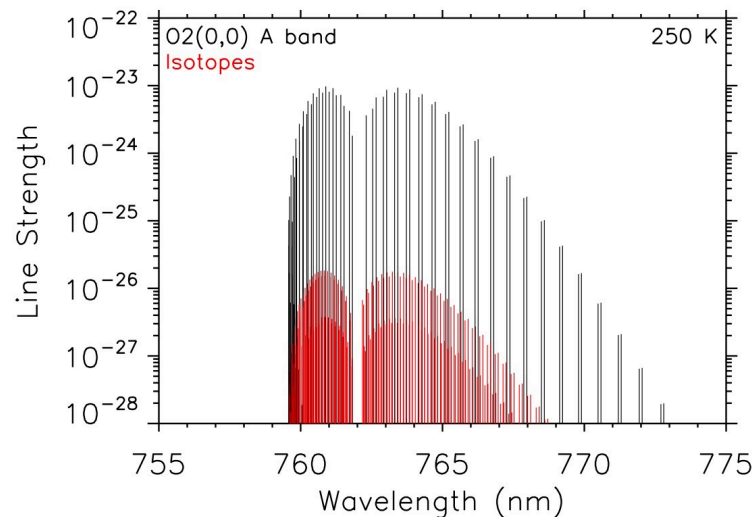# ICON/MIGHTI temperature tutorial

The MIGHTI Team

Naval Research Laboratory, Space Systems Research Corp.,
Space Sciences Lab, University of California, Berkeley
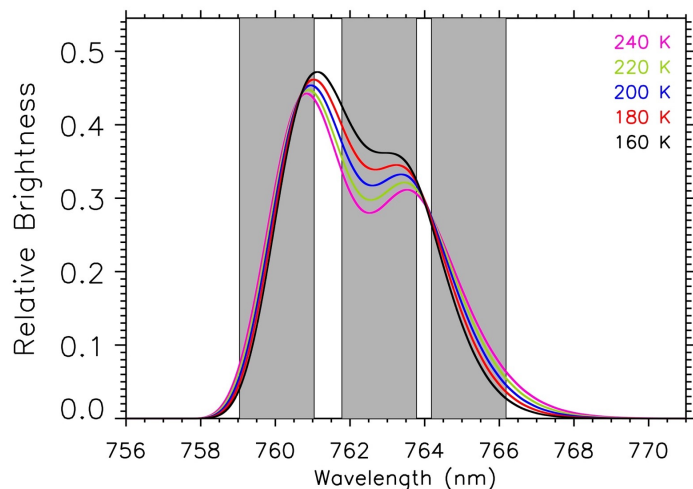
The MIGHTI O$_2$ A Band Observations

O$_2$ (0,0) A Band line positions and line strengths from HITRAN 2016 database [Gordon et al., 2017].

Isotopes (in red) are weak but included in the analysis.

The rotational distribution is a strong function of temperature.

A Band spectrum convolved w/ MIGHTI filter width.

Approximate MIGHTI filter positions and widths are shown. Convolved spectrum is shown at 5 temperatures.

Ratio of signal between filters determines temperature.

Stevens et al. [SSR, 214:4, DOI 10.1007/s11214-017-0434-9, 2018]

