



Contrails Dataset Labeling Instructions

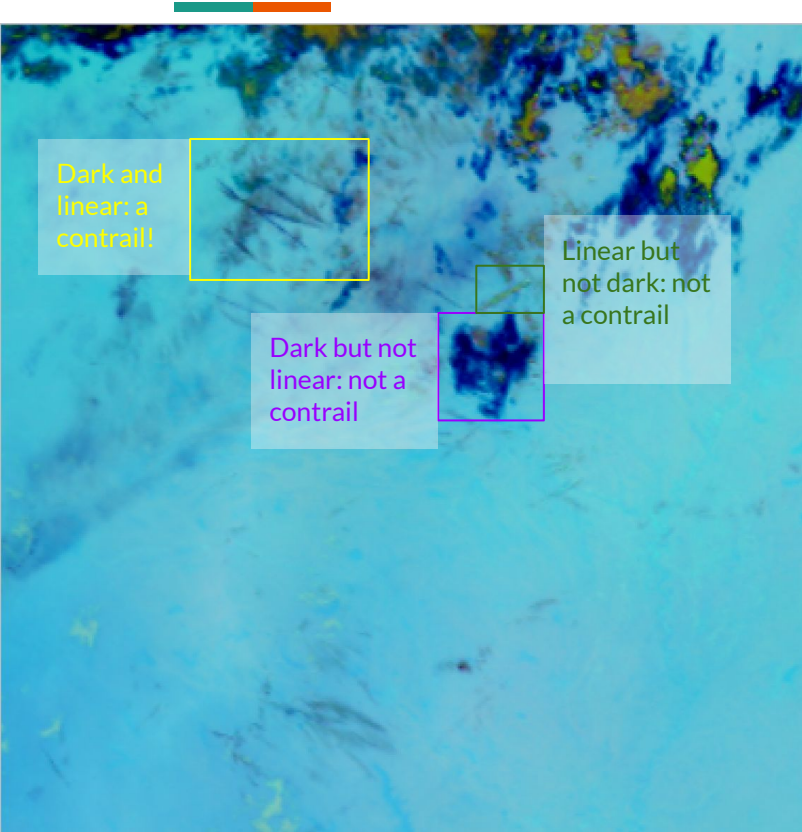
Contrails - Definition



Contrails (short for "condensation trails") are line-shaped clouds produced by aircraft engines, typically at aircraft cruising altitudes several miles above the Earth's surface.

Image from: [https://commons.m.wikimedia.org/wiki/File:Contrail_with_jet_\(aka\).jpg](https://commons.m.wikimedia.org/wiki/File:Contrail_with_jet_(aka).jpg) (CC-BY SA 2.5)

Color scheme

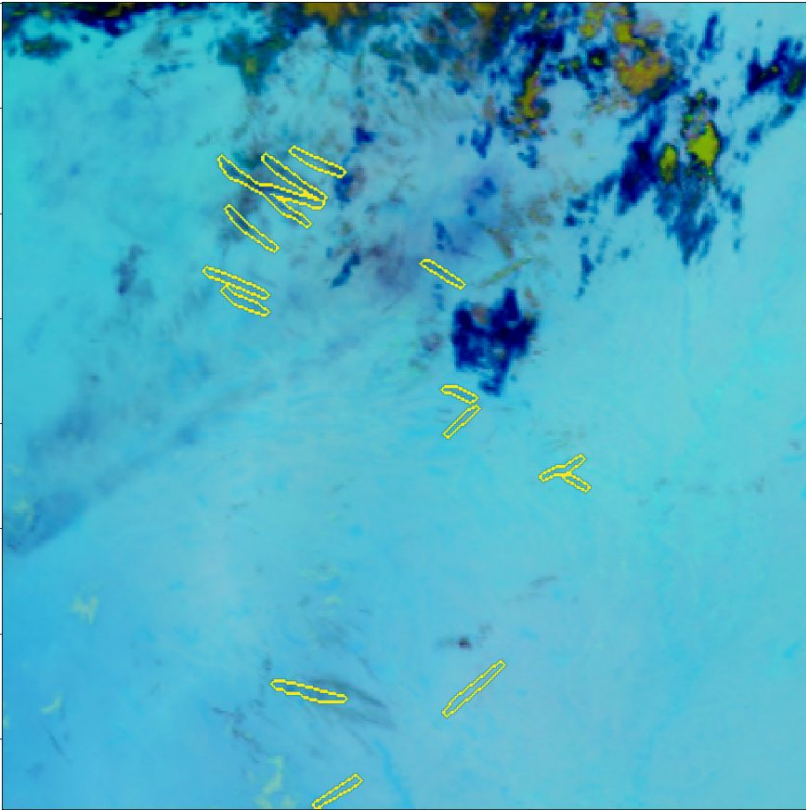


The top image is a false-color image of some infrared satellite bands.

The image is calibrated so that **contrails will appear dark in color**

An object is a contrail if it is both **line-shaped** and **darker than its surroundings**

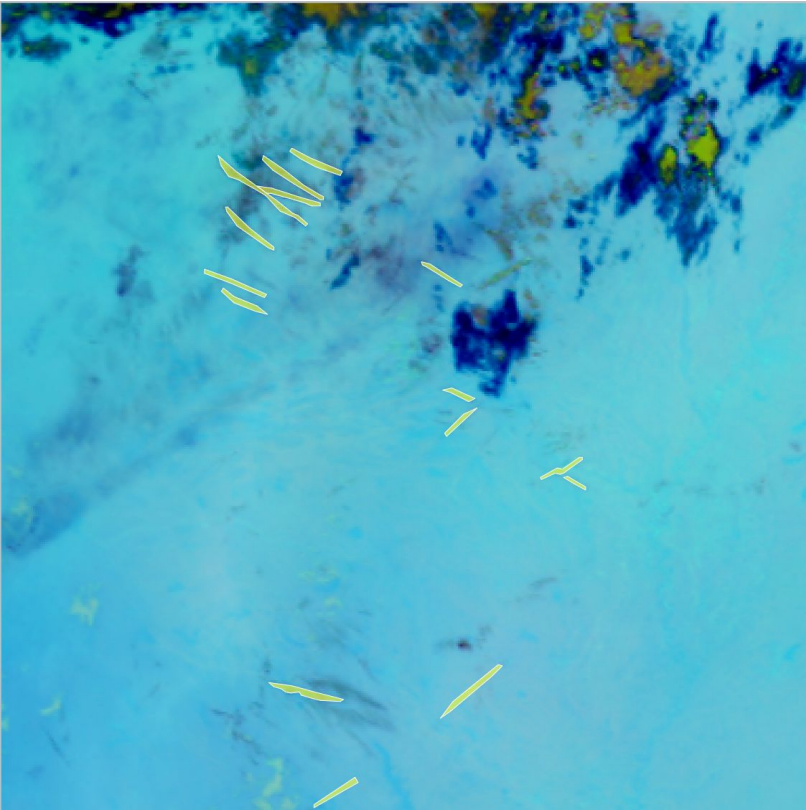
Contrails - Labelling



Your task is to draw a polygon around each contrail. The polygon should include all of the dark pixels that make up the contrail

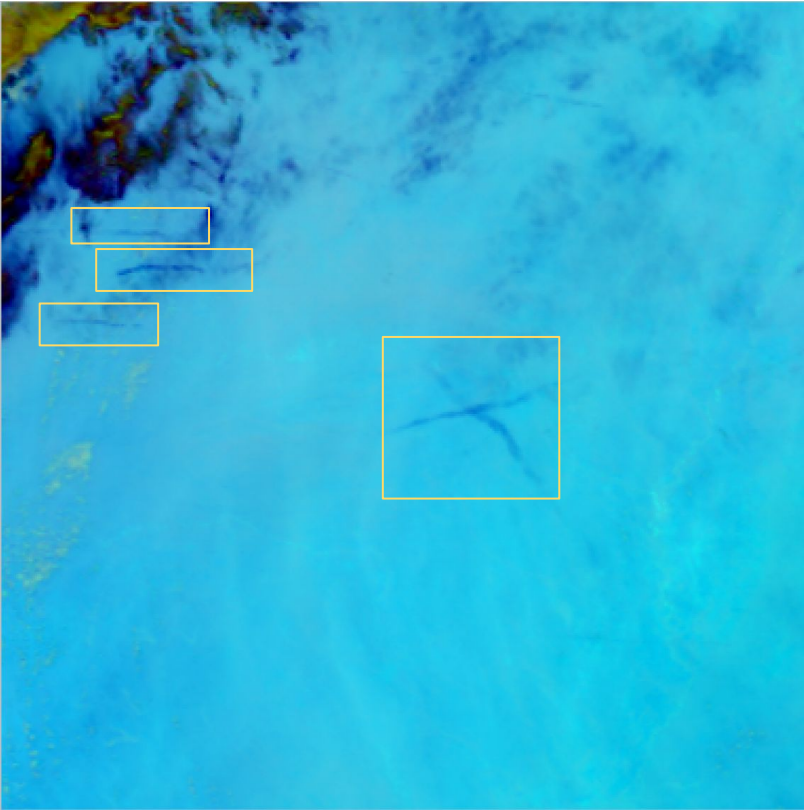
Here the objects which are contrails have been highlighted

