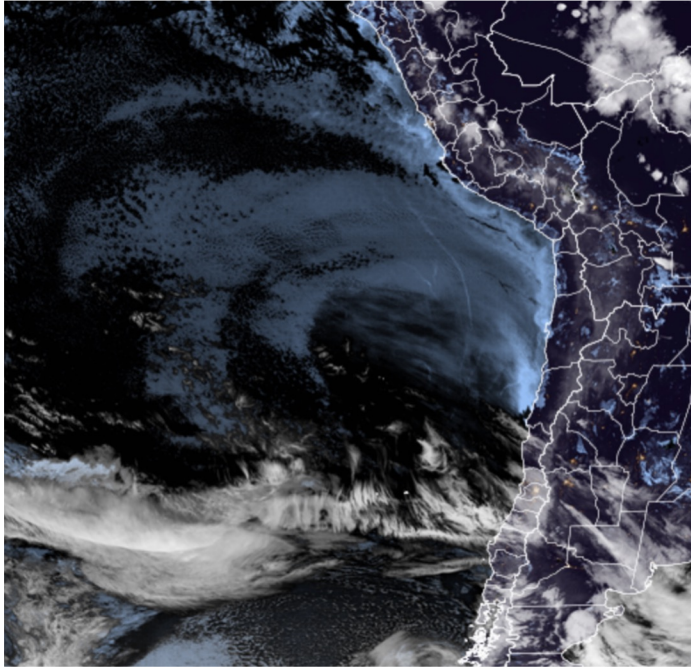




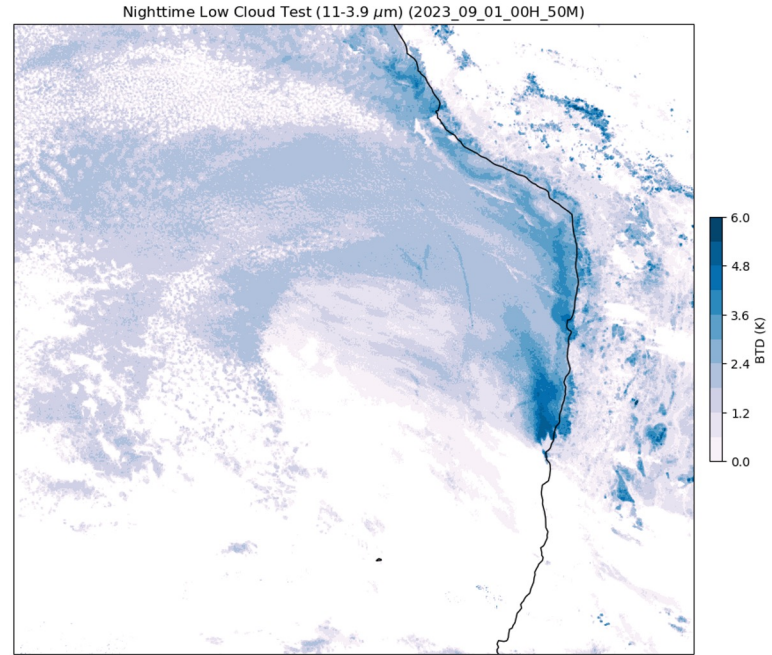
False Alarms in the Satellite-Based IR Difference