The MIGHTI O$_2$ A Band Observations (cont.)
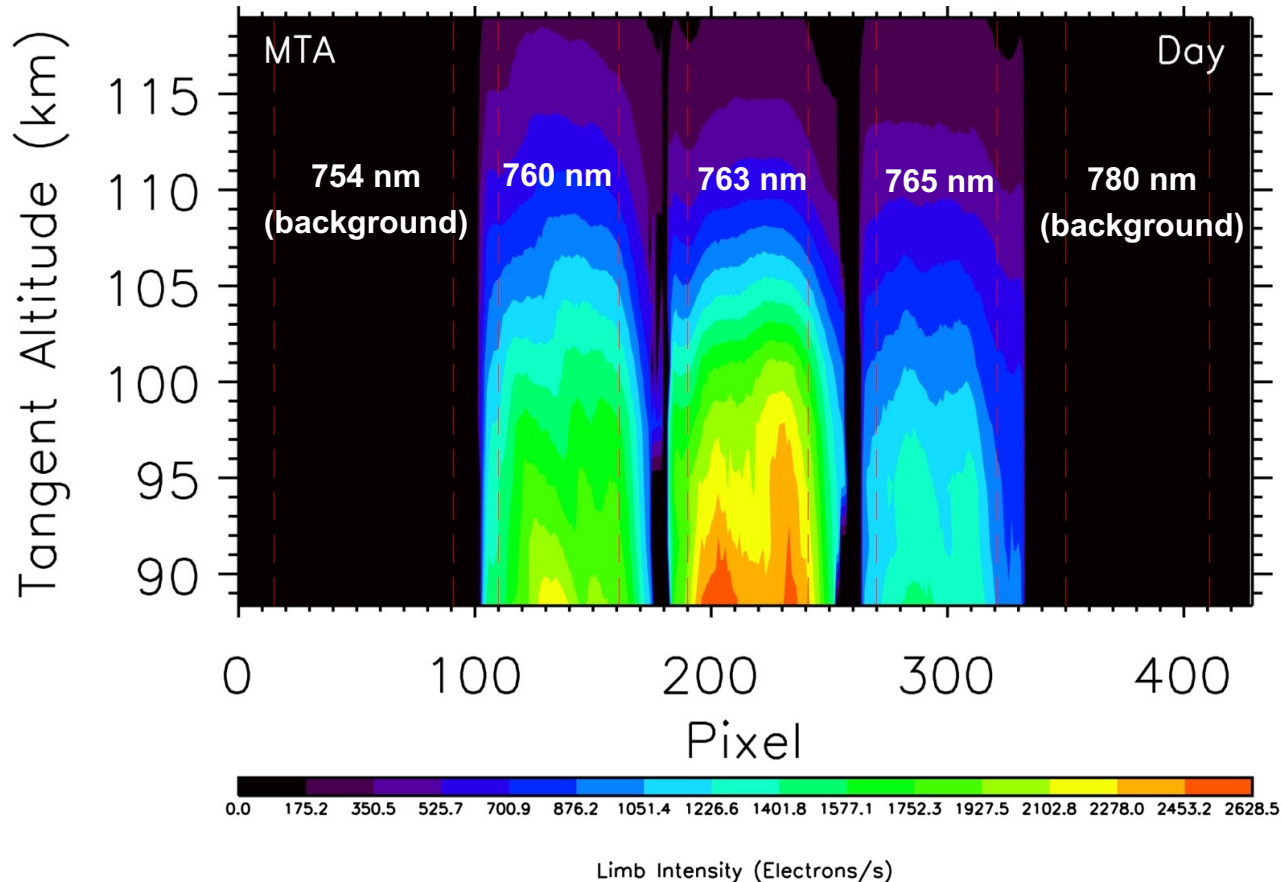
- One sample 30s daytime image from MTA on 1 Jan 2020
- Background channels are used to remove any underlying signal
- Structure in the "x" dimension is due primarily to the flatfield, measured in lab prior to launch
- Retrieval uses the ratio of 760 nm/763 nm channels for temperature
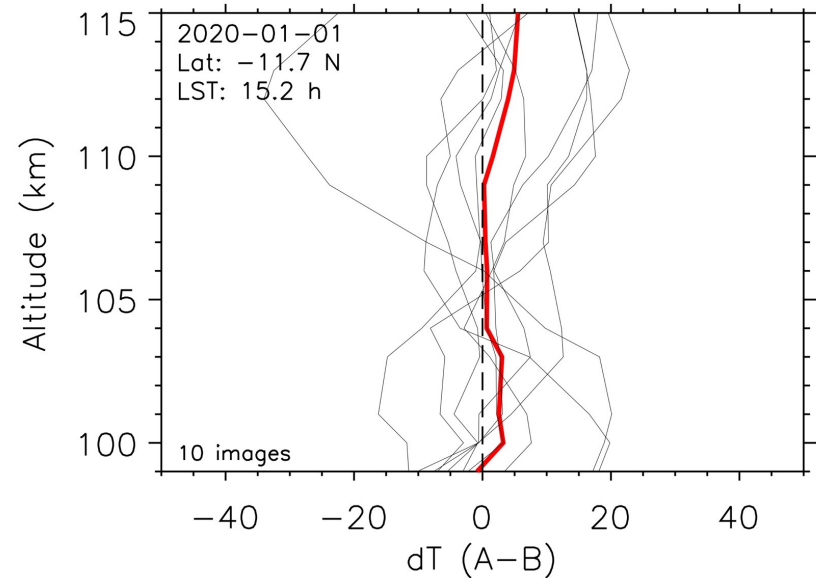
Temporal Resolution

