**Why is the Cloud Base Height (CBH) Important?**

The CBH is an estimation of the base altitude of the uppermost cloud layer in each column of the atmosphere as viewed from above by satellite. Information of 3-D cloud structure is significant to the aviation community. It also bears high relevance to model developers for weather and climate applications. CBH is a key component required to construct a full 3-D cloud field, although assigning cloud base from satellite data is still challenging. The current CBH algorithm is operational as part of the NOAA Enterprise Cloud Algorithms.

\[ CBH = CTH - CGT \]

\[ CGT = (a \times CWP) + b \]

where \( a \) and \( b \) are obtained from statistical relationships.

**How is the VIIRS CBH Created?**

The CBH is obtained from a semi-empirical approach, based on a statistical analysis of multiple satellite data (CloudSat/CALIPSO and Aqua MODIS). In the algorithm, Cloud Geometric Thickness (CGT) is derived from statistical relationships between observed CGT, Cloud Water Path (CWP), Cloud Top Height (CTH) and subtracted from CTH to generate CBH. The algorithm includes special accommodations for handling optically thin cirrus (an extinction method) and deep convection (supplementary NWP data). The CBH product is provided for any cloudy pixel with valid cloud top height globally, day and night (750 m resolution, ~50 min revisit between S-NPP and NOAA-20).

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**Impact on Operations**

- CBH information can be used to improve the Cloud Cover Layers (CCL) products by introducing additional cloud coverage at lower levels of the profile, typically hidden under cloud top.
- Vertical cloud structures including CBH provide useful information for aviation weather applications.
- The CBH algorithm is also applicable to geostationary sensors as well as polar satellite sensors. Global observations of 3-D cloud fields are relevant to model developers for integrating improved cloud radiative feedbacks in numerical models.

**Limitations**

- The performance of the CBH retrieval is highly dependent on the accuracy of CTH and CWP (from cloud optical properties).
- The nighttime CBH retrieval performance would be degraded due to the difficulty of CWP retrievals.
- The algorithm is optimal for single layer clouds. The CBH may not be ‘ceiling’ for multi-layered cloudy scenes. The accuracy of the CBH product for multi-layer clouds may comprise the uncertainties of the upstream retrievals. Most likely \( CBH = \) actual ceiling in cases of an optically thin cirrus cloud that is not categorized as a “multi-layer” cloud type, a boundary layer cloud, and a cloud base for deep convection derived using NWP supplementary data.