Contrails - Labelling



This is that the image should look like after you are done labelling it

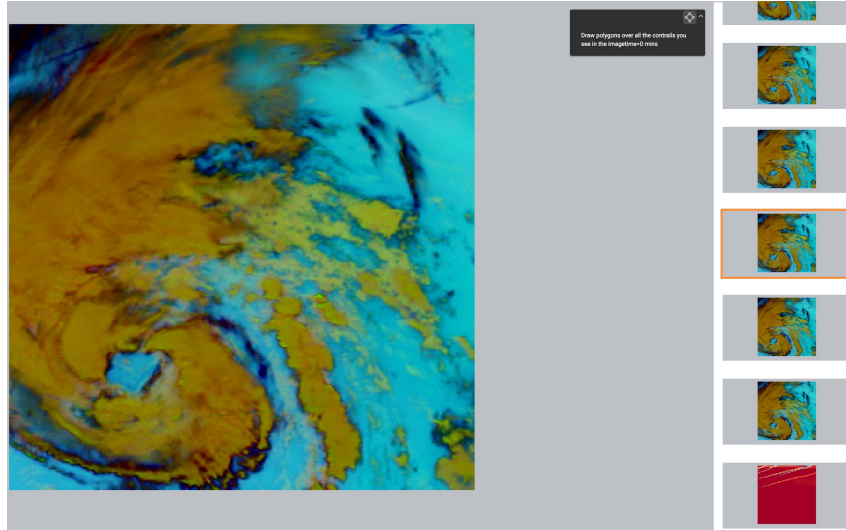
Image resolution



Compared to previous imagery you might have labelled, these images have much less resolution

Each pixel is ~2 km. Contrails will be 1-10 pixels wide, and ~10x as long as they are wide

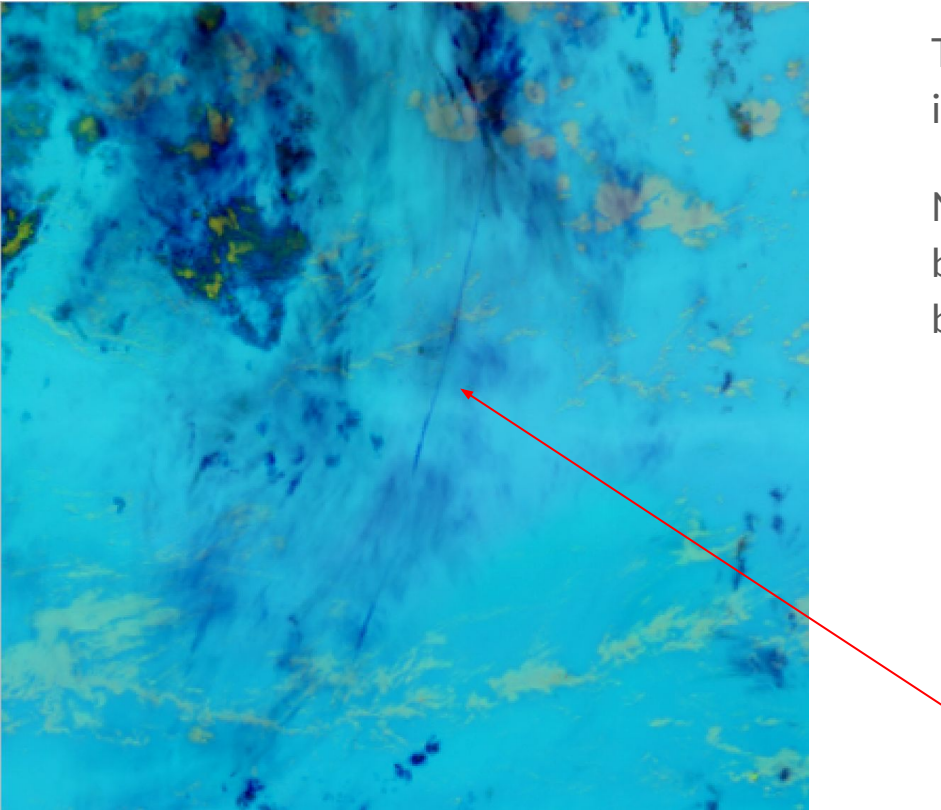
Time evolution



The low resolution of the images makes contrails difficult to see. However we can make them easier to see by viewing the contrail at multiple times

The first few and last few images do not need to be labelled, they are there to provide context. The images you need to label will have a message box that say they need labelling. The labelling tool will be disabled on other images.

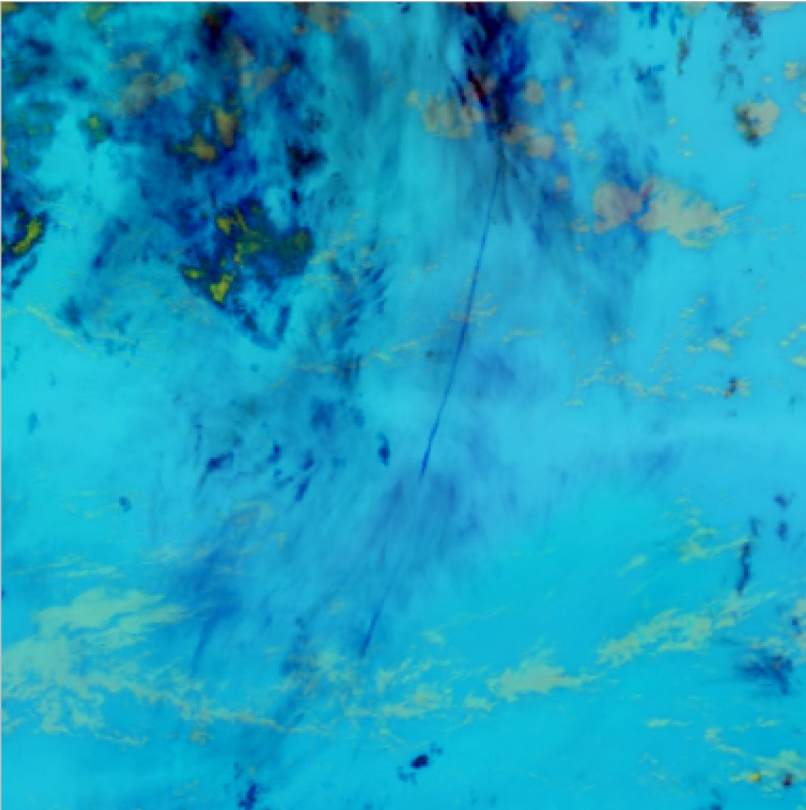
Contrails move!



The next few slides show several consecutive images of the same contrail.

Note how the contrail moves around between frames. It is doing this because it is being blown by the wind