- Daytime: **30 sec** sampling

- Nighttime: **60 sec** sampling

- Assumed stationarity over 5-8 minutes needed for MIGHTI-A and MIGHTI-B to sample the same location.
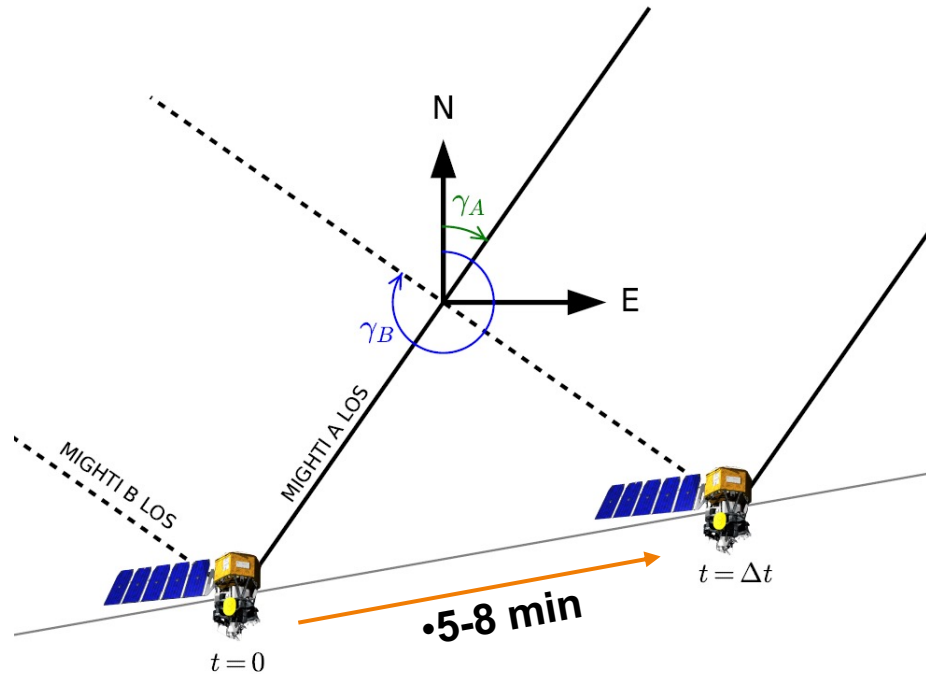
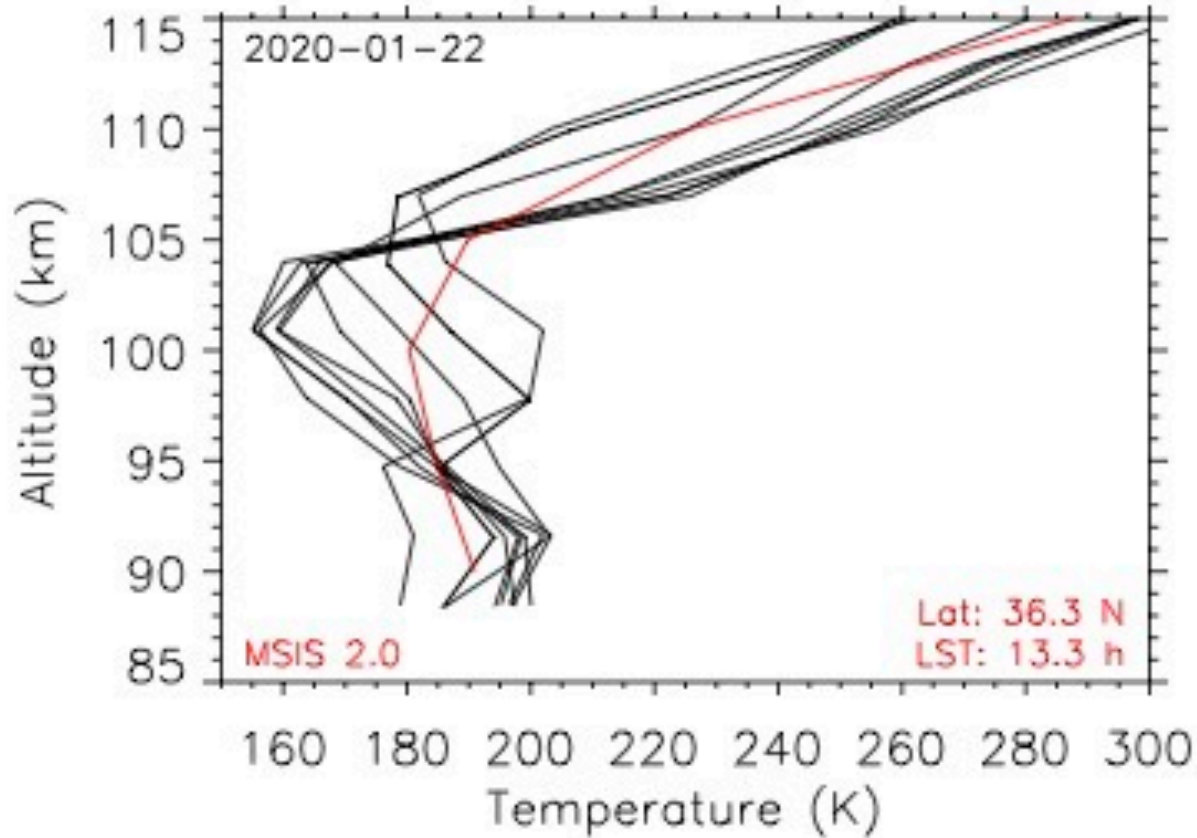# MIGHTI Temperatures: "A" vs. "B" Sensors
