

# SIFTing through imagery with the Satellite Information Familiarization Tool

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# Why “SIFT”?

- SIFT is the Satellite Information Familiarization Tool.
- “Whatever may be the limitations which trammel inquiry elsewhere we believe the great state University of Wisconsin should ever encourage that continual and fearless sifting and winnowing by which alone the truth can be found.”
  - Taken from a 1894 Report of the Board of Regents

# SIFT...

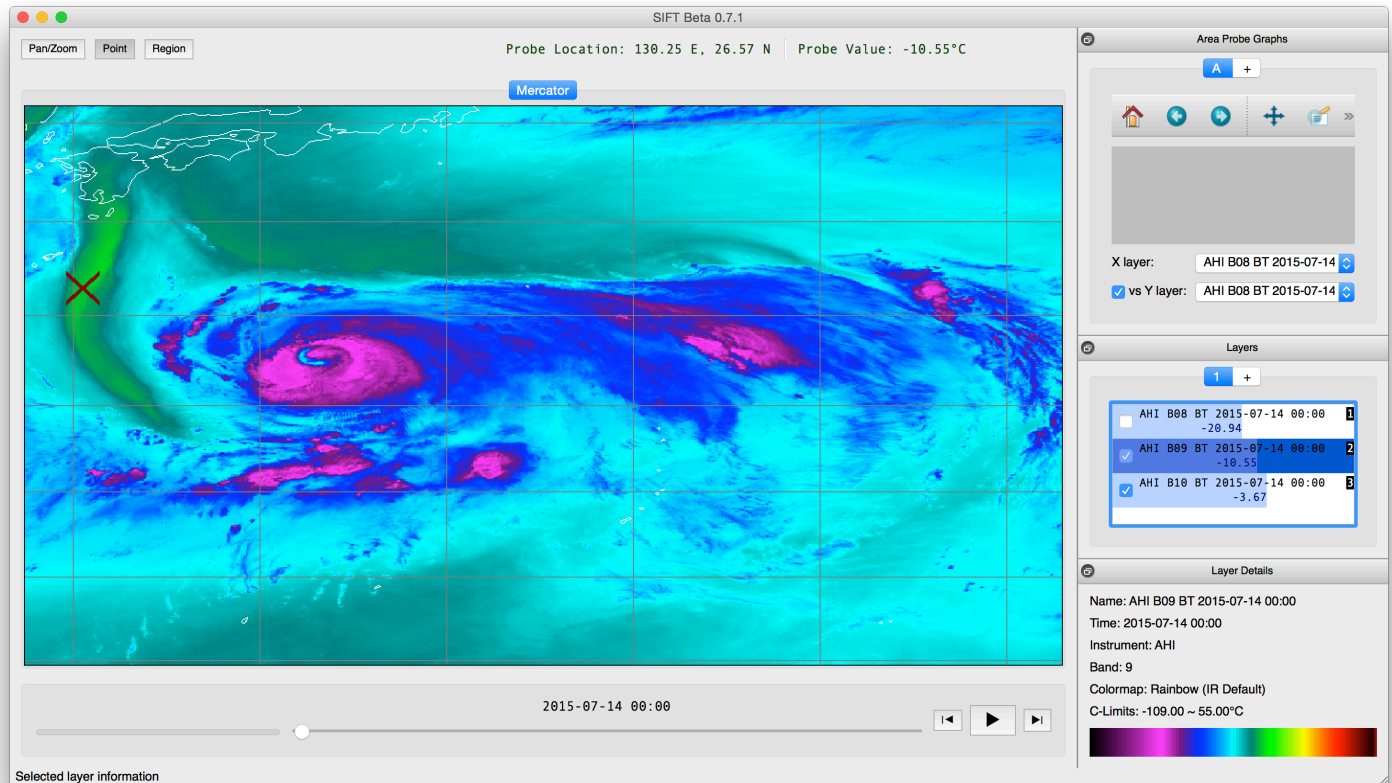
- Provides an intuitive workspace to display loops of multi-spectral imagery from advanced geostationary imagers quickly, at high resolution, with panning and zooming capabilities.
- Runs on three major operating systems.
- Requires pre-processed case data.
- Only displays satellite imagery (and in the future, derived products).
- Can be used as a training aid to sample pixels and compare different spectral bands over regions.