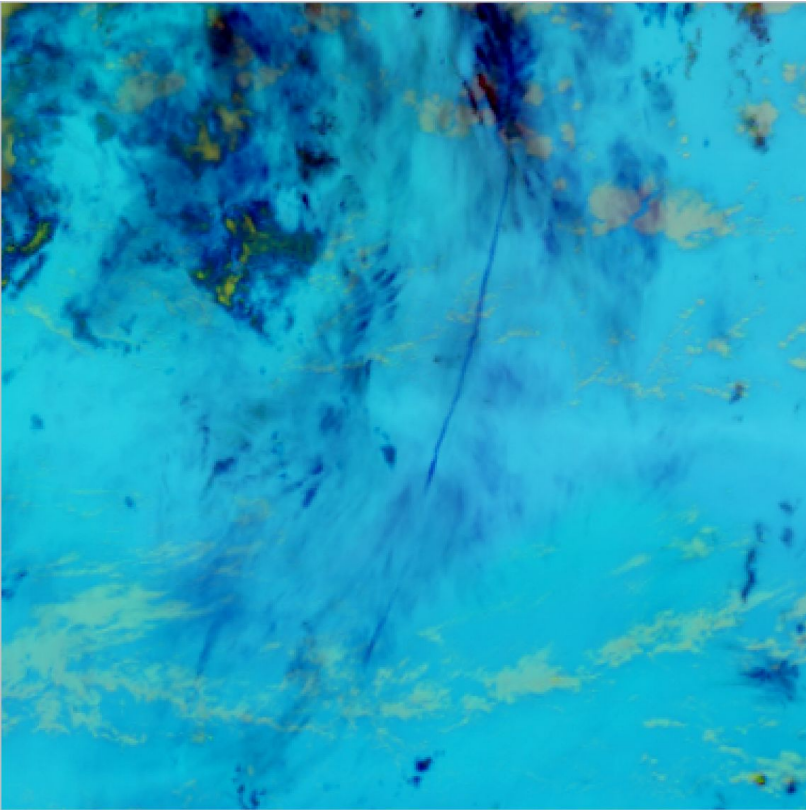
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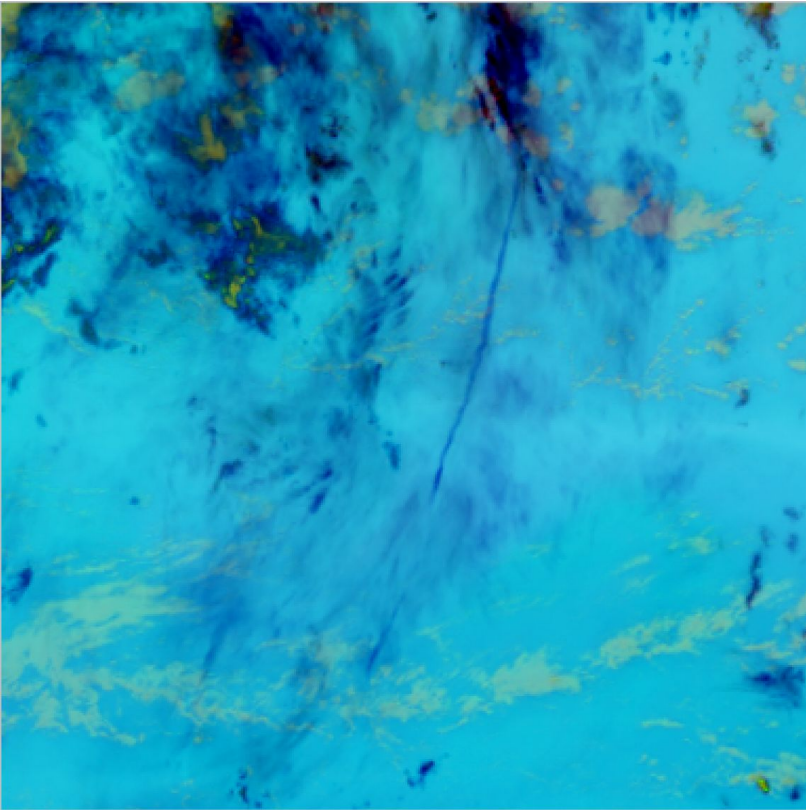
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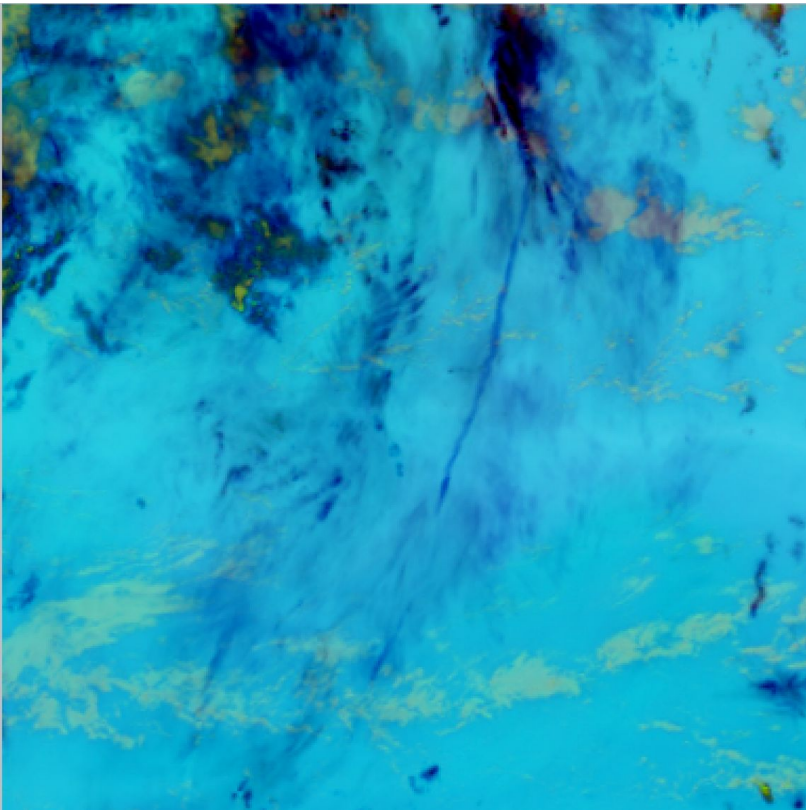
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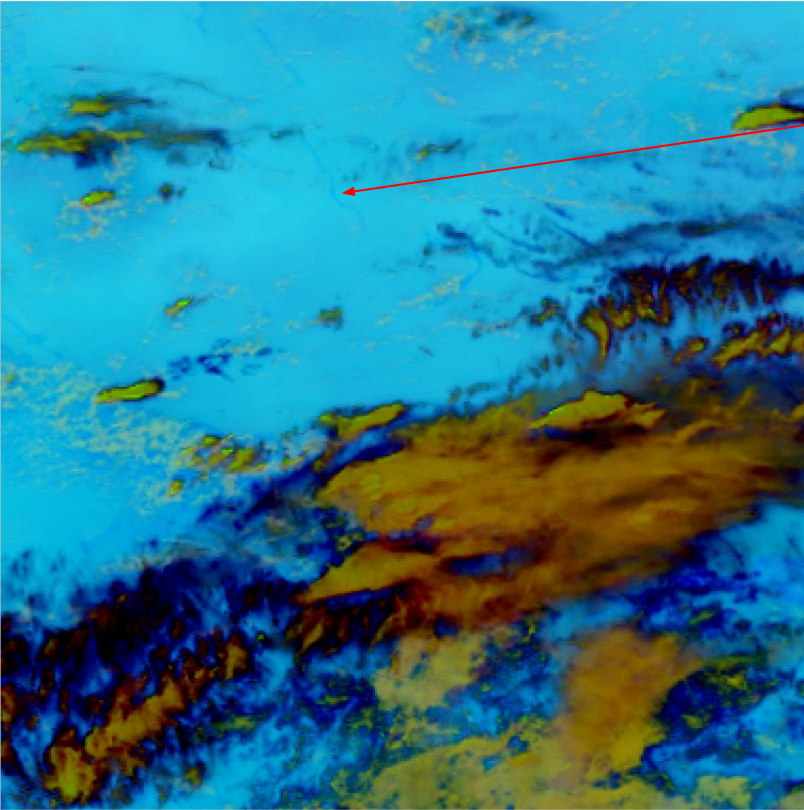
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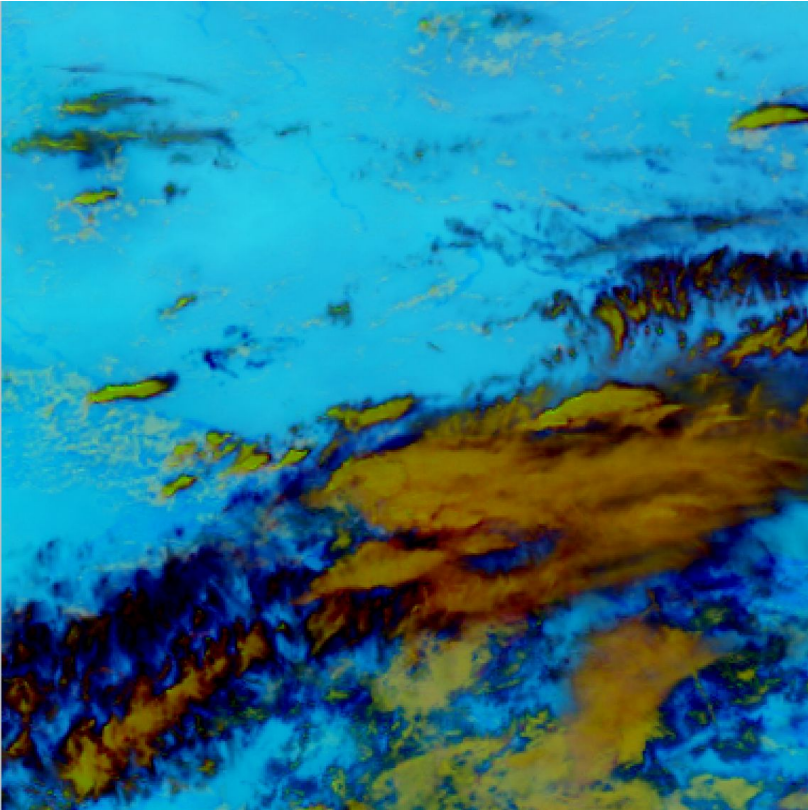


The next few slides show the opposite case. Here we have a dark object, but it does not move with time.

This is a good sign that it is not a contrail. Likely it is an object on or near the ground, unaffected by wind.

Once again you can page through quickly to get a sense of how things change with time

Contrails move!