When maritime low clouds are overstated at night

At night, the 11-3.9 μm BTD is used to spot low clouds

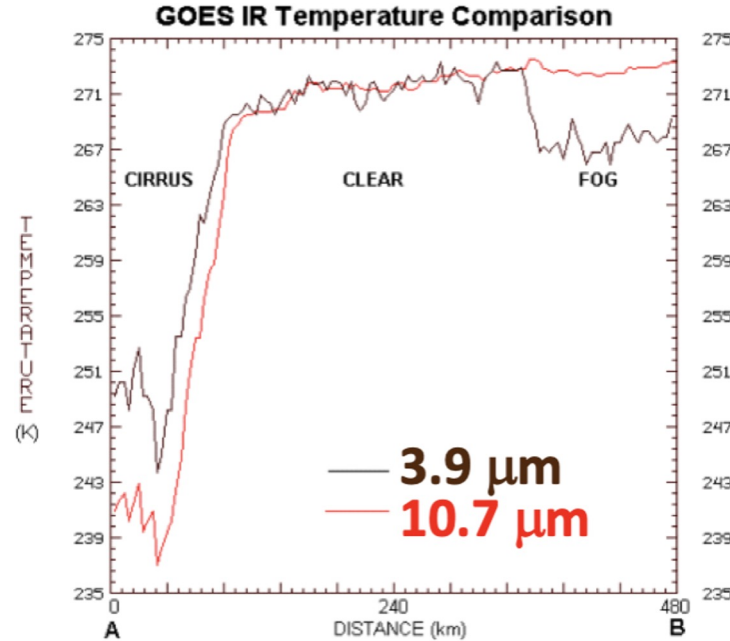


GeoColor



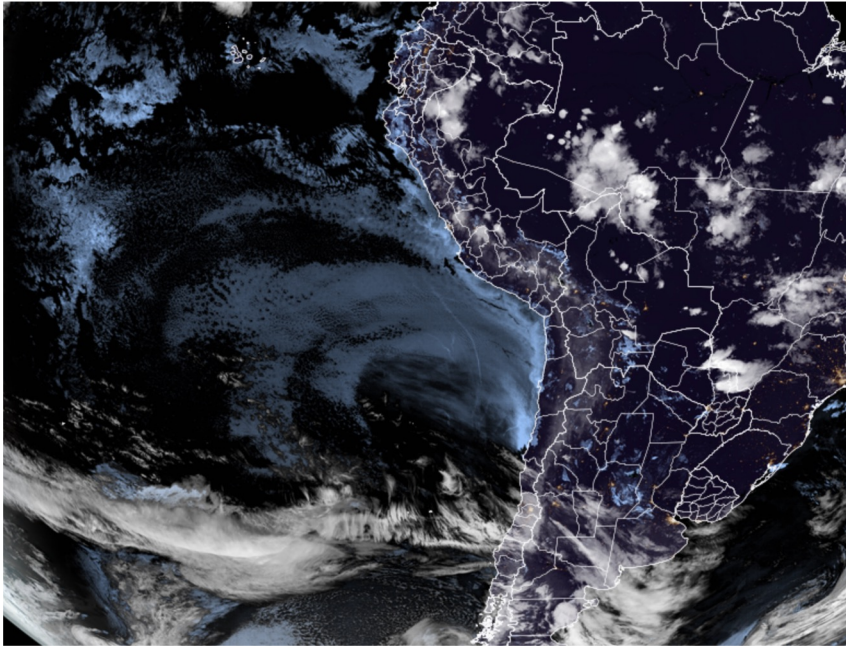
11-3.9 BTD

The BTD works because the two bands respond to cloud differently

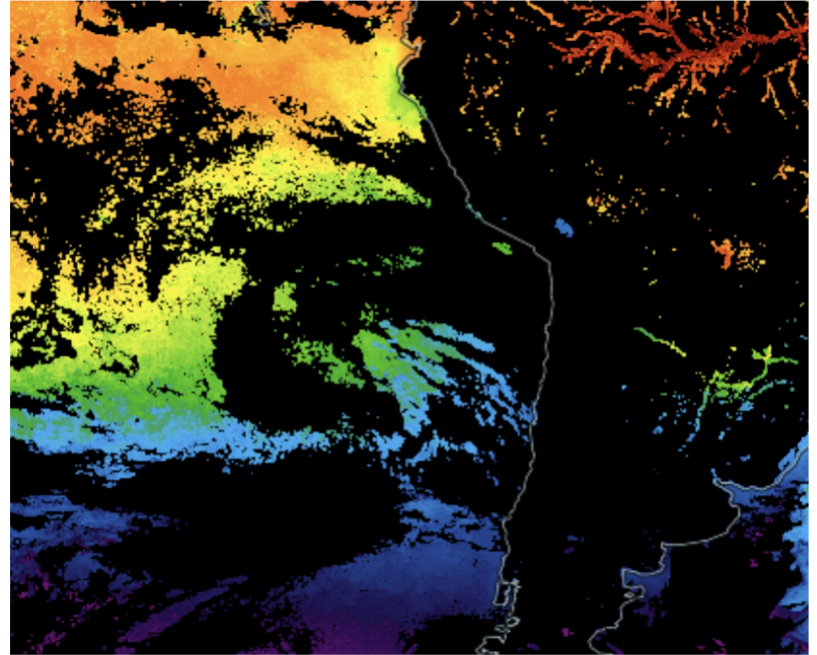


[CIMSS Night Fog Difference - Quick Guide](#)

IR methods help determine cloud masks for sea surface temperature products



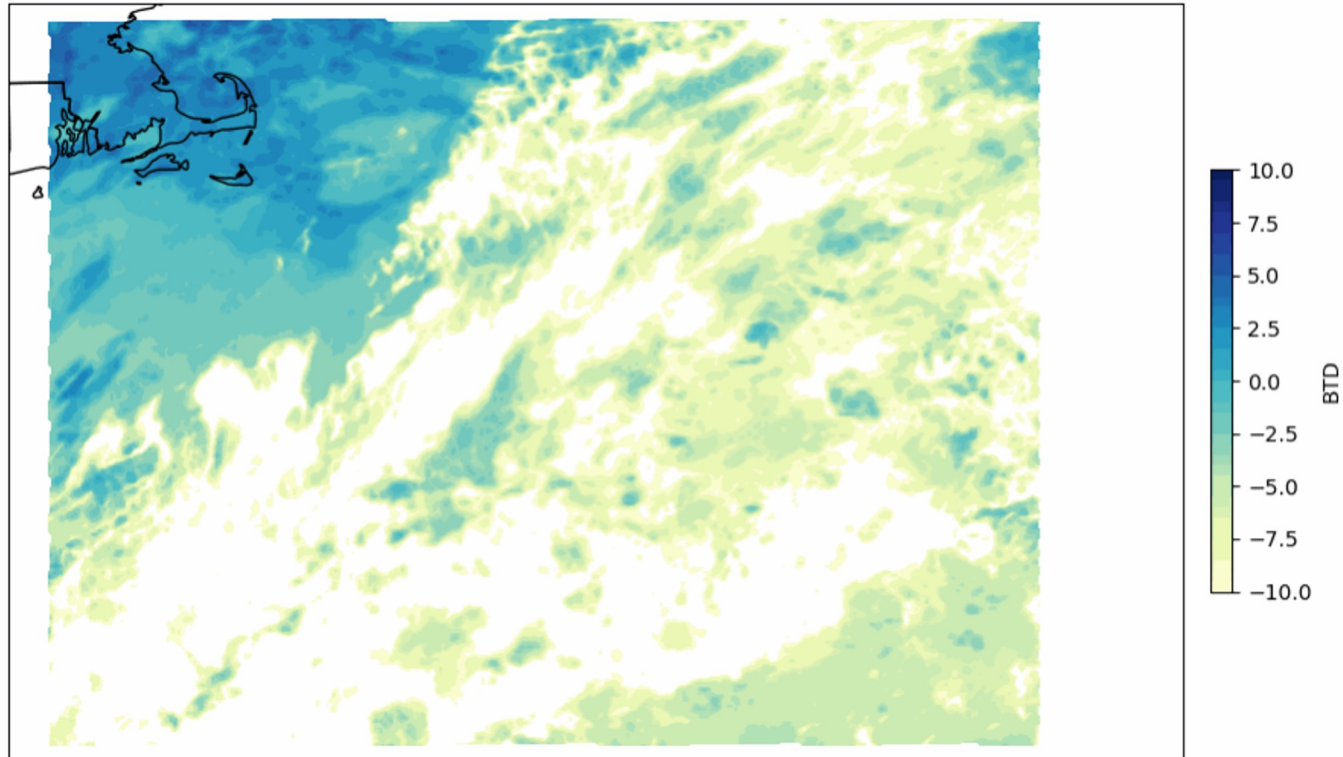
GeoColor (ABI)