# SIFT...

- Was built with Python and PyCharm
  - Numerous open source packages: Numpy, Matplotlib, SciPy, Numba, PyProj, VisPy, PyOpenGL, NetCDF4, H5Py, Pillow, PyShp, Shapely, Rasterio, GDAL
- Supports Mercator projection only (current pre-release)
- Reads GeoTIFFs (current pre-release)
- Determines reflectance or brightness temperature for all loaded bands with user-dropped point probe
- Creates histograms (single band) and density maps (two bands) based on user-defined polygon



# SIFT Example



# History of SIFT

- The idea came during the training workshop in Miami on polar-orbiting satellite imagery in February 2015.
- SSEC's training tool for that course, the Hyperspectral-viewer for Development of Research Applications (HYDRA), could not loop imagery.
- A decision had to be made whether to further develop HYDRA or create a new tool.
- Ultimately, SSEC decided to propose a new tool and have it ready to train Guam in November 2015.
- Two developers worked feverously to get it ready.

# History of SIFT

- SIFT features came from three sources:
  - Existing capabilities in HYDRA
  - New capabilities necessary for imagery unique to geostationary satellites
  - Capabilities that enhance the training and learning experience
- These features were specifically proposed to the NWS and ultimately funded for development.
- NESDIS has interest in developing and using SIFT for additional purposes, and SIFT may ultimately become the visualization frontend for the Community Satellite Processing Package for Geostationary data (CSPP Geo).

# SIFT vs. WES

- SIFT is for use in concert with foundational training and early exposure to imagery as part of satellite-only case studies.
- SIFT itself does not provide training. It should help trainers present concepts (as part of lessons) and trainees cement concepts (as part of labs).

# SIFT vs. WES

- WES is for use in concert with applications training and comparing satellite imagery with other meteorological data as part of an operational workflow.
- The envisioned NWS training plan for GOES-R will use both SIFT and WES as trainees transition from foundational lessons to applications.

# Present State of SIFT

- The current SIFT version is 0.7.5. It is still beta software.
- A standalone installer is available for Windows. Instructions are available for Mac and Linux, but not publicly.
- The next incremental release will support the creation of Red-Green-Blue (RGB) composites.
- Subsequent development subject to funding.

# Upcoming SIFT Capability

The screenshot displays a web-based interface for satellite data visualization. The main window shows a map of the Indian subcontinent with a cyan outline. The interface includes a 'Pan/Zoom' section with 'Point' and 'Region' buttons, a 'Probe Location:' field with a 'Mercator' dropdown, and a 'Probe Value:' field. The 'Layers' panel on the right shows a list of satellite data layers:

Layer Name	Time	Order
<input type="checkbox"/> R: B05 G: B04 B: B03		
<input type="checkbox"/> AHI B03 Refl 2015-07-14 03:50	2015-07-14 03:50	1
<input type="checkbox"/> AHI B04 Refl 2015-07-14 03:50	2015-07-14 03:50	2
<input type="checkbox"/> AHI B05 Refl 2015-07-14 03:50	2015-07-14 03:50	3
<input type="checkbox"/> AHI B08 BT 2015-07-14 03:50	2015-07-14 03:50	4

The 'Layer Details' panel at the bottom right shows the following fields:

- Name:
- Time:
- Instrument:
- Band:
- Wavelength:
- Colormap:
- C-Limits:

A red starburst graphic in the bottom left corner contains the text 'RGBs'.



# The Future of SIFT

- Advanced Baseline Imager (ABI) compatibility
- The ability to specify, and display data on, a Lambert Conformal projection, will support users over the contiguous United States.
- An improved user interface for selecting multiple bands for multiple times will be implemented in the form of a new window that allows individual band and time range selection within a base data directory, without needing the user to specify individual filenames.

# The Future of SIFT

- The ability to save and load the state of the workbench will allow users to load a case by selecting one state file, and allowing that file to be easily shared and modified between users.
- Supporting baseline satellite products and other data types, such as gridded binary (GRIB) model data, will provide users with an ability to correlate spatial patterns and values of various meteorological datasets and parameters, especially when overlaying satellite imagery.

# Bugs and New Features

- SSEC has been funded to create a users' guide.
- Operations and maintenance (O&M) will be funded. STI is envisioning SIFT as the primary tool for “day one” readiness.
- Suggestions for new features are appreciated, but current funding structure and timeline makes it unlikely that those capabilities will be incorporated in the near future (before the launch of GOES-R).
  - There are already dozens of proposed enhancements pending.