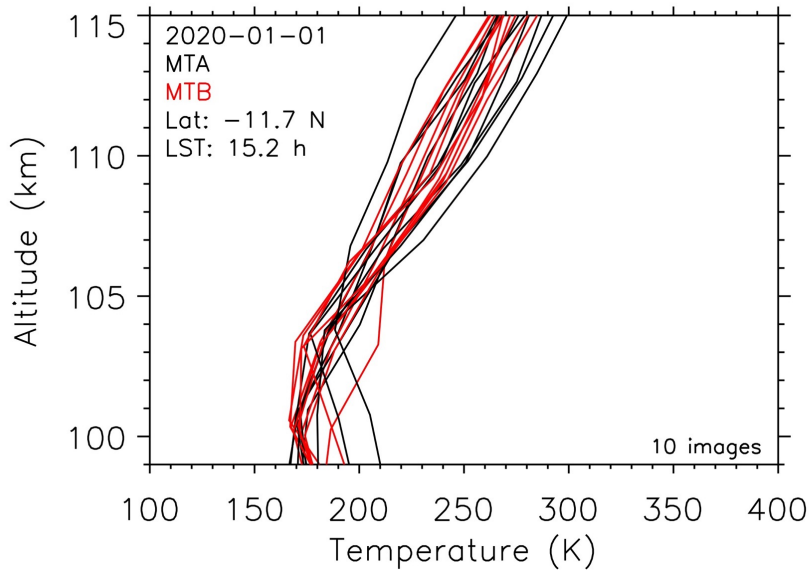
Ten sequential daytime images from MTA (black) and MTB (red)
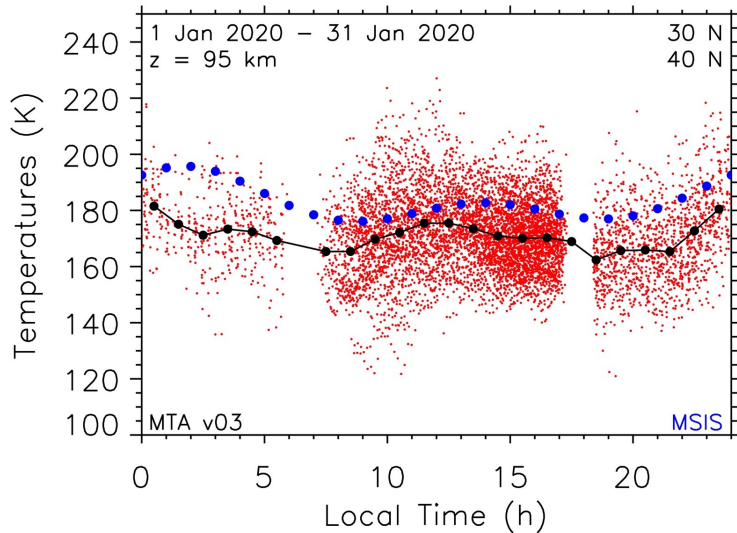
Difference between MTA and MTB temperatures (black). Average difference in red.