Sea Surface Temperature ([MODIS + VIIRS](#))

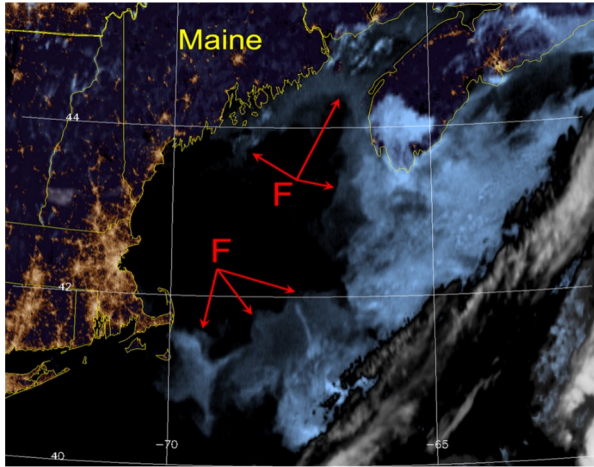
Sometimes, low clouds are suspicious

ABI BTM (11-3.9) 2022_09_14_00H_00M

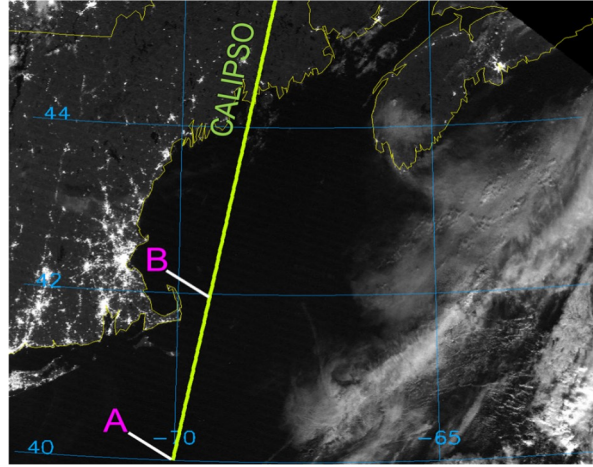


[Backup](#)

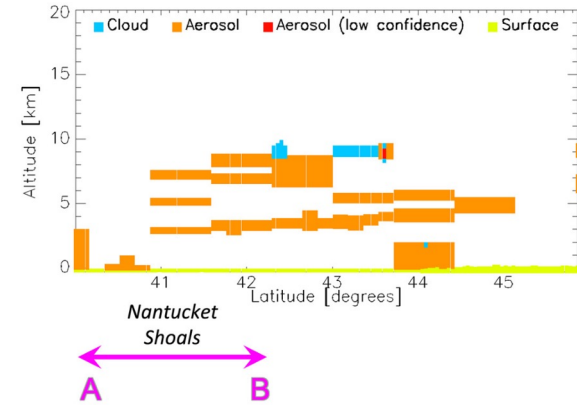
Is this fog? Or an error in the low cloud method?



GeoColor (ABI)

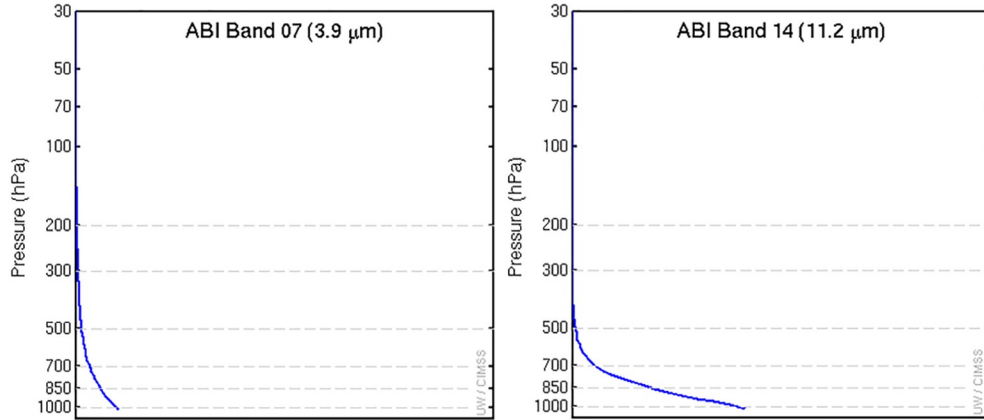


Day Night Band (VIIRS)

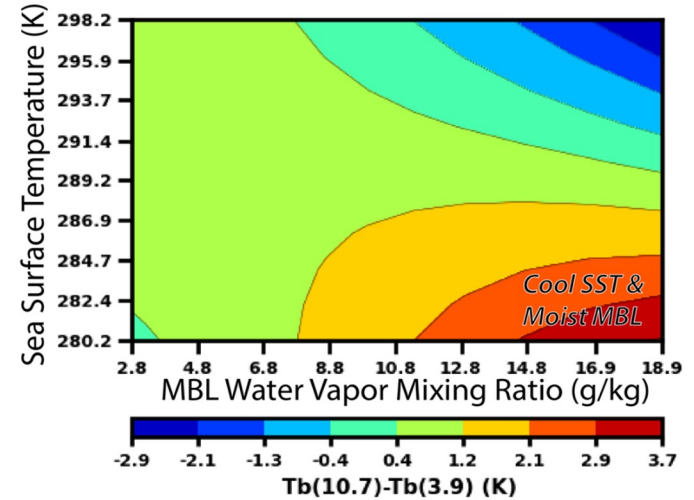


CALIOP (CALIPSO)

What could cause this false low cloud (FLC)?



Weighting functions for the wavelengths used in the low cloud test



CRTM simulations for a range of environments

Where does this cool water under warm moist air occur?

