

The GLOBE Earth Day 2004 Contrail Count-a-Thon  
Lin H. Chambers  
NASA Langley Research Center  
Hampton, VA USA 23681-2199  
Telephone: (757) 864-4371; Fax: (757)864-7996  
Lin.H.Chambers@nasa.gov  
Julia Cole  
Science Applications International Corporation  
(now at Virginia Department of Environmental Quality)

## Introduction

Early in 2004 the GLOBE Science team suggested a contrail count activity to celebrate Earth Day 2004, which was held this year on April 22<sup>nd</sup> in the United States and some other countries around the world. The GLOBE contrail team embraced this idea and developed a simplified data collection sheet for this special project. Information about the event was shared through the GLOBE site, UCAR and NASA press releases, the NASA portal (<http://www.nasa.gov>) and the CERES S'COOL Project (<http://scool.larc.nasa.gov>). On Earth Day, about 120 observations were received through the GLOBE Contrail Count-a-Thon website, about 70 contrail observations were received through regular GLOBE data reporting, and 19 contrail observations were received through regular S'COOL data reporting. Only observations between 11:00 and 13:00 local time were included in the Count-a-Thon. The event was reported in the Boulder Daily Camera beforehand and in the Oregon Register-Guard after the fact. It was also reported on National Public Radio's Day-to-Day show; whose host even submitted an observation. This poster discusses the Count-a-Thon experience and reports the results.

## Results

A total of 215 observations were received from 3 sources: regular GLOBE observations, regular S'COOL observations, and through the event website. Global maps of total and short-lived contrails reported during the Count-a-Thon are shown below (Figs 1 and 2).

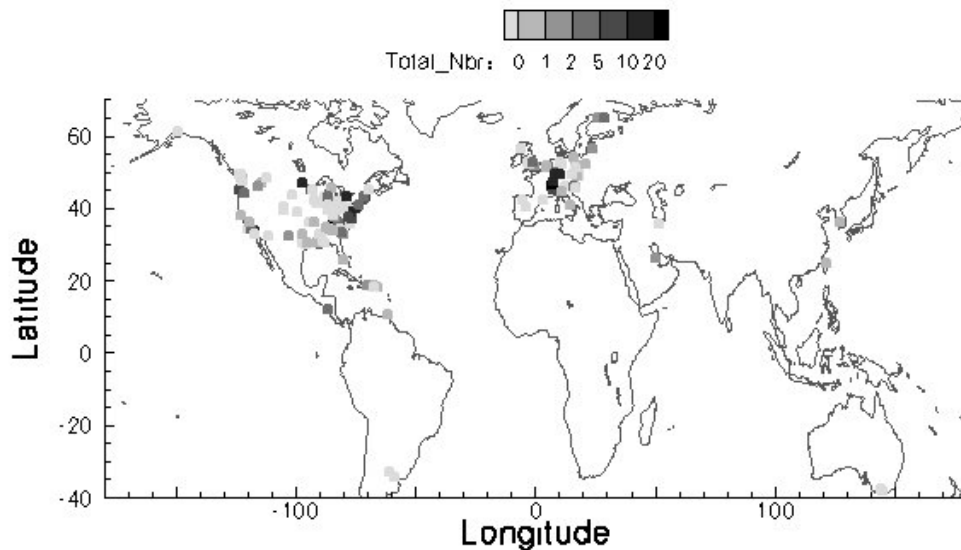


Figure 1. Total number of contrails reported from locations around the world.

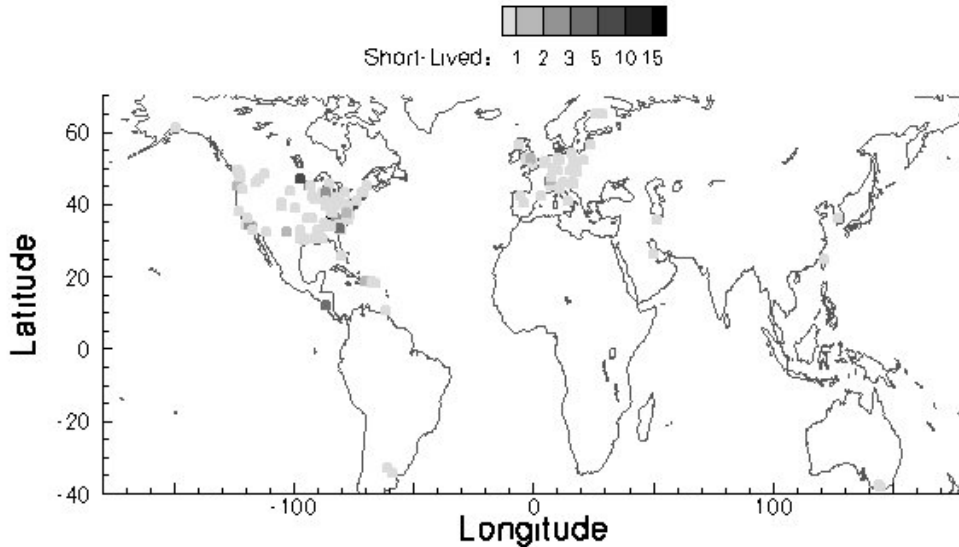


Figure 2. Number of short-lived contrails reported from locations around the world.