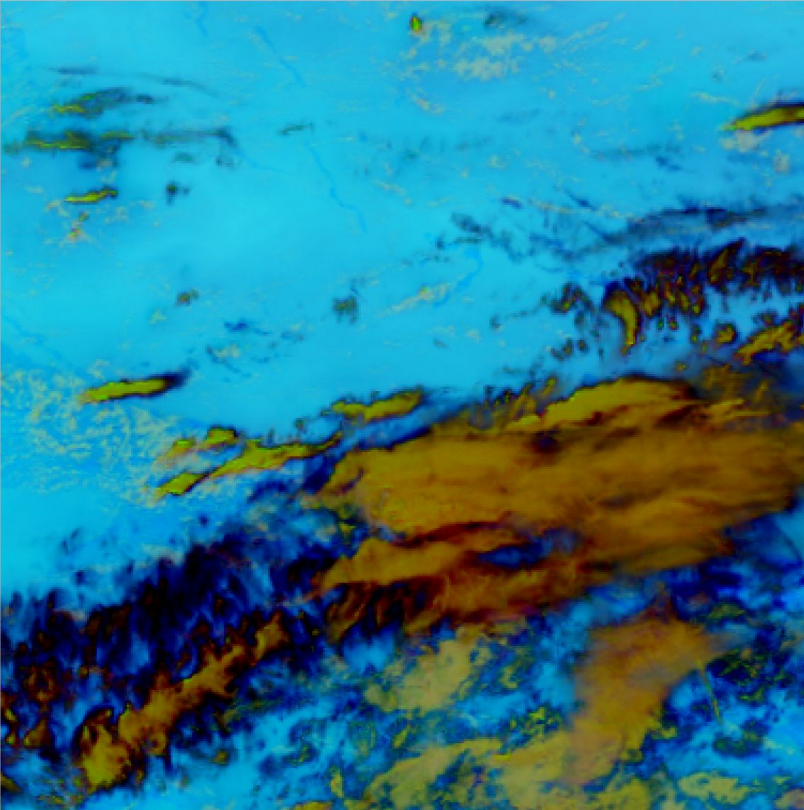


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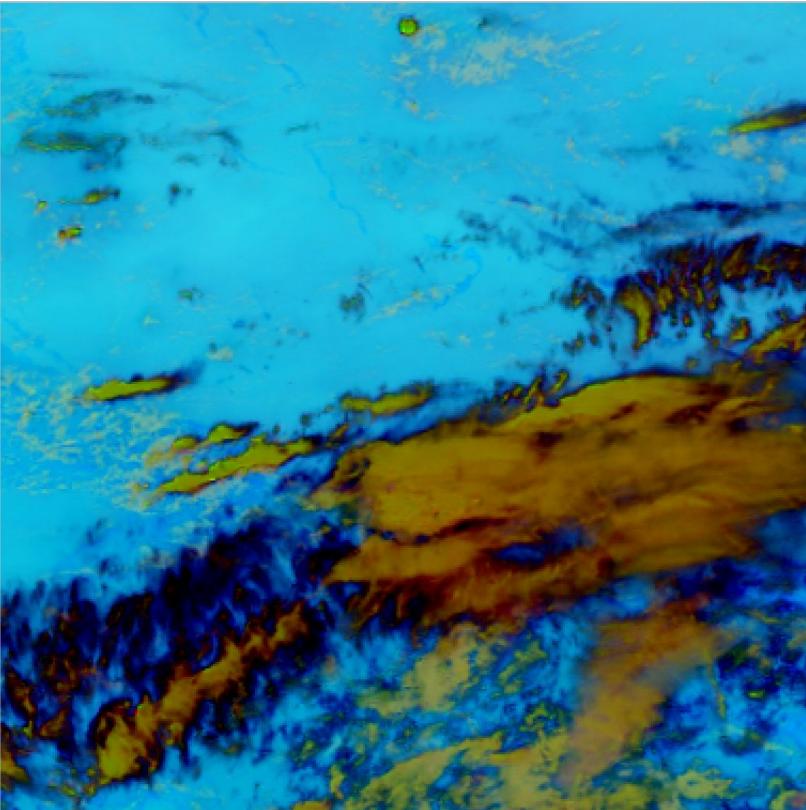


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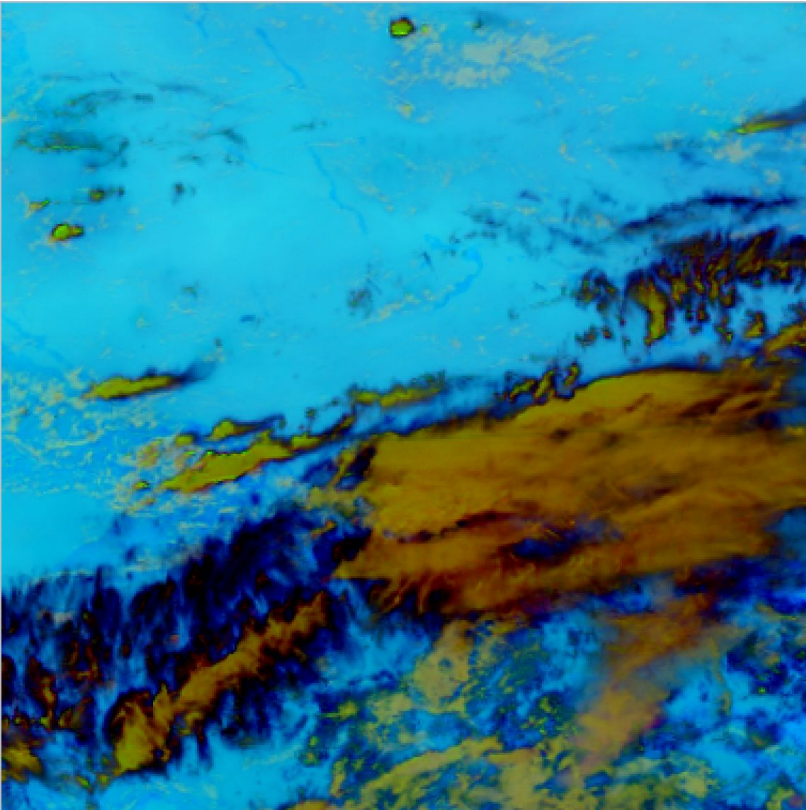


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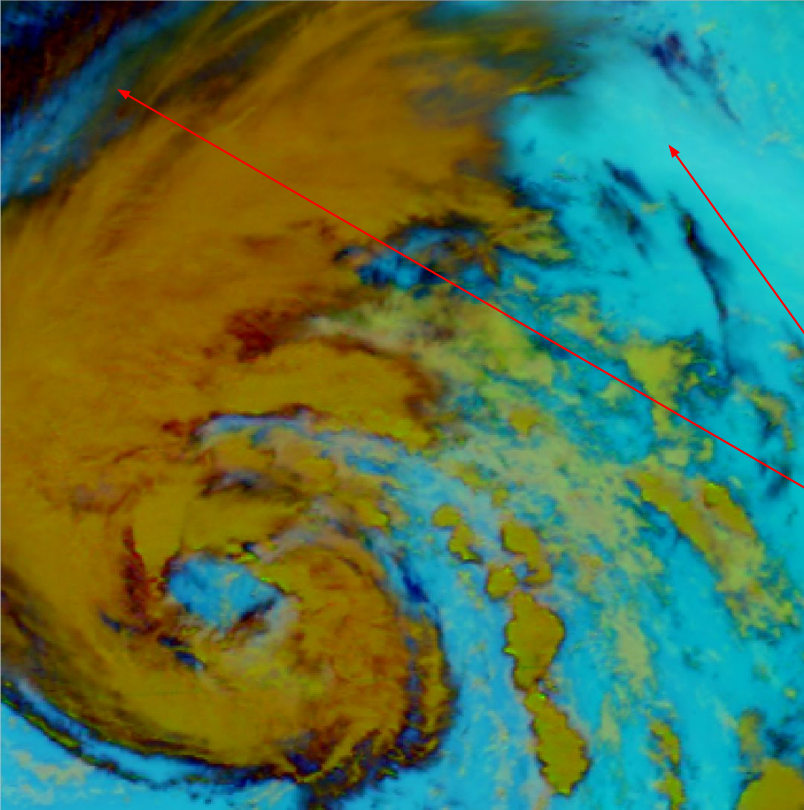


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Once again you can page through quickly to get a sense of how things change with time