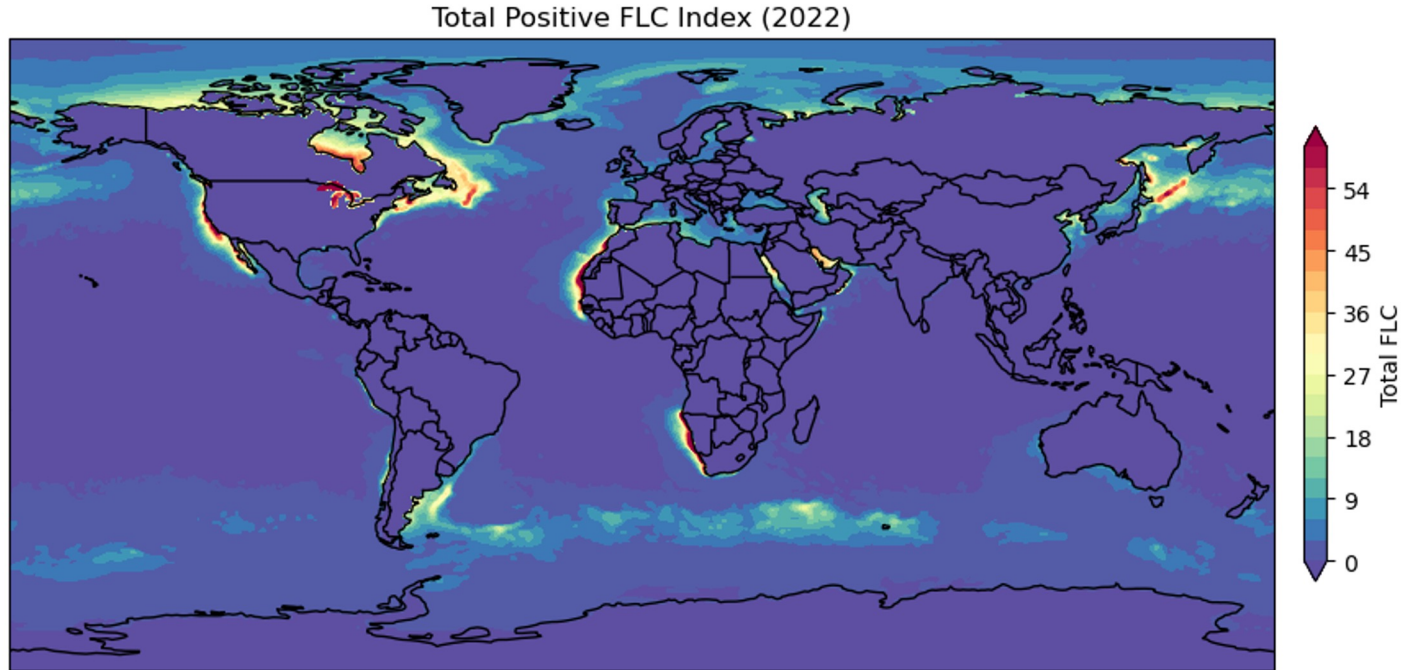
Creating a “false low cloud index”

- NOAA High-Resolution SST Analysis
- NOAA Global Forecast System Model
 - Atmosphere temperature was averaged over the MBL
 - Max specific humidity in the MBL
 - Marine boundary layer (MBL) limited to pressures > 850 mb

$$\text{FLC Index} = \text{Normalized}(\text{MBL Temp} - \text{SST}) \times \text{Normalized}(\text{Specific Humidity})$$

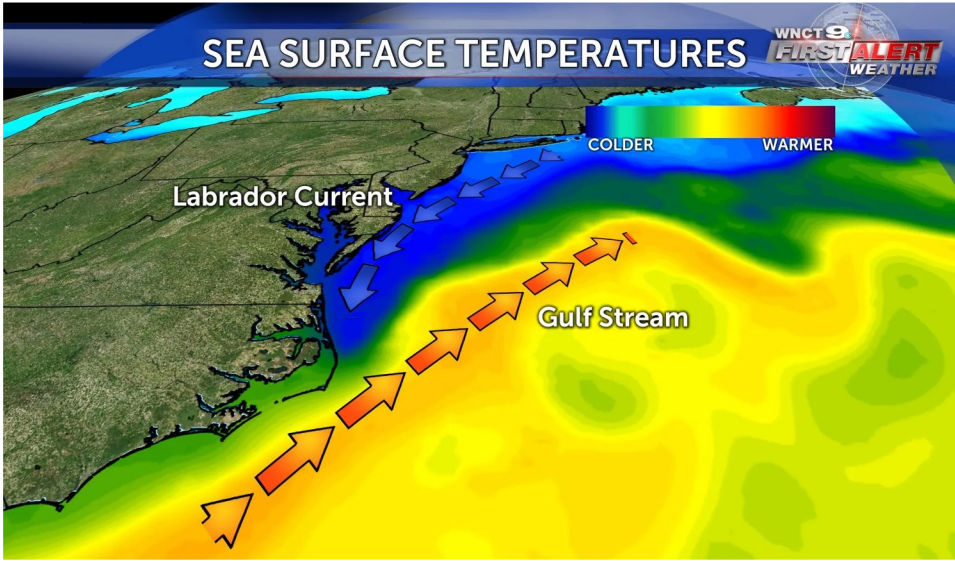
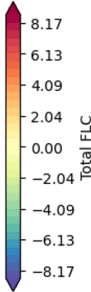
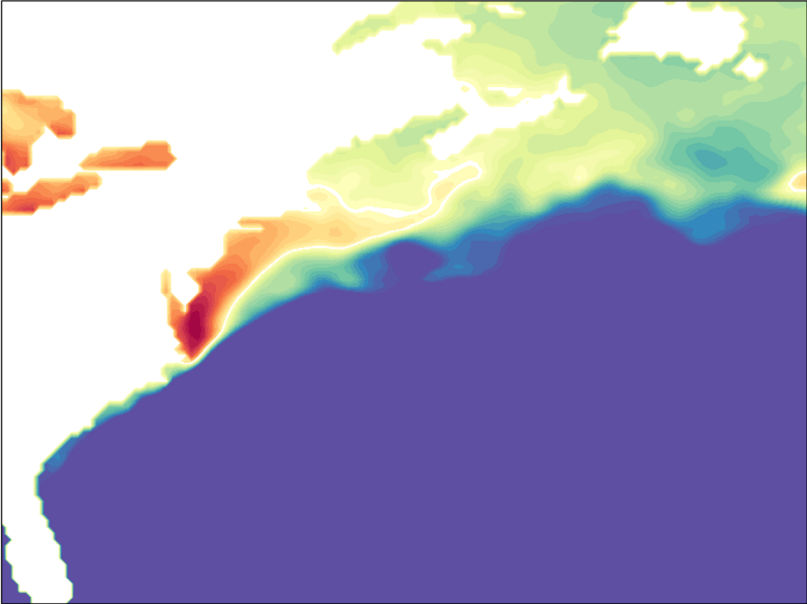
Where does this cool water under warm moist air occur?