Clearly, most of the observations in this first-ever count-a-thon event came from the US and Europe, with almost no contrails reported in other parts of the globe where observations were made. Thus, let us look more closely at these two regions.

### Europe

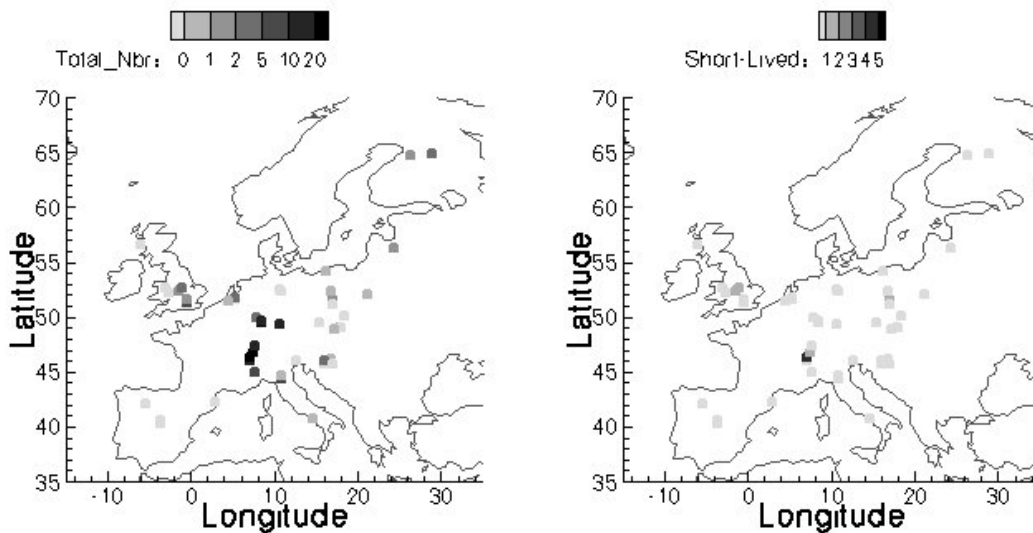


Figure 3. Total contrails and short-lived contrails reported over Europe.

Observations were made covering a large area of Europe (Fig. 3). Contrail cover appears to be highest in Central Europe, based on the reports received. In this region, observers in Martigny, Switzerland, sent photos from the courtyard of their elementary school (Fig. 4). These were taken at 11:30 local time on Earth Day. As you may notice, this school is located right up against the Alps. All views in these photos show persistent, and in some cases persistent spreading contrails, with a significant fraction of the sky covered by contrails.



Figure 4. Views of the sky in Martigny, Switzerland during the Contrail Count-a-Thon

### North America

Again, observations were made covering a large area of North America (Fig. 5). Here contrail cover is highest along the US East coast, where large numbers of aircraft fly everyday between the big cities of the eastern seaboard. Some contrails are also reported in other areas, with a big hole in observations in the western half of the country.

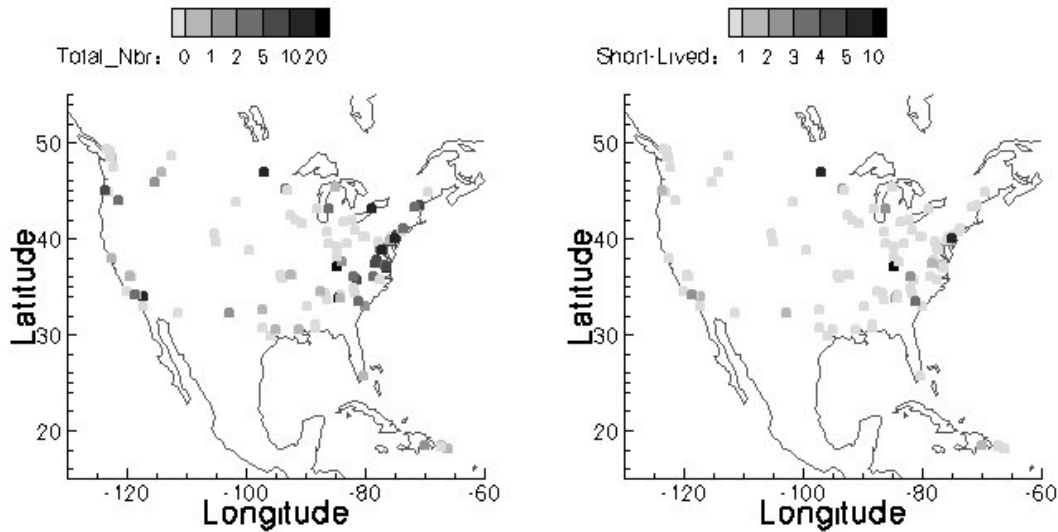


Figure 5. Total and short-lived contrails reported in North America during the count-a-thon.