Contrails appear quickly

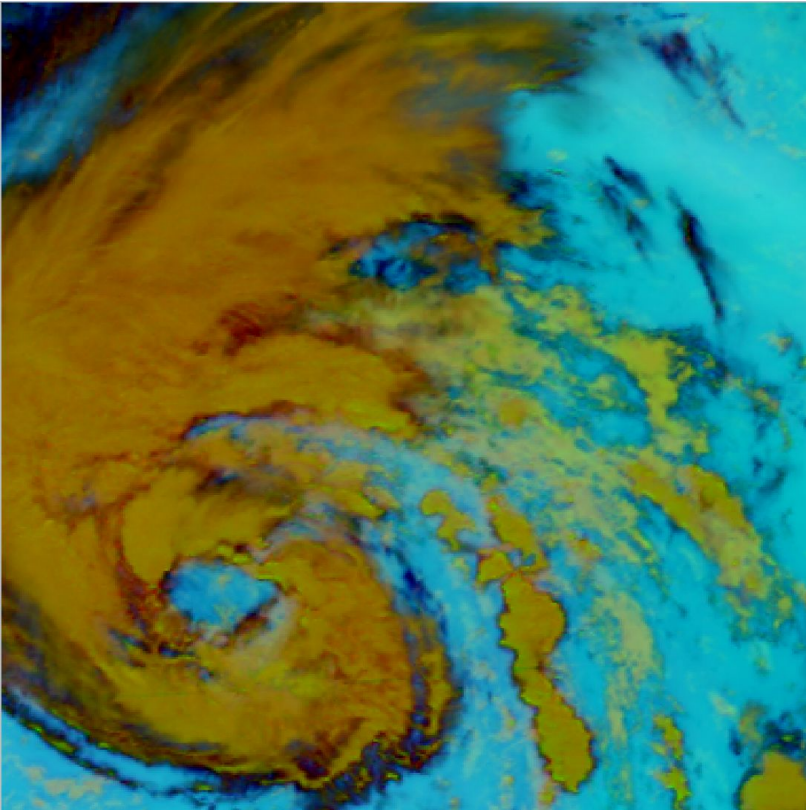


Airplanes move really fast, which means that in these images contrails appear essentially instantly

The image on the left doesn't contain any contrails. Scroll into the next few slides to see contrails appear spontaneously

Watch these areas!

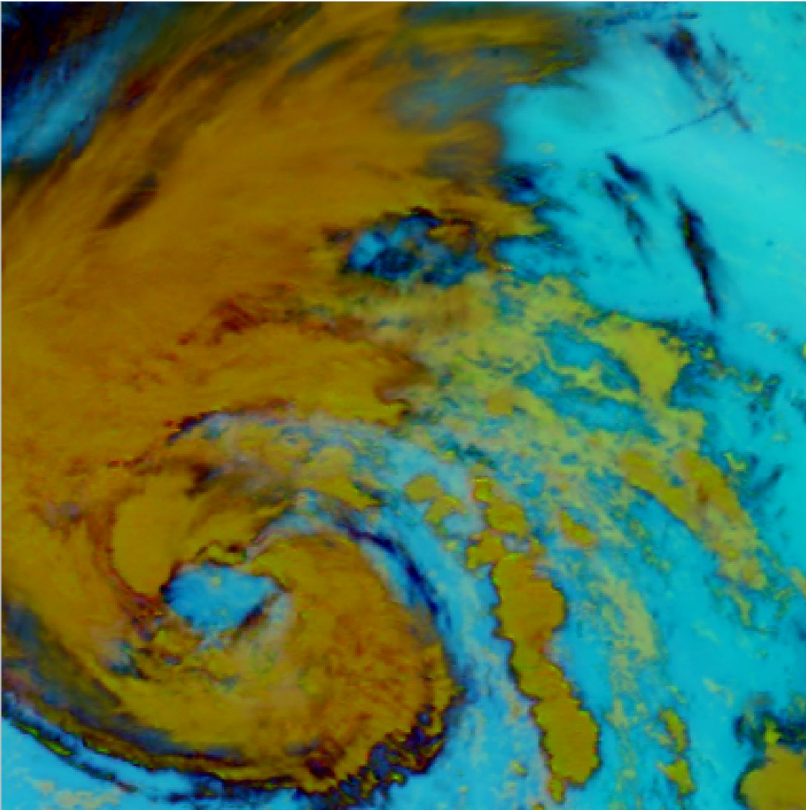
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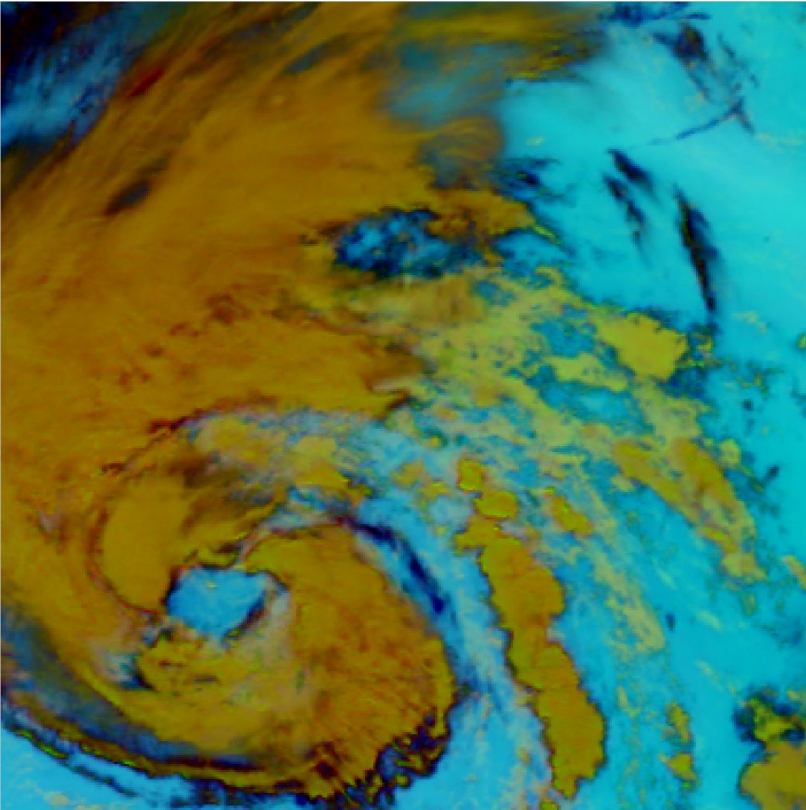
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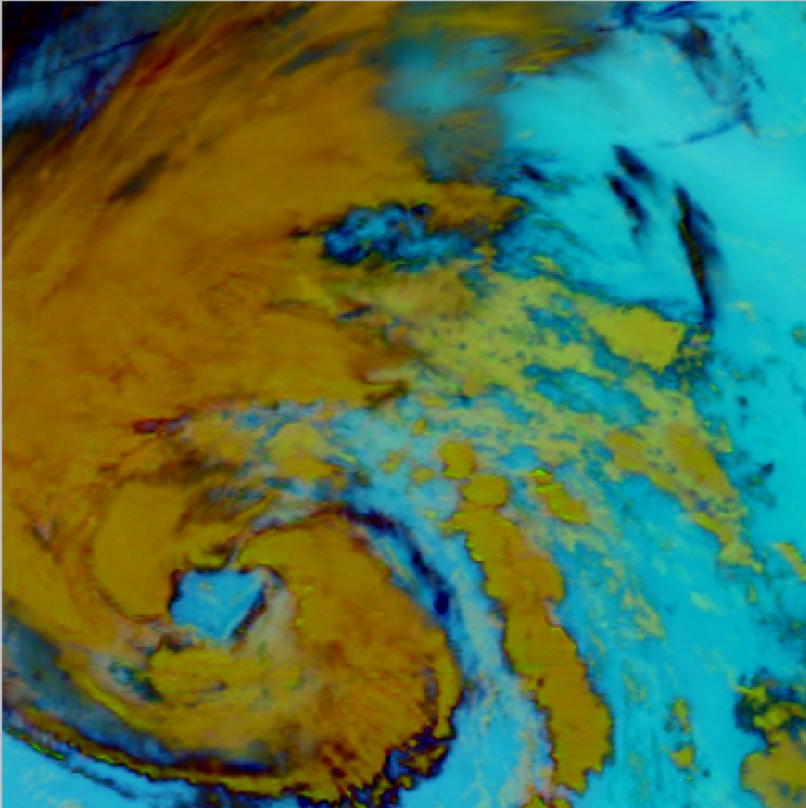
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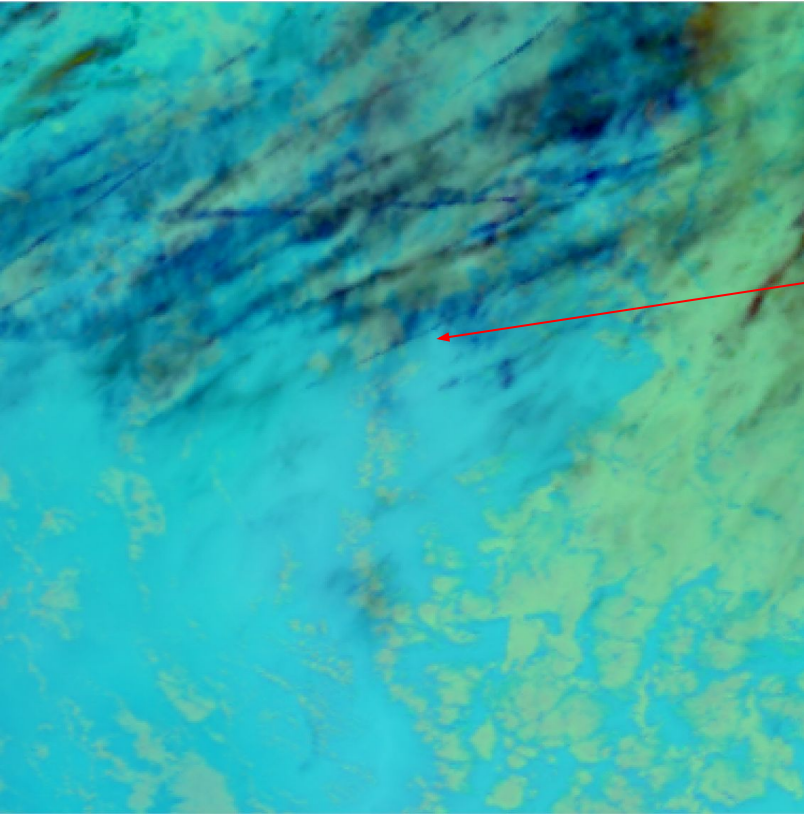
Contrails appear quickly



