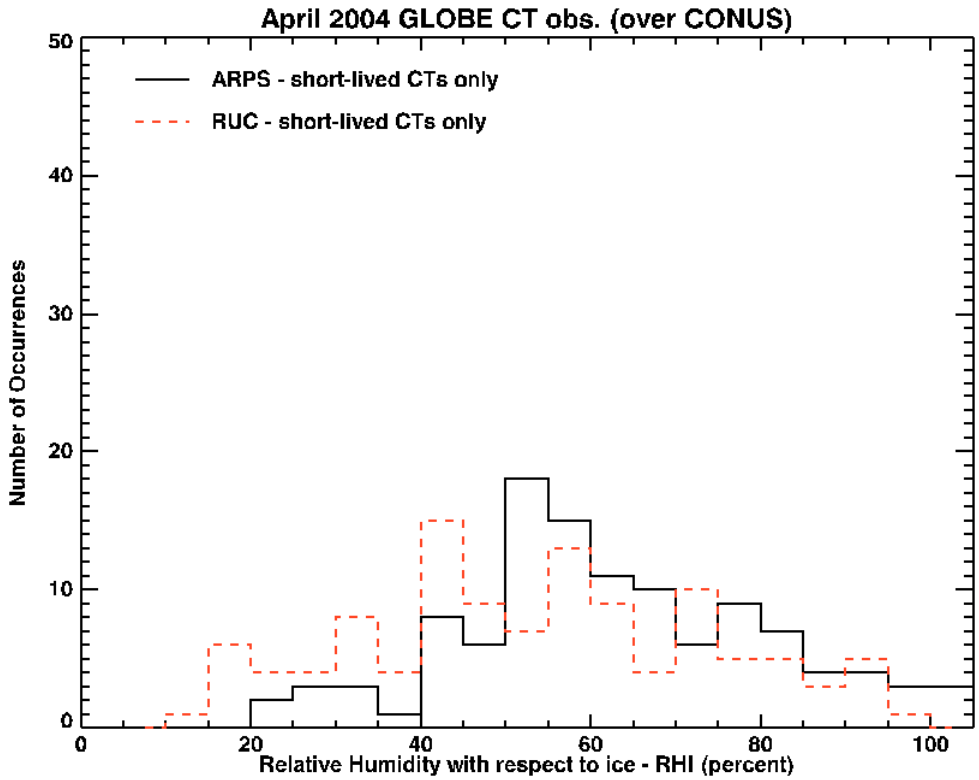
❑ Haze

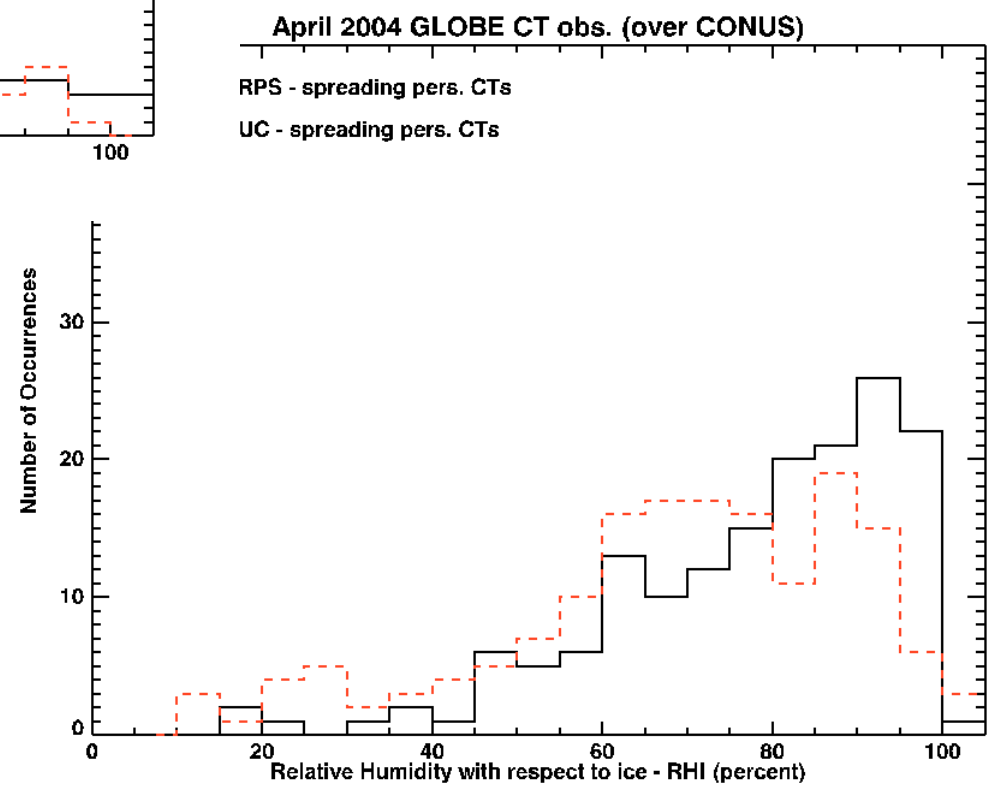
Comments:_____

_____

Initial GLOBE Contrail Data Analysis

Dr. Dave Duda,
Hampton University

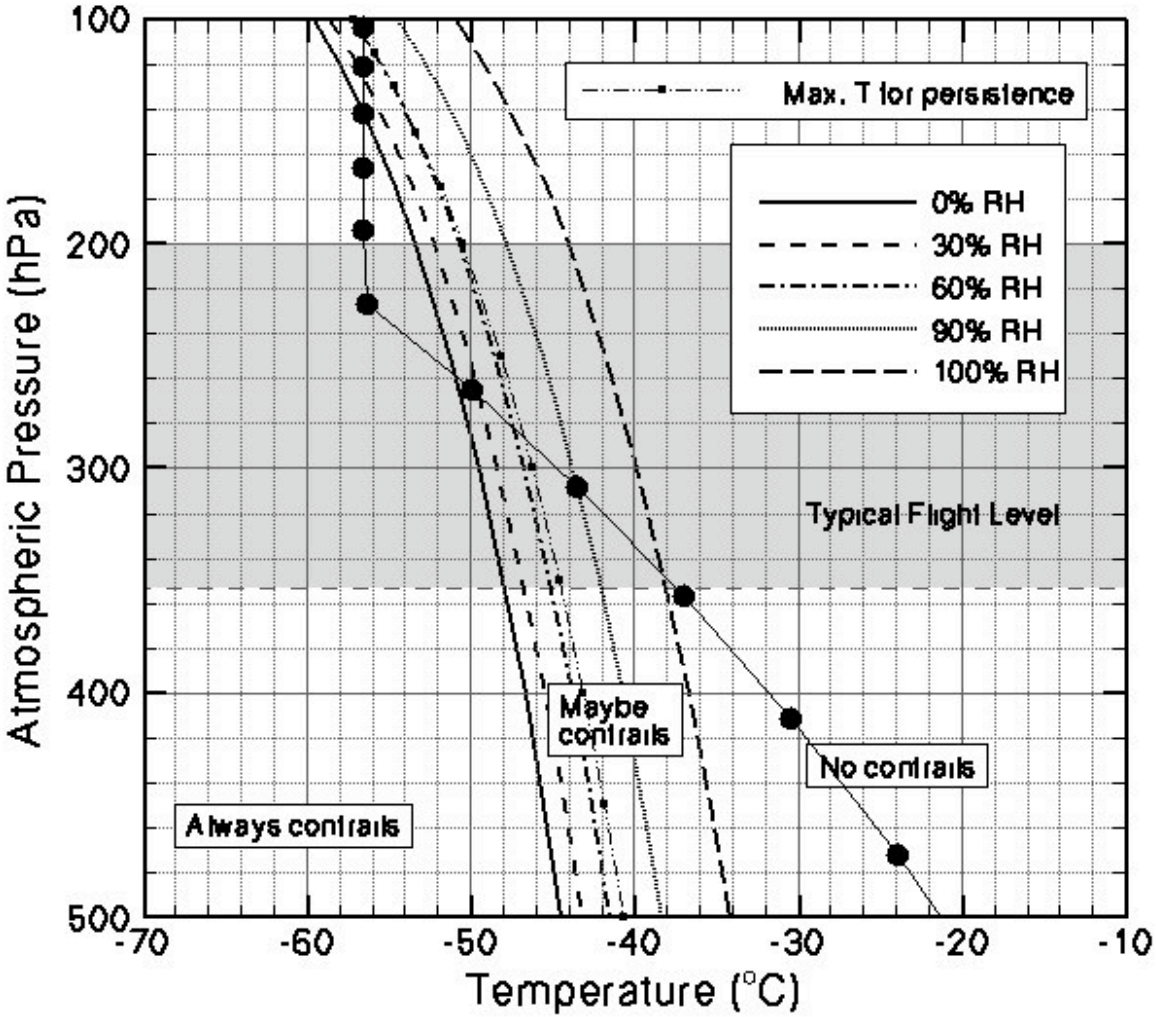




Method

