Detection / Bayesian / Data

- Surface temperature (T_{surf})
- 10.8 micron brightness temperature ($T_{10.8}$)
- Brightness temperature difference ($T_{10.8} - T_{12}$)
- Visible channel reflectance (R_{vis})
- $R_{3.8}$ / R_{vis} (RAT, $R_{3.8}$: 3.8 micron reflectance)

Detection / Bayesian / Calculation

$$P(a_0 \mid T_{10.8-12}, T_{10.8}, T_{surf}, R_{AT}, R_{vis})$$

$$= \frac{P(T_{10.8-12}, T_{10.8}, T_{surf}, R_{AT}, R_{vis} \mid a_0) P(a_0)}{\sum_i P(T_{10.8-12}, T_{10.8}, T_{surf}, R_{AT}, R_{vis} \mid a_i) P(a_i)}$$

$$= \frac{P(T_{10.8-12}, T_{10.8}, T_{surf} \mid a_0) P(R_{AT}, R_{vis} \mid a_0) P(a_0)}{\sum_i P(T_{10.8-12}, T_{10.8}, T_{surf} \mid a_i) P(R_{AT}, R_{vis} \mid a_i) P(a_i)}$$

$$= \frac{P(T_{10.8-12} \mid T_{10.8}, T_{surf}, a_0) P(T_{10.8} \mid T_{surf}, a_0) P(T_{surf} \mid a_0) P(R_{AT} \mid R_{vis}, a_0) P(R_{vis} \mid a_0) P(a_0)}{\sum_i P(T_{10.8-12} \mid T_{10.8}, T_{surf}, a_i) P(T_{10.8} \mid T_{surf}, a_i) P(T_{surf} \mid a_i) P(R_{AT} \mid R_{vis}, a_i) P(R_{vis} \mid a_0) P(a_i)}$$

Assumptions

1) $P(T_{10.8-12}, T_{10.8}, T_{surf}, R_{AT}, R_{vis} \mid a_i)$

$= P(T_{10.8-12}, T_{10.8}, T_{surf} \mid R_{AT}, R_{vis}, a_i) P(R_{AT}, R_{vis} \mid a_i)$

$= P(T_{10.8-12}, T_{10.8}, T_{surf} \mid a_i) P(R_{AT}, R_{vis} \mid a_i)$

2) $P(T_{10.8}, T_{surf} \mid a_i) = P(T_{10.8}, T_{surf} \mid a_j)$

3) $P(R_{AT}, R_{vis} \mid a_i) = P(R_{AT}, R_{vis} \mid a_j)$

P(a0) was empirically adjusted

a_i : ash(i = 0) / clear or cloud (i ≠ 0)