# About Massed Training

- Students in massed training are able to quickly develop relevant skills and demonstrate advanced performance.
  - Dempster, 1990; Glenberg, 1979, 1992
- However, these gains are fairly short-term, and skills and knowledge are lost fairly readily.
  - Ebbinghaus, 1885/1964
- Beware of relaxing in the face of short-term excellence instead of long-term competence. Distributed training may be more effective.
  - Baddeley and Longman, 1978; Simon and Bjork, 2001

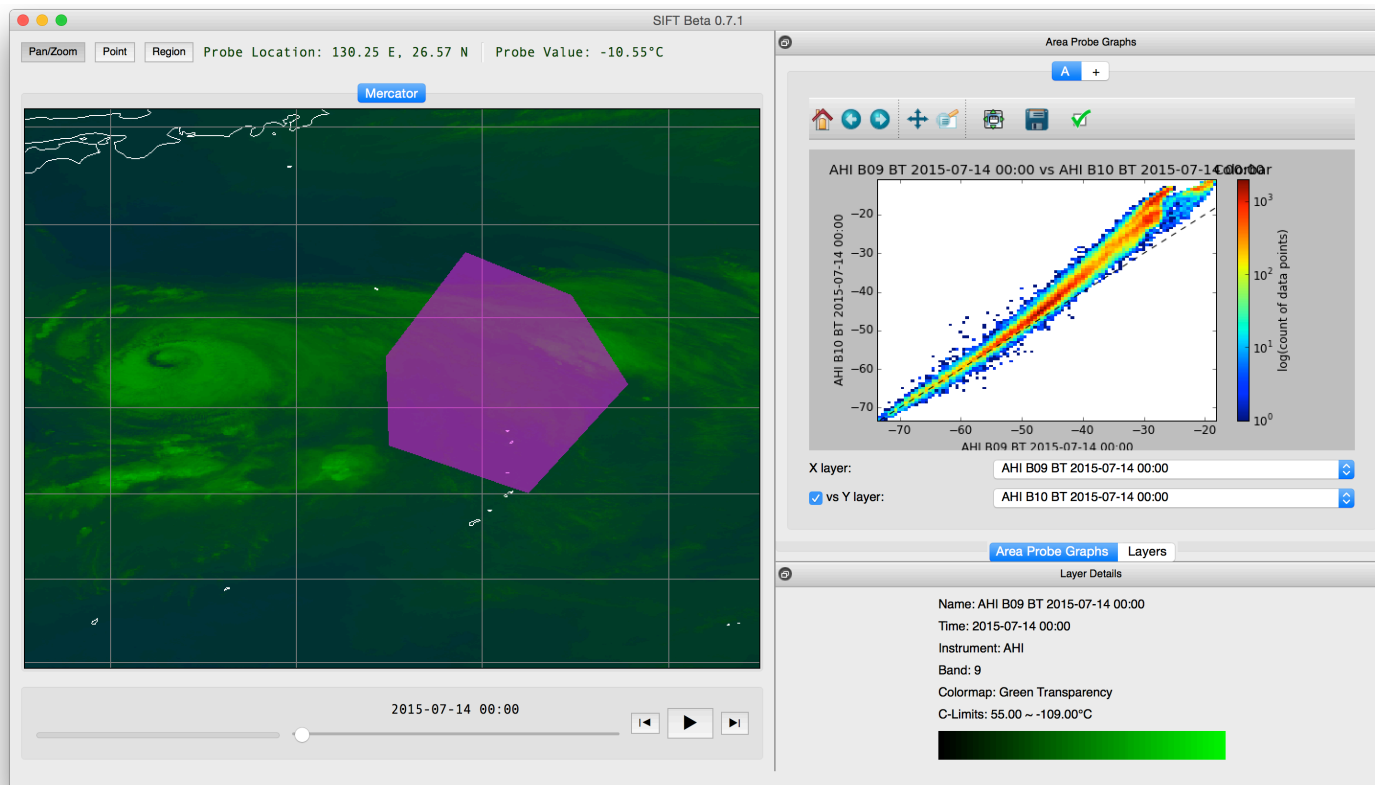
# Incorporate SIFT into Training

- This training workshop is an example of how to incorporate SIFT into massed training. Nationally, efforts are generally focused on producing massed training.
- We may need to rely on distributed training to ensure forecasters are retaining what they are learning. Distributed training is about reiterating the same information in different ways over a period of time.
  - Liaisons are ideal for this at National Centers.
  - This will be a challenge for sites with no on-site liaisons (NHC, CPHC, TAFB, and some WFOs in the OCONUS).

