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Using satellite imagery to study contrails

How do scientists use satellite imagery to study contrails?

Satellite imagery allows scientists to study contrails around the globe. Satellite imagery is used to determine the rate of growth and spreading of contrails under different atmospheric conditions. Scientists can estimate the number of contrails over the Earth from the pictures, and determine how much cloudiness they add to the atmosphere. These estimates will help in determining the effect of contrails on the energy balance of the atmosphere.

What size contrail can be seen from the ground?

Under the right conditions, even the smallest and most short-lived contrails can be seen from the ground. See the Contrail Gallery for some examples. This is because the white contrail shows up very well against the blue sky; and because our eyes have much better resolution than do satellite instruments. To be fair, we are also much closer. Typical Earth-observing satellites orbit about 700 km above the Earth. Contrails occur between 8 and 12 km above the surface (and us). This is why GLOBE is interested in student observations of contrails.

What size contrail can be seen in a satellite image?

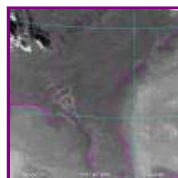
In order to be seen, a contrail must be wide enough (and long enough) to change the brightness of a satellite [pixel](#). Each pixel covers a portion of the Earth. The size of that area is determined by the resolution of the satellite instrument. Typical weather satellites, such as you see on the news, have pixels that might be 8 km, 4 km, or 1 km on a side. To show up in such an image, a contrail must be nearly 1 km wide! For Earth science, the state of the art imager is the MODIS instrument, whose pixels are as small as 0.25 km on a side. Thus, MODIS can see contrails that are much thinner, around one quarter kilometer wide. Also, view [ship tracks](#).

Can contrails be seen from space?

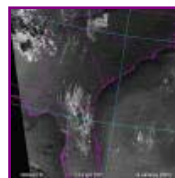
Yes! If contrails grow large enough, they can be seen from weather satellites orbiting Earth. The images below (click on image to enlarge) show groups of persistent contrails over the southeastern US on January 9, 2003. These pictures show that the number and location of contrails change rapidly.



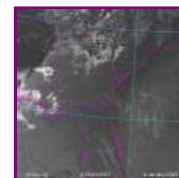
7:13 am
Almost no contrails



10:51 am
Some contrails over
southeastern Georgia



1:14 pm
Many Contrails!



4:20 pm
Several contrails over
Florida and nearby ocean



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