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Contrails get wider

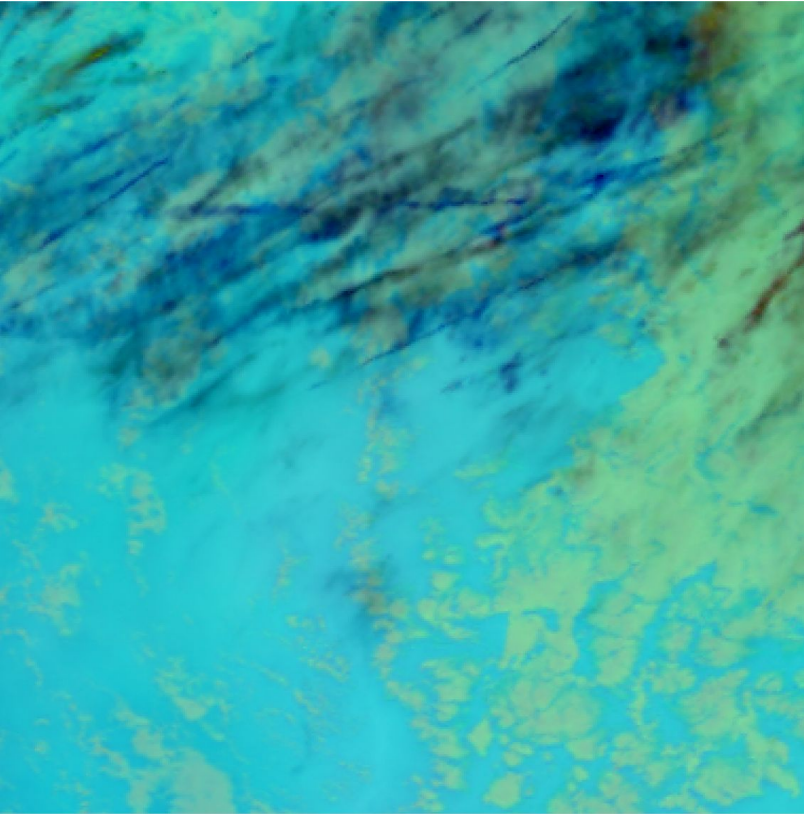


Contrails start as very sharp lines, over time they spread out

Over the next few slides you can watch a thin line get wider and wider

You can label the spread out contrails, but you should have seen them as sharper contrails in the past

Contrails get wider

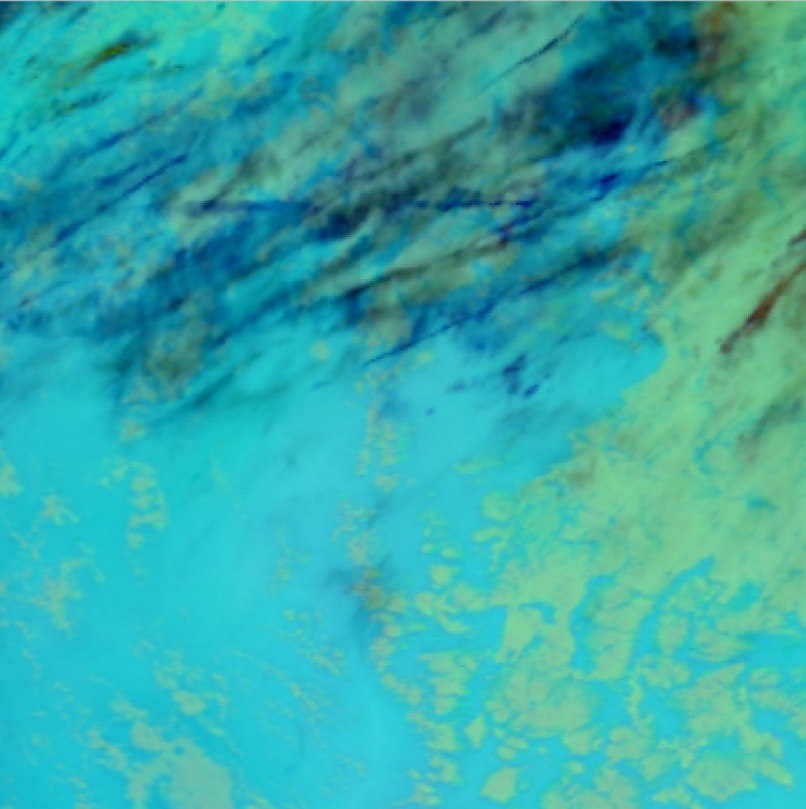


Contrails start as very sharp lines, over time they spread out

Over the next few slides you can watch a thin line get wider and wider (there are lots of other contrails in this image as well)

You can label the spread out contrails, but you should have seen them as sharper contrails in the past

Contrails get wider

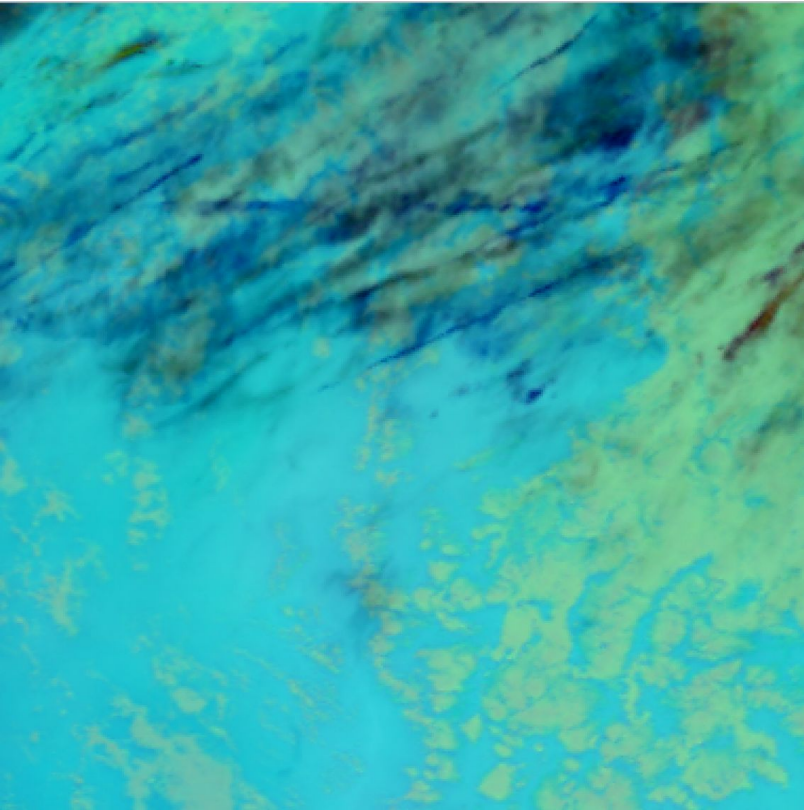


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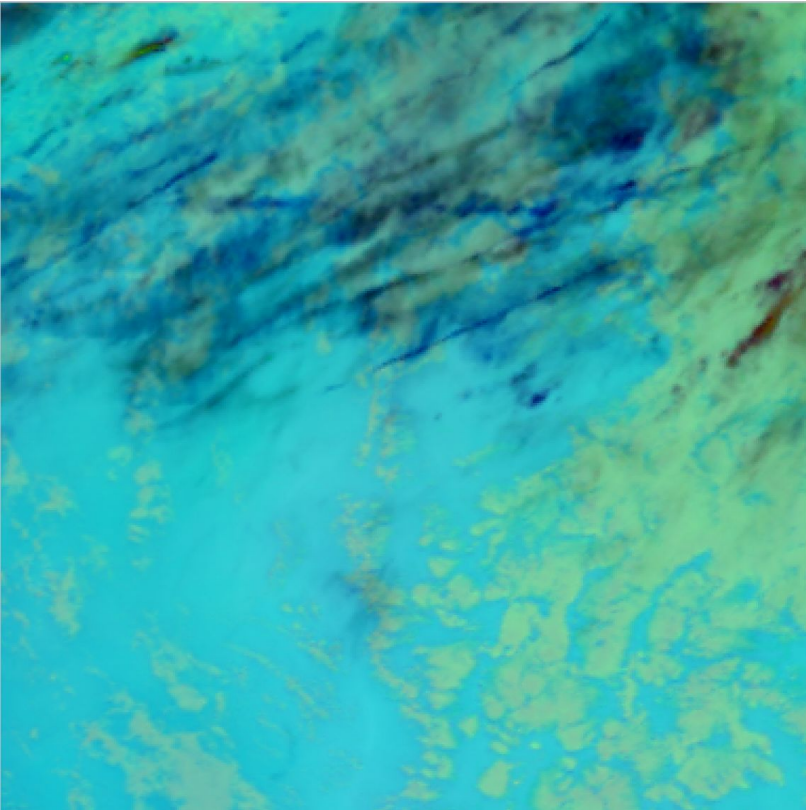


