Innovative Methods For Retrieving Cloud Properties From BASTA

SOFOG-3D Science Meeting

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LWC retrieval using BASTA(Z) and MWR(LWP)

• Z and LWC are related with a powerlaw equation

\[ Z = a \cdot LWC^b \]
\[ \ln{Z} = \ln{a} + b \cdot \ln{LWC} \]

• A retrieval algorithm with variational method to retrieve LWC and scaling factor \( \ln{a} \).

• Given Z and LWP information LWC in liquid cloud is retrieved by adjusting scaling factor for each profile.

• Apriori of LWC and \( \ln{a} \) is considered in the retrieval from empirical relation from literature.
Strategy of Retrieval Algorithm

• The observation vector and state vector for the retrieval are:
  
  \[ Y = [\ln Z_1, \ln Z_2, ..., \ln Z_n, \ln LWP] \]
  
  \[ X = [\ln LWC_1, \ln LWC_2, ..., \ln LWC_n, lna] \]
  
  \[ LWP = \sum (LWC) dz \]

• Stand alone retrieval of BASTA by using the climatology of \( lna \) from the above algorithm setup
  
  \[ Y = [\ln Z_1, \ln Z_2, ..., \ln Z_n] \]
  
  \[ X = [\ln LWC_1, \ln LWC_2, ..., \ln LWC_n, lna] \]

• Retrieval is constrained to give more weightage to \( lna \) apriori (derived from climatology) and LWC is retrieved.
LWP for SOFOG-3D cases

- For every 10 minutes LWP observation is missing due to boundary layer scan for temperature.

- LWP for the gaps is interpolated.

- LWP is averaged between two consecutive BASTA time as the frequency of two instrument is different.
• Averaged LWP is assimilated with Z for each profile

• Retrieved LWP is compared with LWP from MWR.

• Validation of distribution of LWC is yet to be done

• There is some high value of LWC and LWP around 8:00 hrs.
*Ina* retrievals for fog and cloud at SIRTA

- Set of fog and cloudy cases are used for discussing the behavior of retrieved *Ina*
- The range of *Ina* varies from -6 to 0
- Peak *Ina* values are used for profiles without LWP information.
Climatology of *lna*

- Variation on *lna* for 14 cloudy and fog cases is shown as a function of Z and V.
- This statistics is useful for *lna* apriori for LWC retrieval of missing LWP profiles.
Using \textit{lna} apriori for without LWP assimilation: SIRTA
Future work

• Validation of LWC distribution using tethered balloon and other in situ measurements.

• Statistical analysis of ‘Ina’ for SOFOG3D cases.

• Retrieval of LWC without LWP assimilation for missing LWP observation.
Thank you