- Compare GLOBE obs to:
  - RUC (Rapid Update Cycle; Benjamin et al.)
  - ARPS (Advanced Regional Prediction System; Xue et al.)
- Initial comparison for April 2004
- 1500 GLOBE observations of contrails

Website & Activities



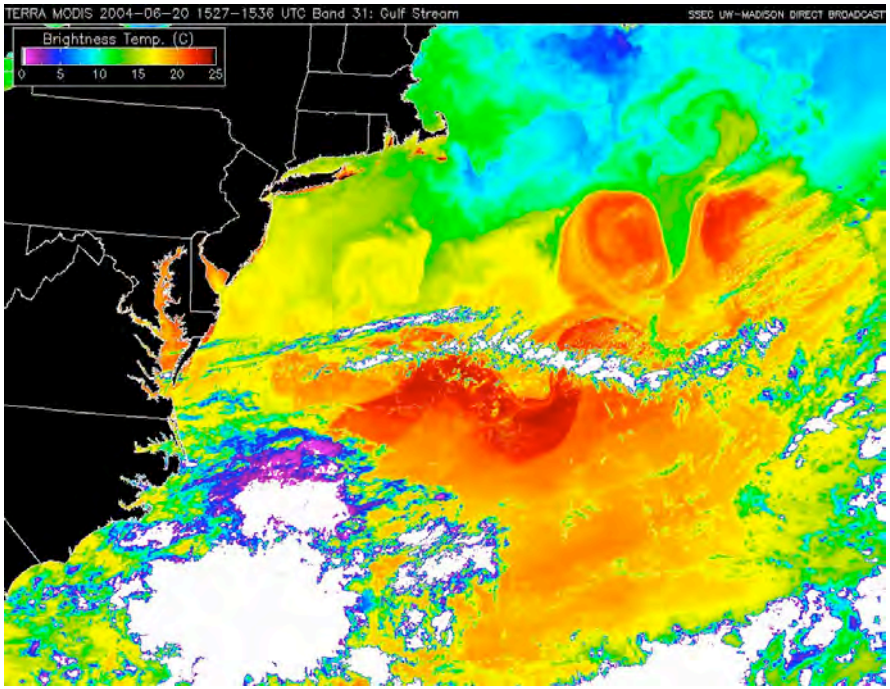
http://asd-www.larc.nasa.gov/GLOBE/

- Some other things you may see…

Inverse contrails (distrails)

Aircraft sometimes make holes in clouds!

Contrail Cousins



Cloud “zippers” on Father’s Day, 2004