**Introduction**

- Satellite-derived information on cloud phase comes from narrow bands in the shortwave- and thermal-infrared traditionally, with sensitivity biased strongly toward cloud top. However, this may be an important limitation for assessing cloud phase characteristics in particular for clouds which often exist in the liquid phase at temperatures below 0°C at their tops but a predominantly ice phase residing below (in-situ observations).

- We describe a physical basis for the detection of liquid-top mixed-phase (LTMP) clouds from passive satellite radiometer observations. The algorithm makes use of reflected sunlight in narrow bands (1.6 and 2.25 μm) to optically probe below liquid-topped clouds and determine phase. Detection is predicated on differential absorption properties between liquid and ice particles for varying sunsensor geometry and cloud optical properties.

- This algorithm utilizes spectral bands available on VIIRS, Himawari AHI and the future GOES-R ABI that will enable daytime monitoring with potential applications to aviation and the validation of NWP models.

**Case Study Analysis with S-NPP VIIRS Data**

**Flow chart of the LTMP cloud detection algorithm**

- The physical basis for a daytime detection algorithm of clouds with liquid-top and mixed-phase or pristine ice below cloud top has been presented. This algorithm was designed toward applications on the ABI sensors of the next-generation GOES-R series and JMA Himawari-8/9 AHI sensors.

- The algorithm takes advantage of differential optical properties of liquid and ice phase cloud particles using SWIR bands whose weighting functions peak below cloud top and below levels of sensitivity for conventional cloud top phase discrimination techniques.

- LUTs for the algorithm are based on SBDART radiative transfer calculations for the idealized two-layer cloud scenario composed of various liquidice phase fraction, cloud optical thickness, cloud top effective radius, and sunsensor geometry.

- The LTMP flag is identified using the departure of reflectance ratios between the observed cloud and an idealized all-liquid cloud (having the same cloud/geometry bulk properties) from cloud-property-dependent threshold values.

- The ARM/NSA case study and WRF model simulations reveal both capabilities and limitations of the current algorithm but show promising potential of the algorithm.

- In future work, we will explore various subsets of the spectrum providing optimal detection capabilities.

**Summary**

- The views, options, and findings contained in this poster are those of the authors and should not be construed as an official NOAA or U.S. Government position, policy, or decision.