Lakes, outflows, upwelling, cold currents, etc



FLC caused by the Gulf Stream

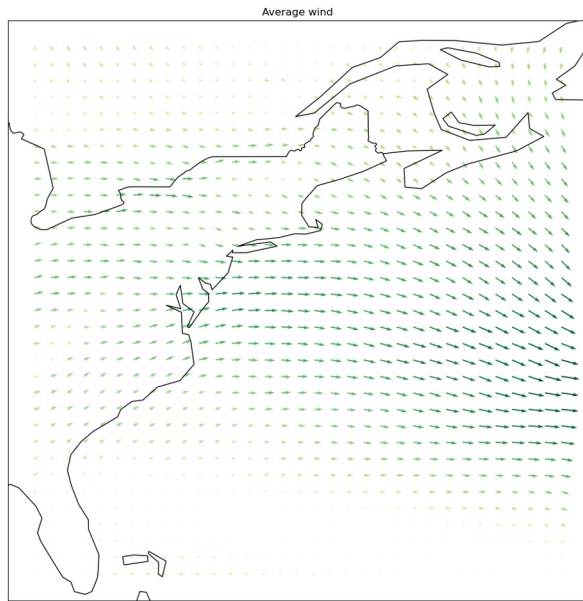
Total FLC Index



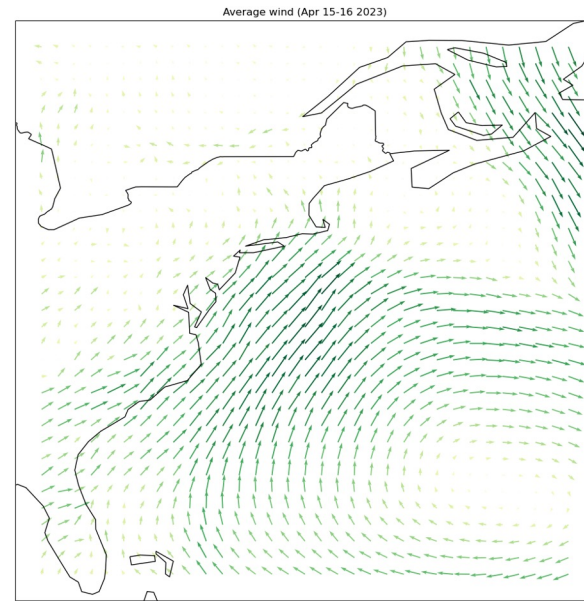
Credit to WNCT First Alert Weather

FLC caused by the Gulf Stream

In order to achieve warm air over cool water, we need a northern wind:

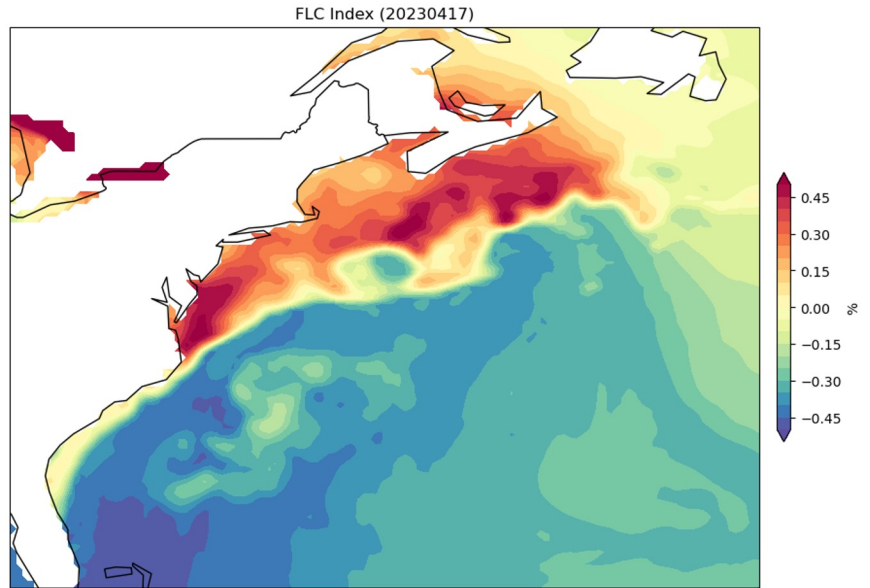
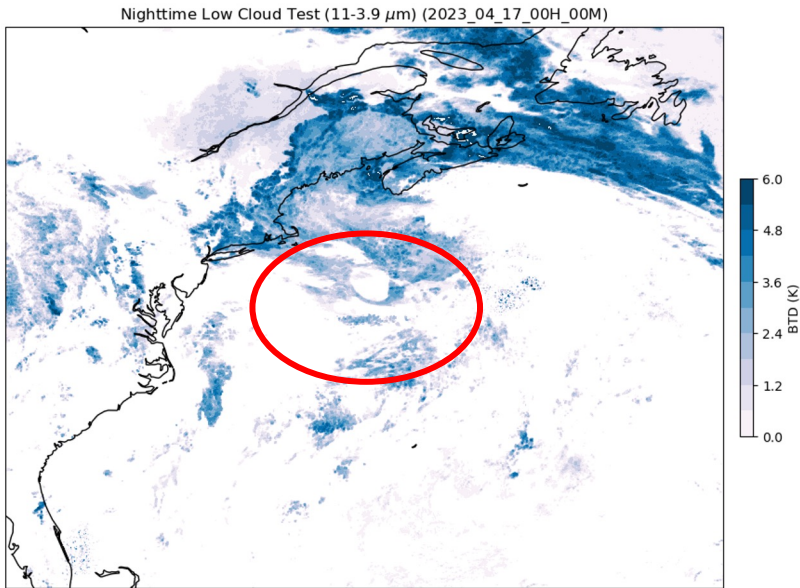


