



# Student Worksheet

## Introduction

This worksheet will allow you and your students to collect and report information about the contrails and clouds that you see. Print out this document and follow the *Measurement Steps* given below to collect information about contrails and clouds. Record the information that you collect on the Contrail Count-a-Thon Data Sheet, which can be downloaded from the project Web site at [www.globe.gov/earthsciweek2004/](http://www.globe.gov/earthsciweek2004/).

Then report the information that you have collected through the Online Data Entry Form (please make a link) located on the project Web site. By participating in this project you and your students will learn about the clouds above you. Please be aware that you do not have to do all the parts of this worksheet, but the more that you do, the more you will learn!

Note: If you are a GLOBE school, please report cloud and contrail measurements following the Cloud Protocols on October 14<sup>th</sup> and 15<sup>th</sup>, 2004 in place of performing this activity.

## What You Will Need

- **Printout of this Student Worksheet**
- **Printout of the Contrail Count-a-Thon Data Sheet** (downloaded from the project web site at <http://www.globe.gov/earthsciweek2004/>)
- **GPS Receiver** (optional)

## Measurement Steps

1. Fill out the **School Information** section at the top of your Contrail Count-a-Thon Data Sheet.
2. Pick a site outside your school, home, office, business, etc, where you have a view of most of the sky.
3. Fill out the **Site Information** section of your Contrail Count-a-Thon Data Sheet.  
Please try to record the latitude and longitude of your site in decimal degrees, using either a GPS Receiver or a map with coordinates from one of these Web sites:
  1. [www.Maporama.com](http://www.Maporama.com)
  2. [www.Topozone.com](http://www.Topozone.com)
  3. U.S. Census Bureau (in the U.S.) at [www.census.gov/cgi-bin/gazetteer](http://www.census.gov/cgi-bin/gazetteer)  
If you are unable to obtain coordinates, record the address of your site.
4. Review the descriptions and pictures of contrails and clouds given on the Contrail Types and Cloud Types pages below.
5. Go to your site sometime between 11 am and 1 pm on October 14<sup>th</sup> & 15<sup>th</sup>, 2004, and observe as much of the sky as you can.
6. Count the total number of contrails. If you can, count the number of contrails in each of three categories using the Contrail Types page below for reference:
  - Short-Lived Contrails
  - Persistent Non-Spreading Contrails
  - Persistent Spreading contrails
7. Record the total number of contrails, along with the number of each type of contrail, in the **Contrail Information** section of your Contrail Count-a-Thon Data Sheet. If you cannot see if there are contrails because low clouds, fog, or other obstructions are blocking your view, then please check the appropriate box and describe what is blocking your view in the 'further observations about contrails' area.
8. Identify the types of clouds that you see using the Cloud Types page below for reference.
9. Check all the types of clouds that you observed in the **Cloud Information** section of your Contrail Count-a-Thon Data Sheet.
10. Report your data through the Online Data Entry Form located on the project web site at [www.globe.gov/earthsciweek2004/](http://www.globe.gov/earthsciweek2004/).

# Contrail Types

There are three types of contrails that you will be asked to identify in this activity. Please use the pictures and descriptions given below for reference while making identifications.

## Short-Lived Contrails:



Short-lived

These are contrails that disappear shortly and form short line segments in the sky that fade out as the distance away from the airplane that created them increases.

## Persistent Non-Spreading Contrails:



Persistent Non-Spreading

These contrails remain long after the airplane that made them has left the area. They form long, generally straight, lines of approximately constant width across the sky. These contrails are no wider than your index finger held at arm's length.

## Persistent Spreading Contrails:



Persistent Spreading

These contrails also remain long after the airplane that made them has left the area. They form long streaks that have widened with time since the plane passed. These contrails are wider than your index finger held at arm's length. This type is the only type that can currently be seen in satellite imagery; and only when they are wider than four fingers held at arm's length. Therefore, noting the equivalent

finger width of these contrails in the metadata will be very useful for the scientists.

# Observing Cloud Type

There are five descriptive terms for the various types of clouds:

CIRRO or high clouds

ALTO or middle clouds

CUMULUS or white puffy clouds

STRATUS or layered clouds

NIMBUS or clouds from which precipitation is falling

The following ten types of clouds, named using the above terms, are to be used when reporting the cloud type for your area:

## High Clouds



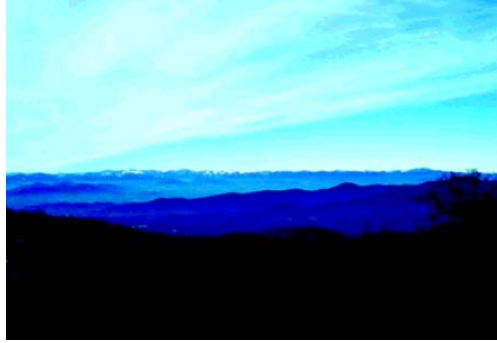
### **Cirrus**

These clouds look like white delicate feathers. They are generally white wispy forms. They contain ice crystals.



### **Cirrocumulus**

These clouds are thin white layers with a texture giving them the look of patches of cotton or ripples without shadows. They contain primarily ice crystals and perhaps some very cold water droplets.



### **Cirrostratus**

These clouds are a thin, almost transparent, whitish layer made up of ice crystals. They may totally or partly cover the sky and can create a halo appearance around the sun.



### **Middle Clouds**

#### **Altostratus**

These clouds form a bluish or grayish veil that totally or partially covers the sky. The light of the sun can be seen through them but there is no halo effect.



#### **Altocumulus**

These clouds look like waves of the sea with white and gray coloring and shadows. They contain mostly water droplets and perhaps some ice crystals.



### **Low Clouds**

#### **Stratus**

These clouds are gray and lie very close to the surface of the Earth. They usually look like a sheet layer but sometimes are found in patches. They rarely produce precipitation.



#### **Stratocumulus**

These clouds are a gray or whitish color. The bases of these clouds tend to be more round than flat. They can be formed from old stratus clouds or from cumulus clouds that are spreading out. Their tops also tend to be mostly flat.



### **Nimbostratus**

This is a very dark and gray-colored cloud layer that blots out the light of the sun. It is massive and has a continuous fall of precipitation.



### **Cumulus**

These clouds have a flat base and a dense, moundshaped top that resembles a large cauliflower. Where the sun hits these clouds they are a brilliant white. The base tends to be a darker gray. They generally do not produce precipitation.



### **Cumulonimbus**

These are large, heavy, and dense clouds. They have a generally flat, dark surface with very tall and large tops like the shape of a massive mountain or anvil. These clouds are often associated with lightning, thunder and sometimes hail. They may also produce tornados.