During the GLOBE contrail team's Earth Day observations, we took this series of pictures of the sky in southeastern Virginia (Fig. 6). As is evident in these photos, there was fairly extensive cirrus cover on that day, along with some contrails. A weather station located nearby at Langley Air Force Base recorded daily temperatures between 18 and 27 C, considerably above the seasonal averages for that time of year (11 to 19 C). The surface relative humidity ranged between 39 and 88 percent. Visibility was reported as 7 miles. Cloud cover was reported as mostly cloudy to scattered during the Count-a-Thon observation window of 11:00 to 13:00.



Figure 6. Views of the sky from NASA Langley Research Center during the Count-a-thon.

Figure 7 shows the temperature soundings closest to the observation time plotted on an Appleman chart (refs 1-2). This chart is used in predicting the occurrence of contrails: whenever the temperature profile (plotted in heavy black lines) is to the left of (colder than) the theoretical curve for 0% RH, contrails are predicted to form if flights occur at that atmospheric level. In this case, the method consistently predicts contrails before and after the time period of the observation.

This prediction technique will shortly be posted on the Contrail Education website (<http://asd-www.larc.nasa.gov/GLOBE>) as a student activity.

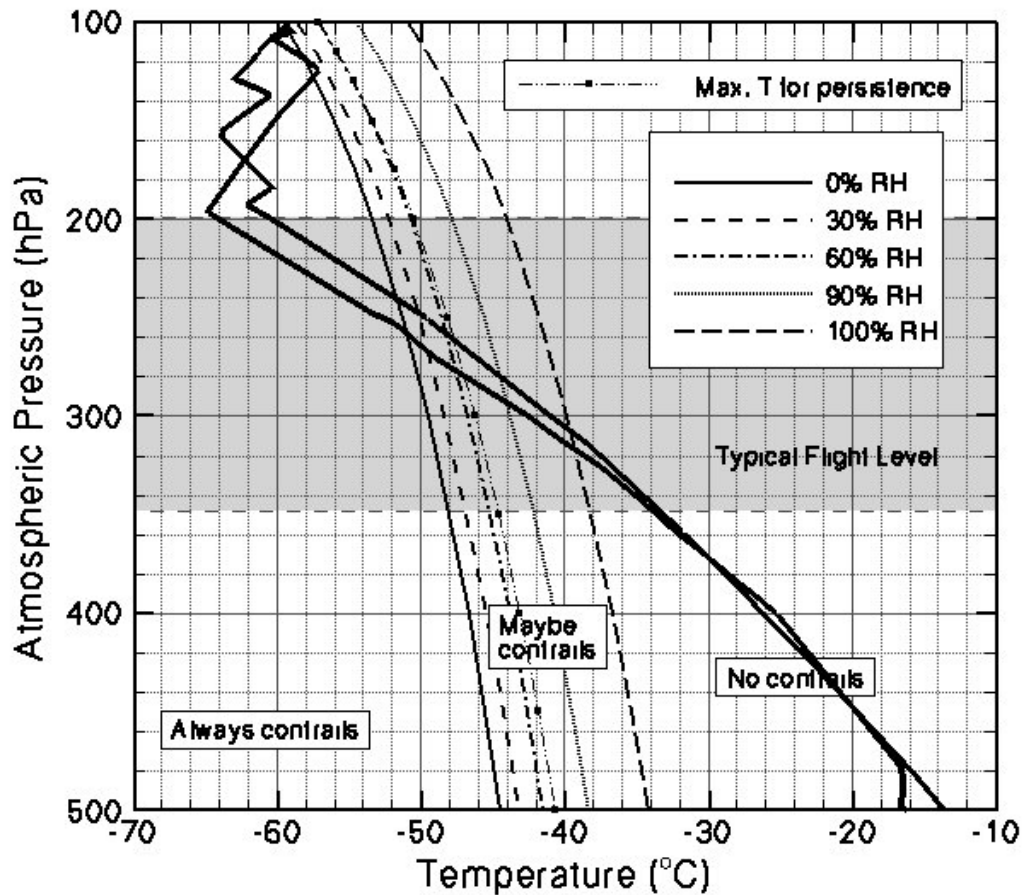


Figure 7. April 22, 2004 12Z and April 23, 2004 00Z temperature soundings from Wallops Island, VA, plotted on an Appleman chart.

### Conclusion

The first-ever GLOBE Contrail Count-a-Thon produced interesting results, which can be subject to further analysis, despite a relatively small number of observations being reported. We suggest repeating this activity next year, with additional advance planning and outreach to enable submission of many more contrail reports.

### References

1. Appleman, H., 1953: The formation of exhaust condensation trails by jet aircraft, Bull. Amer. Meteor., Soc., vol. 34, 14-20.
2. Schrader, M. L., 1997: Calculations of aircraft contrail formation critical temperatures, J. Appl. Meteor., vol. 36, 1725-1729.