Non-FLC wind



Strong FLC wind

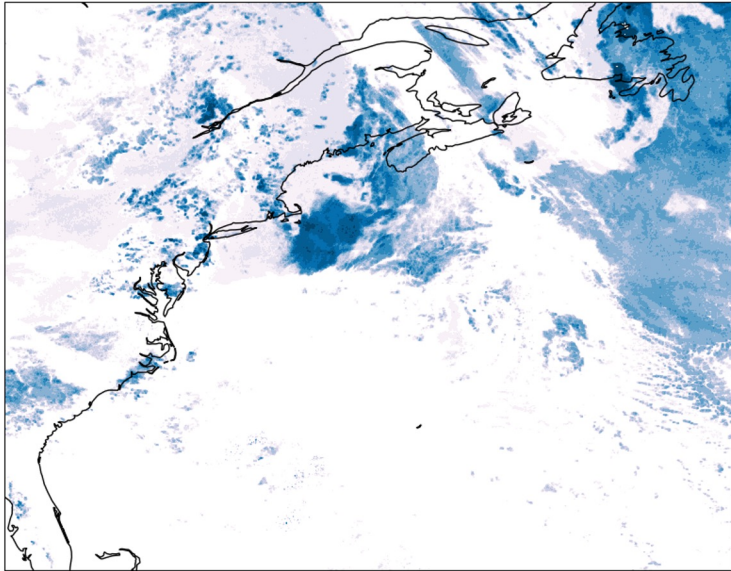
FLC caused by the Gulf Stream



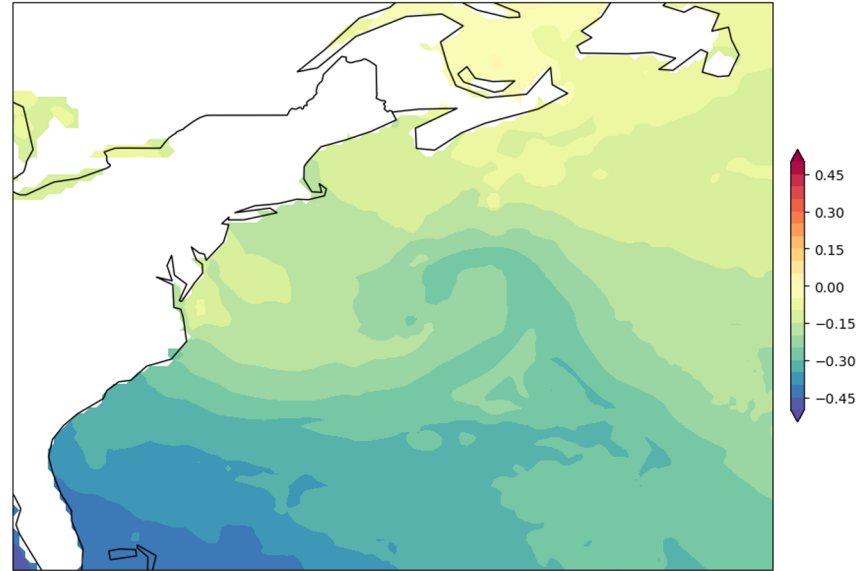
False clouds often reflect eddy features from the Gulf Stream

FLC caused by the Gulf Stream

Nighttime Low Cloud Test (11-3.9 μm) (2023_04_27_00H_00M)



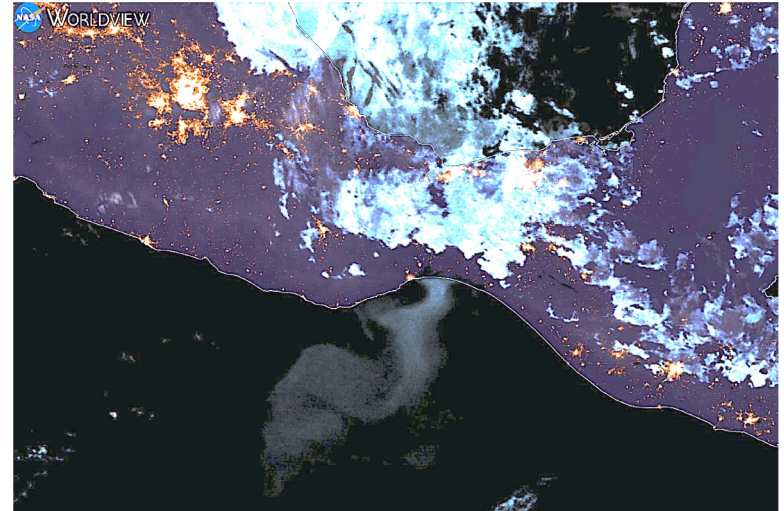
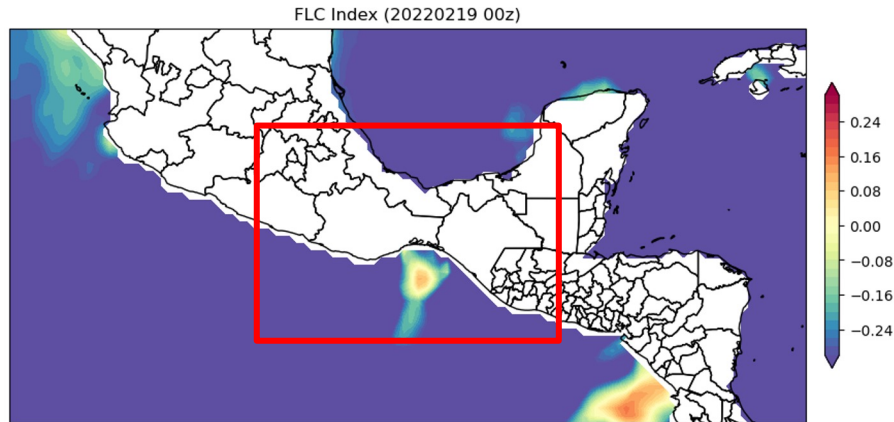
FLC Index (20230427 00z)