# Incorporate SIFT into Training

- A common question from forecasters is: “Do I need to use all sixteen bands? Some of them look very similar to each other.”
- SIFT is a good tool for producing “overconfidence training” (Wilde, 1998) to deal with this question.
  - Histogram and density maps to show small differences
- “Overconfidence training” would put forecasters in a situation where they must assess a case with the five traditional bands, and then, later, compare that assessment to one where they had sixteen bands.
  - This probably has promise in some areas over others, such as the Dvorak technique.

# SIFT Example

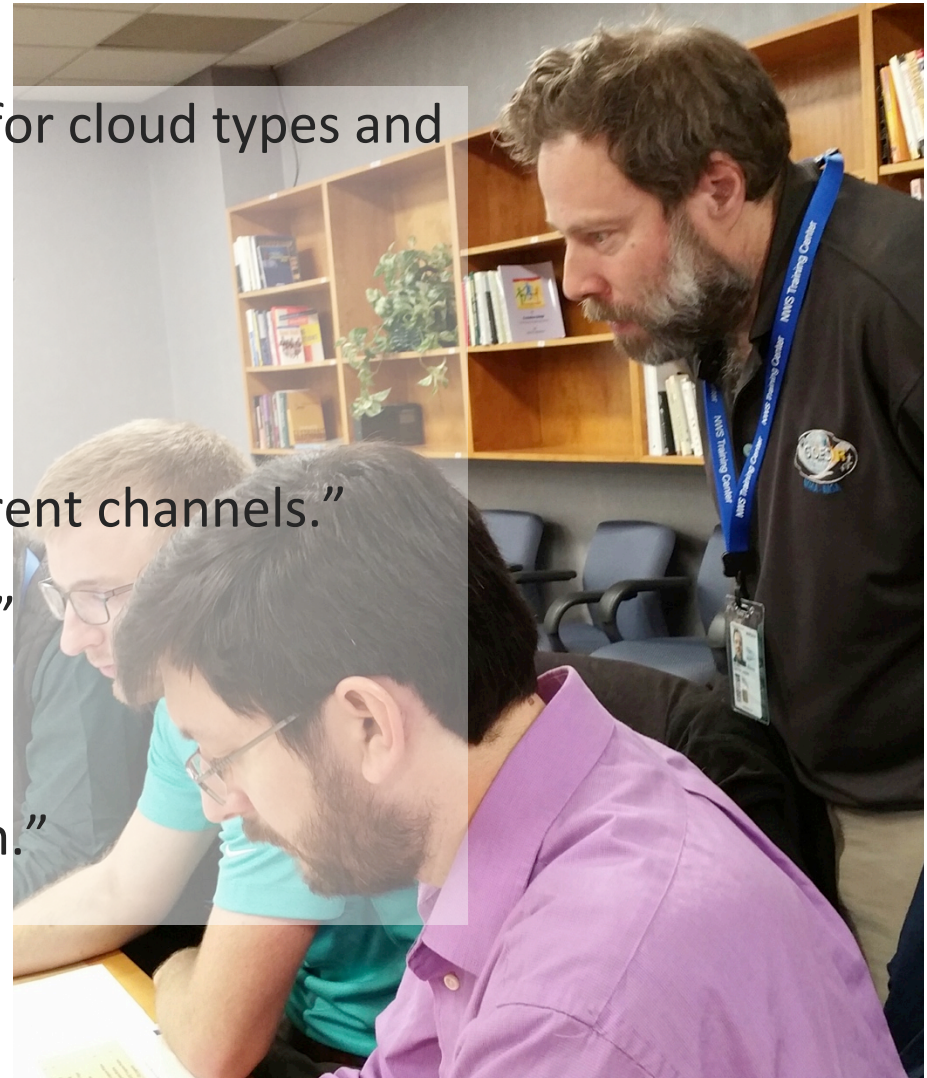




# Said About SIFT

- “A very interesting way to look for cloud types and layers.”
- “All seemed fine to me.”
- “Great training tool overall.”
- “Nice tool to look at many different channels.”
- “SIFT is fast and does not crash.”
- “Stable software.”
- “Very quick. Excellent resolution.”

Excerpts from written survey results following Honolulu forecast office training workshop



# Summary

- SIFT does not provide training itself. It is a way for users to become familiar with the imagery.
- SIFT is intended to be easy to use and display imagery quickly. It is not a replacement for the WES.
- SIFT can contribute to at least three different training arrangements:
  - Massed Training
  - Distributed Training
  - Overconfidence Training
- SIFT is available for you to test. Your feedback on SIFT and how you might use it is appreciated.