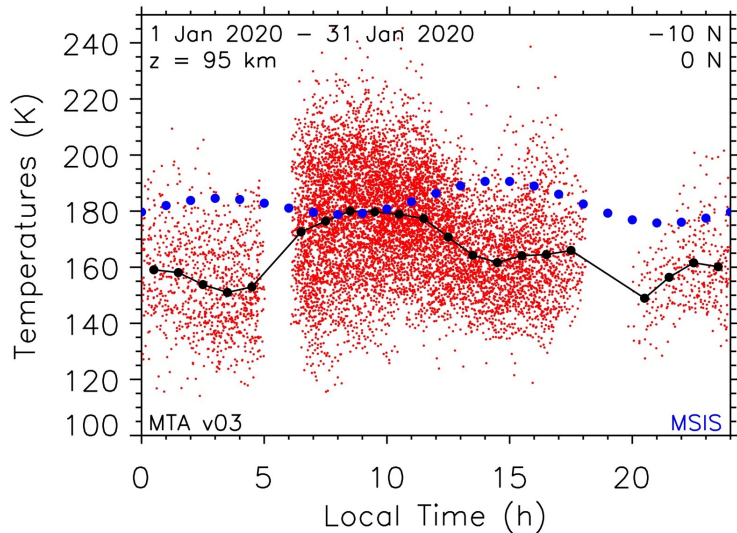# MIGHTI Temperature Variability vs MSIS

MIGHTI-A temperatures vs. empirical model [Emmert et al., in preparation for submission to Earth and Space Science].

- 30º-40º N latitude.
- Red symbols are temperatures from all images.
- Black is 1 h averages of red.
- Blue is MSIS empirical model [Emmert et al., in preparation for submission to Earth and Space Science].

- 10º S-0º latitude.
- Data near terminators are complicated by both saturation effects and inhomogeneities along the line-of-sight.
- Note: MIGHTI has a 12 K systematic uncertainty due to uncertainty in filter center wavelengths.

MIGHTI Temperature Data Product

- **Daytime**

    MTA currently available from 90-115 km.

    MTB currently available from 99-115 km.

- **Nighttime**

    MTA temperature data currently available 90-105 km.

- **Data near the morning and evening terminators are limited due to saturation effects and inhomogeneities along the line-of-sight.**

Summary

ICON Data products, Rules of the Road, and documentation online at the ICON Science Data Center this week at

https://icon.ssl.berkeley.edu/Data

Publications available at

https://icon.ssl.Berkeley.edu/Publications/Papers

Future Improvements to MIGHTI Temperatures Planned

- **MTB daytime temperatures lower bound extended from 99 km to 90 km.**

- **MTB nighttime temperatures.**

- **Daytime upper altitude extended from 115 km to 135 km.**

- **Improvements to the retrieval near the morning and evening terminators.**