Without FLC ingredients, the Gulf Stream features are invisible

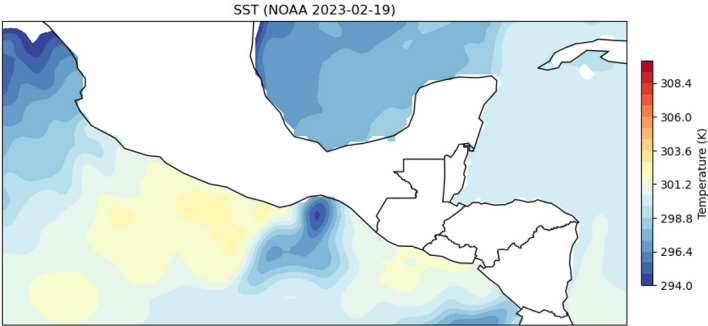
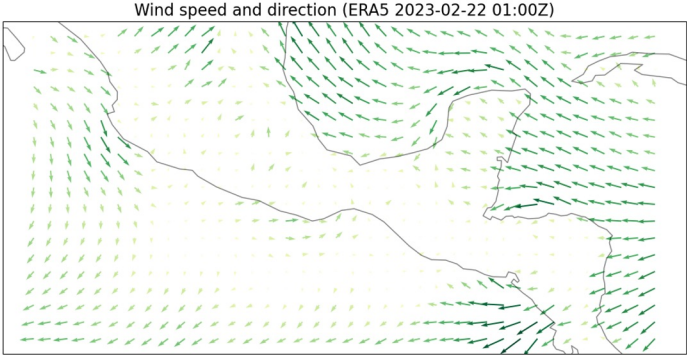
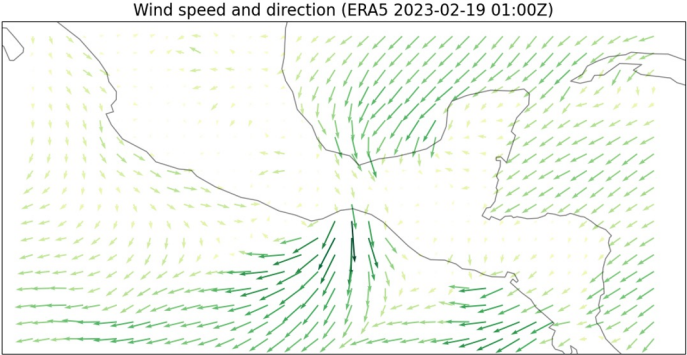
FLC caused by lakes and mountains in Oaxaca