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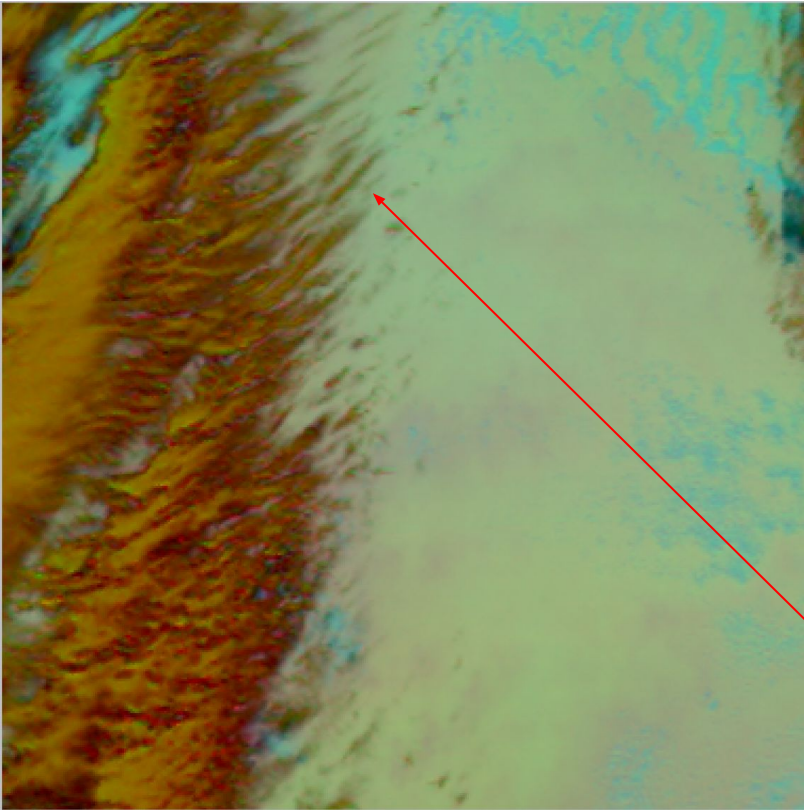


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Contrails dissipate

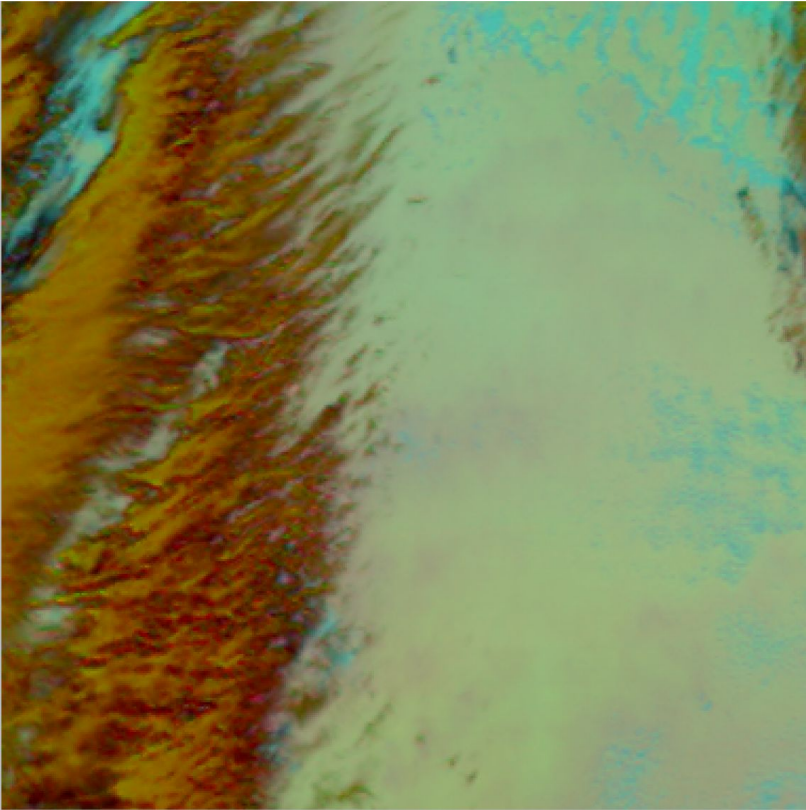


Sometimes there are objects which look like dark lines. However if they don't appear instantly, and they don't spread, they may not be contrails

In the next few slides you can see how the wind has blown part of a larger cloud into a linear object. This linear object didn't appear instantly, and it gets sharper over time instead of spreading out. It is not a contrail

Watch this part of the big cloud turn into something that looks like a contrail, but isn't (and shouldn't be labelled)