$T_{10.8\text{-}12}$: $T_{10.8} - T_{12}$

$T_{10.8}$: 10.8 micron brightness temperature

T_{12} : 12 micron brightness temperature

T_{surf} : surface temperature

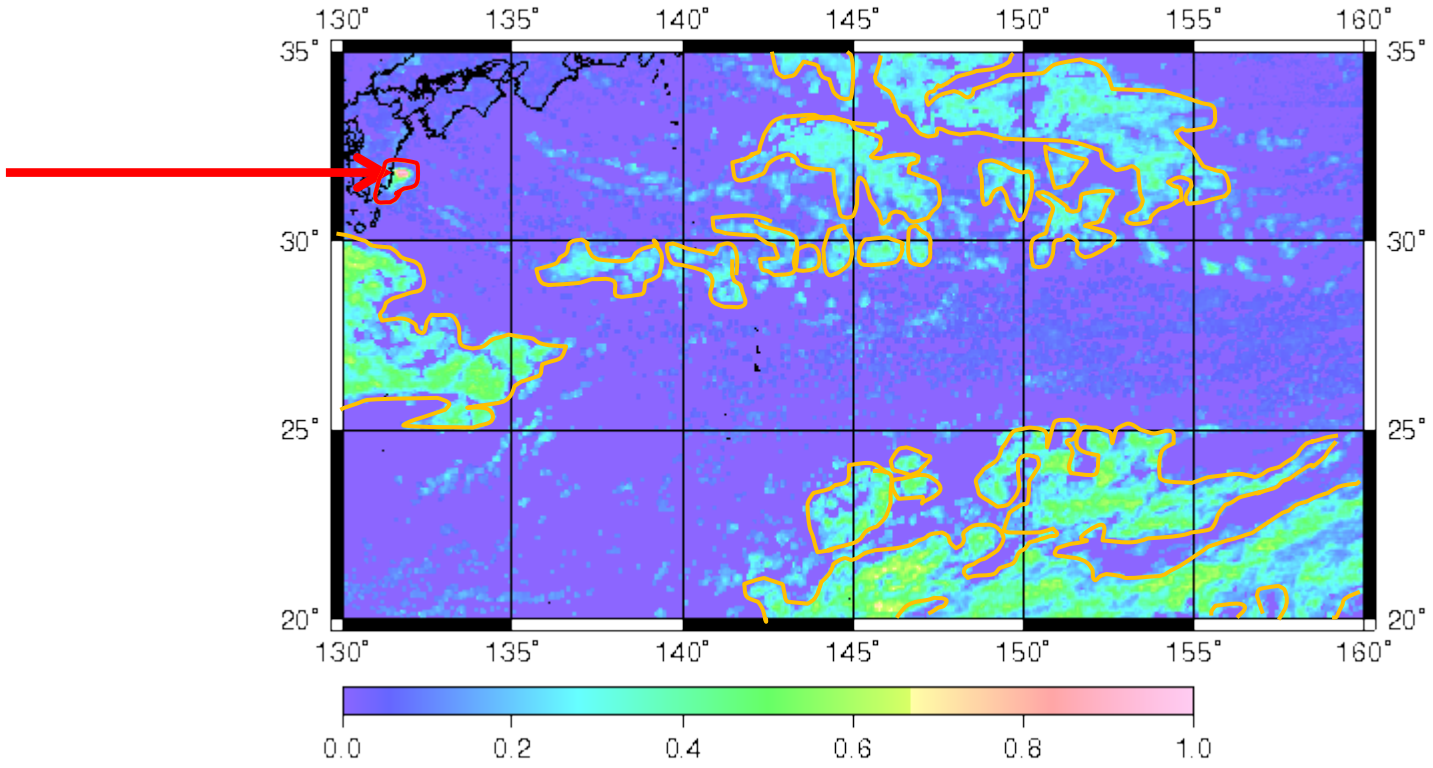
R_{AT} : $R_{3.8}/R_{vis}$

$R_{3.8}$: 3.8 micron reflectance

R_{vis} : reflectanceat visible channel

Detection / Cloud Object / Clustering

- Probability > 0.02
- Cloud Object with Maximum Probability > 0.6



Retrieval / Cloud Top Temperature/Height

- T_{cloud} is estimated from $I_{10.8}$ and I_{wv}
- NWP 6-hour forecast is referred to for the atmospheric temperature and water vapor profiles for RTC
- Cloud height is estimated from calculated temperature and NWP atmospheric profile
- As for T_{cloud} of cloud under the lower limit of WV channel, brightness temperature corresponding to the mid radiation intensity (x0) of x1 ($I_{10.8}$) and x2 (intensity at the lower limit of WV channel) is adopted

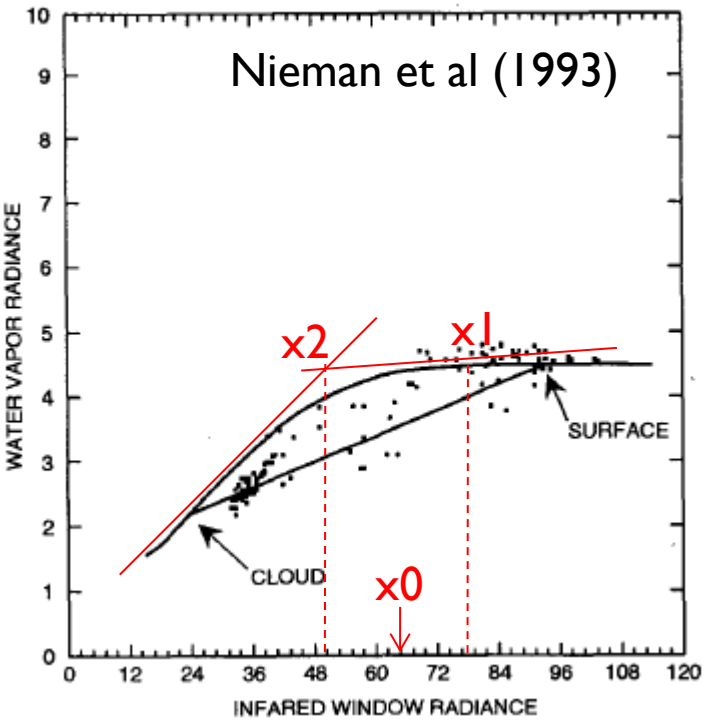


FIG. 1. Measured radiances (mW m^{-2} sr^{-1} cm) for fields of view partially filled with clouds. The curve represents the forward calculations of radiance for both spectral channels for opaque clouds at different levels in the atmosphere. The straight line connects the centers of the warmest and coldest clusters of measured radiances and is extrapolated to intersect the curve and thus identify the height of the cloud.