Possibly cold water outflow from snowmelt

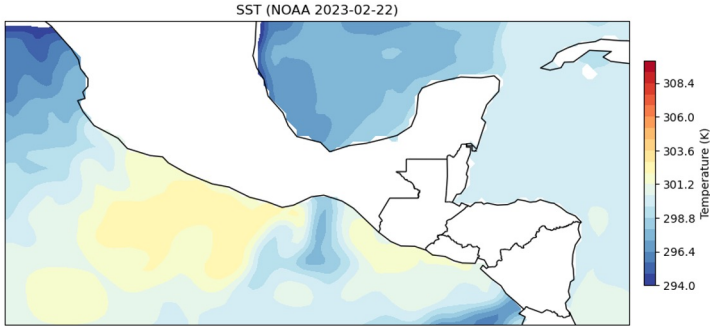


FLC caused by lakes and mountains in Oaxaca

Gap winds push warm water, causing upwelling of colder water

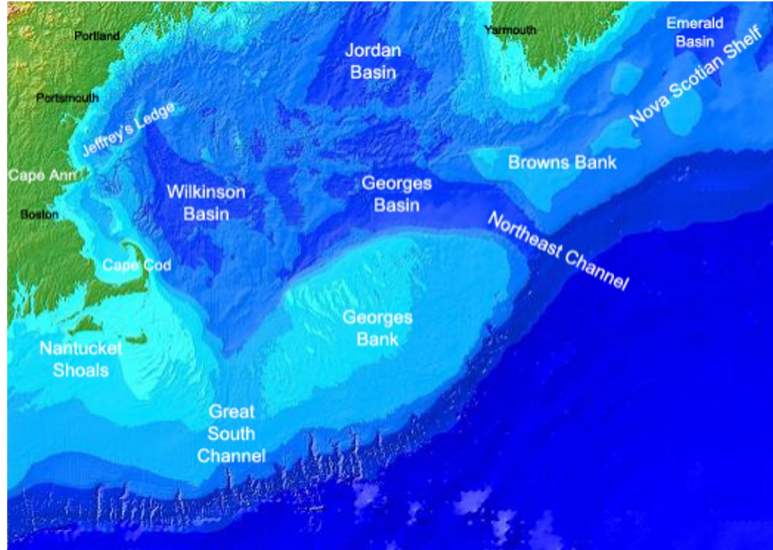


FLC case

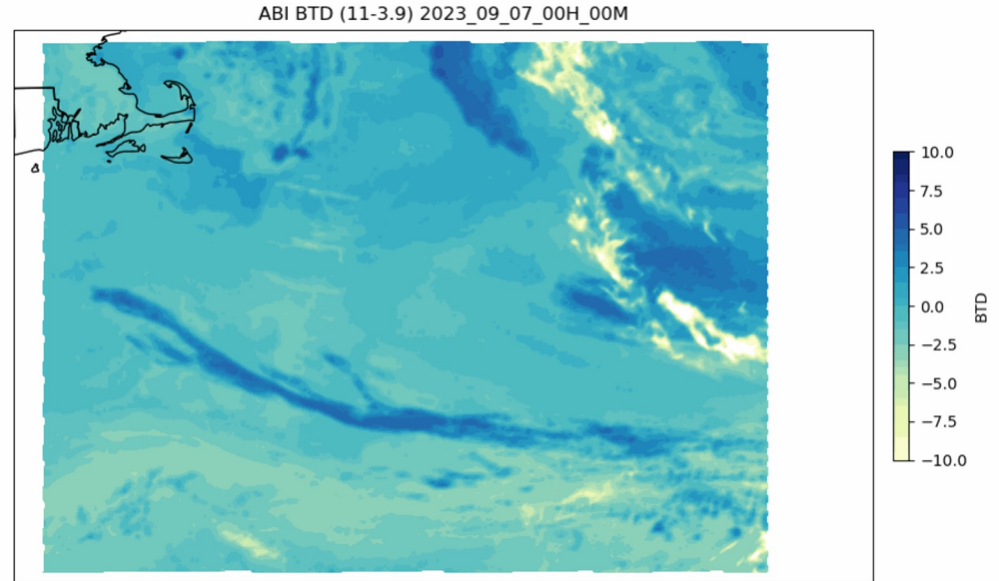


null case

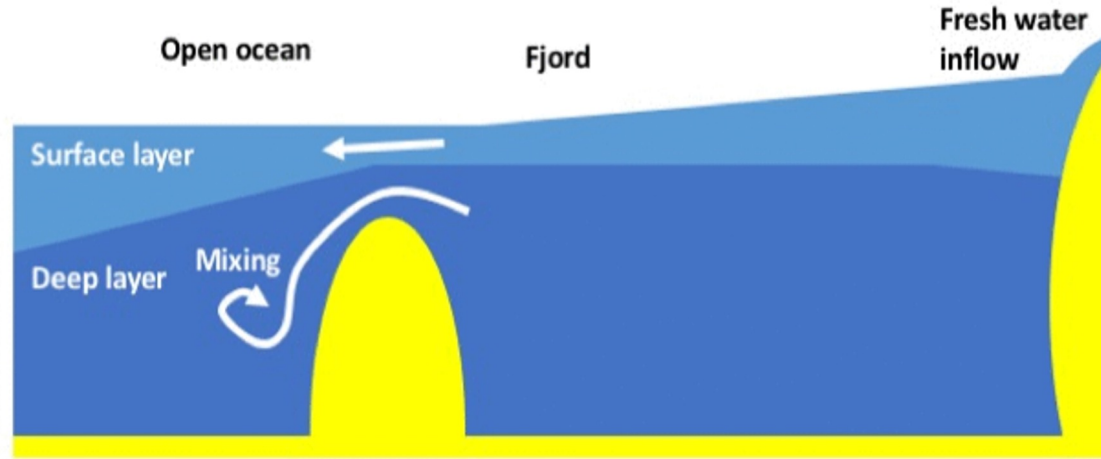
FLC caused by tidal mixing



NOAA US Geological Survey



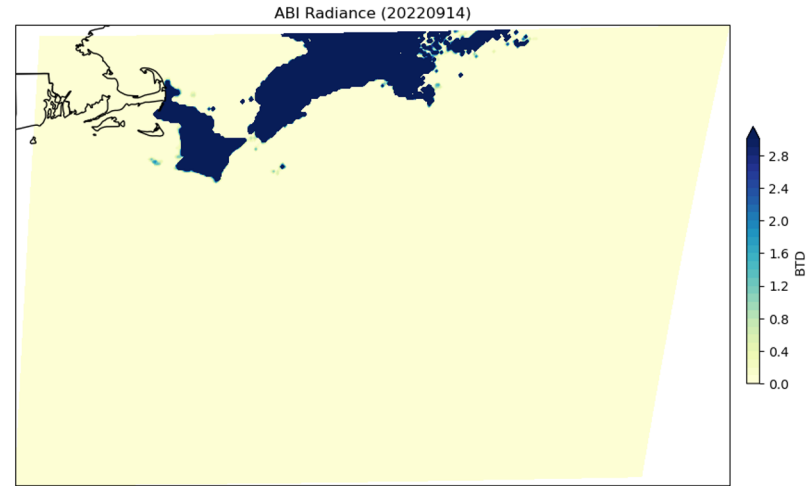
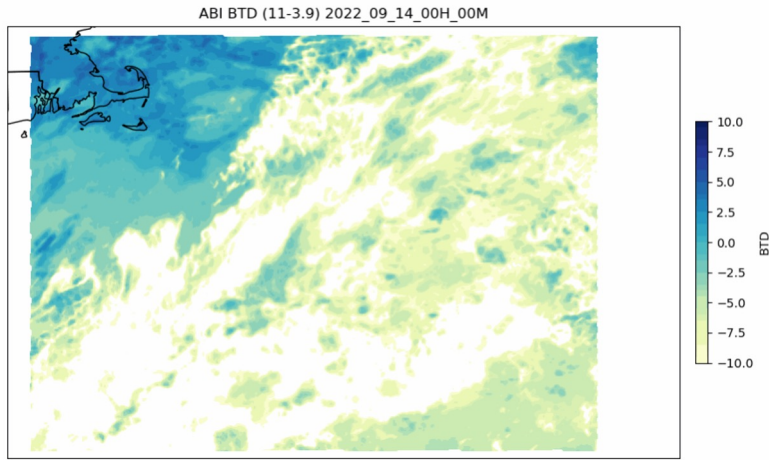
FLC caused by tidal mixing



[Mirjam Glessmer \(Lund University\) blog](#)

FLC caused by tidal mixing

The static features in the image can help identify the extent of these signals





Summary and next steps

Summary

- The standard nighttime low cloud test (11-3.9um) predictably causes false alarms in certain regions
- Regions with strong sea surface temperature gradients are most susceptible to false low cloud signals
- This can occur from currents, upwelling, outflow from lakes and rivers, etc



Summary and next steps

Next Steps

- Are the FLC signals causing a bias in the SST data record in certain regions?
- Can the FLC index be repurposed in order to identify potential regions of real fog and low cloud?

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