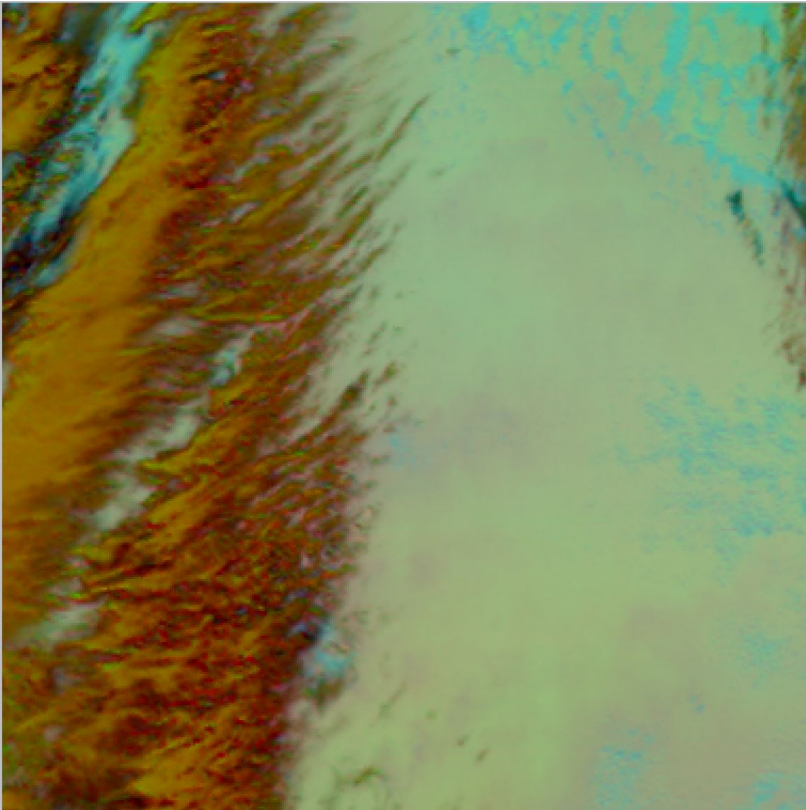
Contrails dissipate



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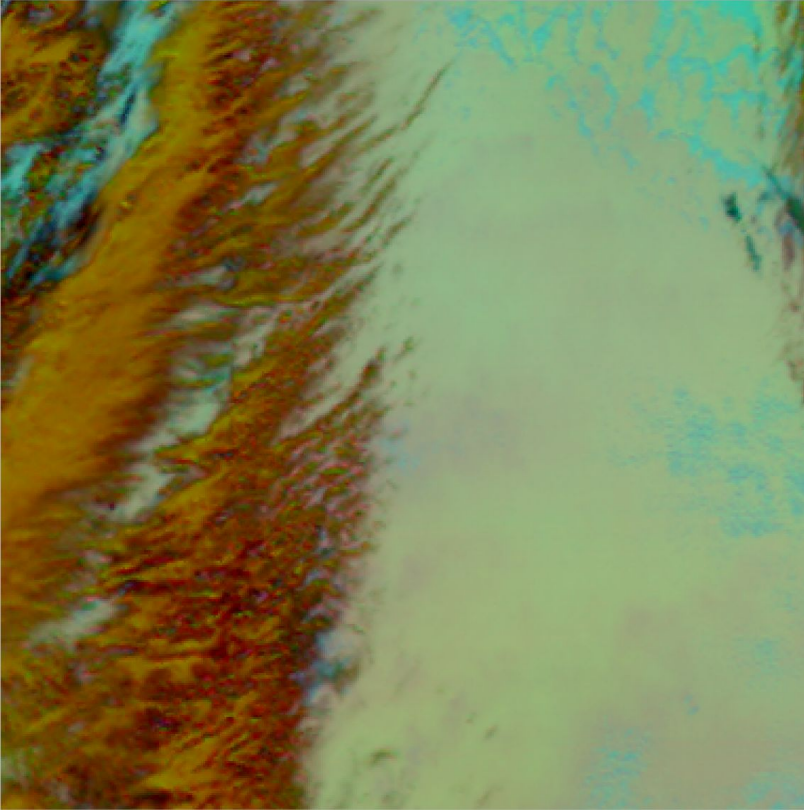
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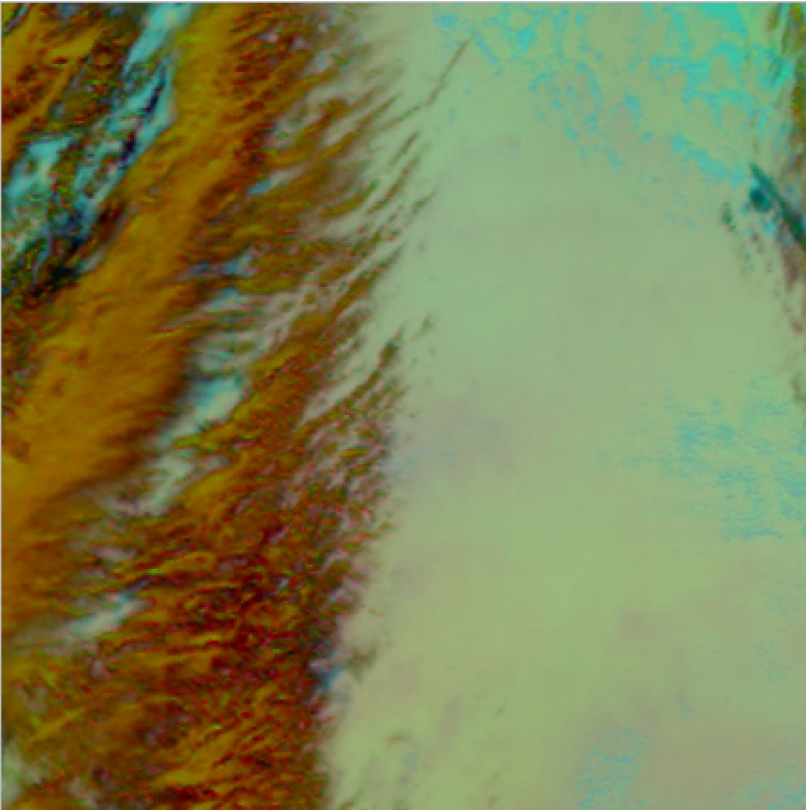
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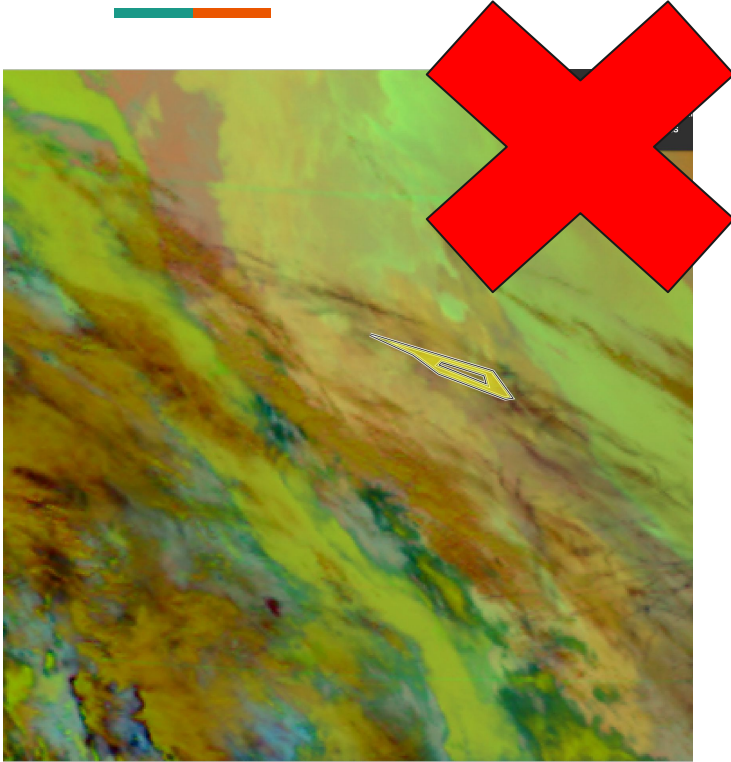
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Rules for contrail labelling



- Contrails must contain at least 10 pixels
- At some time in their life, Contrails must be at least 3x longer than they are wide (generally longer is better). This requirement does not need to be met in every image the contrail is in, but it should be met in at least 1
- Contrails must either appear suddenly or enter from the sides of the image
- Contrails should be visible in at least two image (and more images is better)

No holes



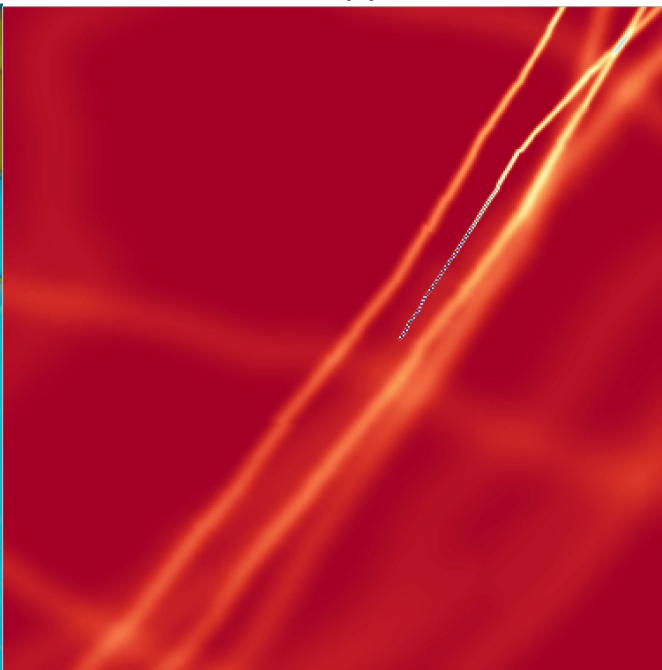
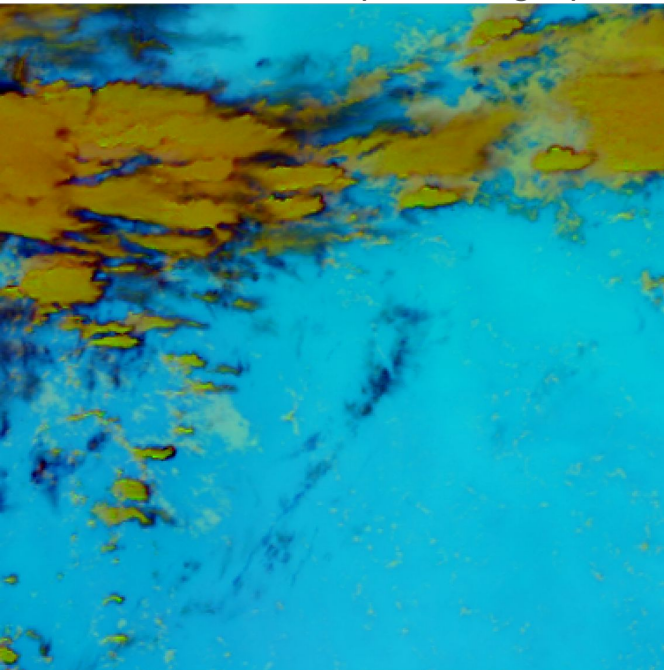
It's possible to use the labelling tools to add holes inside of the label polygons

Contrails are linear objects and do not have holes

Do not draw holes inside any of the polygons

Reference image: flight paths

For reference, we provide flight paths. Contrails are formed by planes, and will likely match a flight path



Most images will have lots of flights

But some will not have any near a potential contrail

If no flight path is found, you should be very (>90%) sure something is a contrail before labelling

If a flight path is found, you only need to be 60% sure

(Flight paths are from <http://flightaware.com>)

Reference



- [Evolution of a contrail](#)