

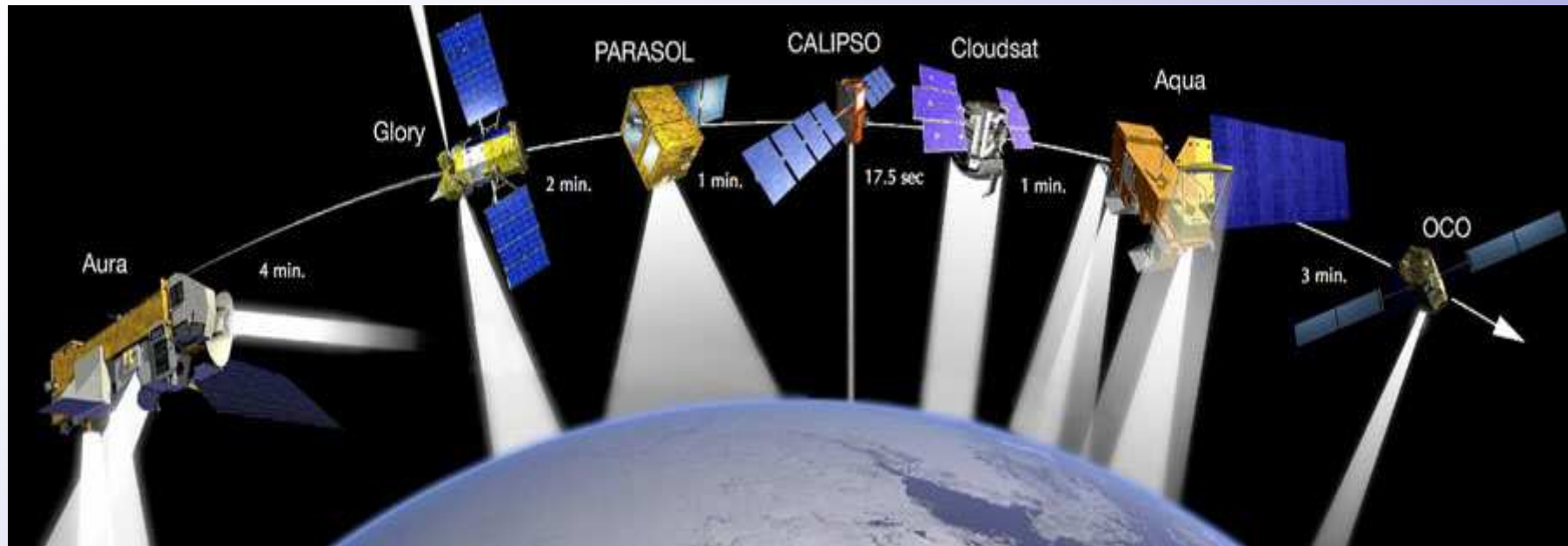
SYNERGY OF MULTIPLE SATELLITE CLOUD OBSERVATIONS USING AIRS/CALIPSO/GEOPROF/DARDAR DATA SETS

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A-Train constellation and cloud observations



Thick cloud



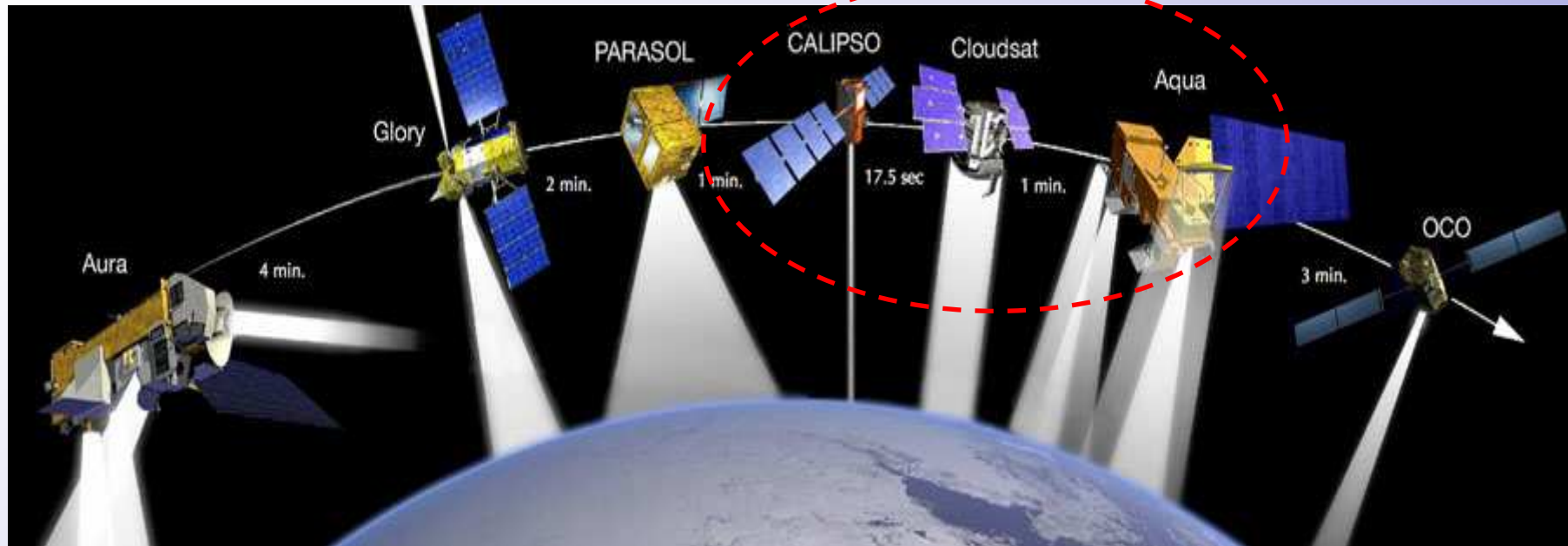
Multiple clouds



Single thin cloud



A-Train constellation and cloud observations



Thick cloud



Multiple clouds



Single thin cloud



Formulation of the problem

- A-Train satellites provide a comprehensive overview of the clouds and their environment.
- Both physical and microphysical parameters are retrieved
- Spatial coverage and sensitivity to different types of clouds vary depending on the instrument.
- Objectives of the work:
 - compare physical and microphysical parameters of the clouds retrieved from different instruments;
 - create a comprehensive data set, which would include a compilation of cloud parameters.

Level 2 data used in this work

AIRS: passive sounder, detects the uppermost cloud.

Retrieves: H/T/P, type, and emissivity of the cloud.

Microphysical properties (A. Guignard, 2012):
effective diameter, aggregates/columns + IWP.

CALIPSO 5km: lidar, can detect more than one cloud.

Retrieves {H}, {T}, {P}, {IWP}, cloud type, and phase.

GEOPROF: (Mace et al. 2009) is based on CloudSat cloud profiling radar and CALIPSO lidar measurements. Contains cloud layer heights and the radar/lidar flags.

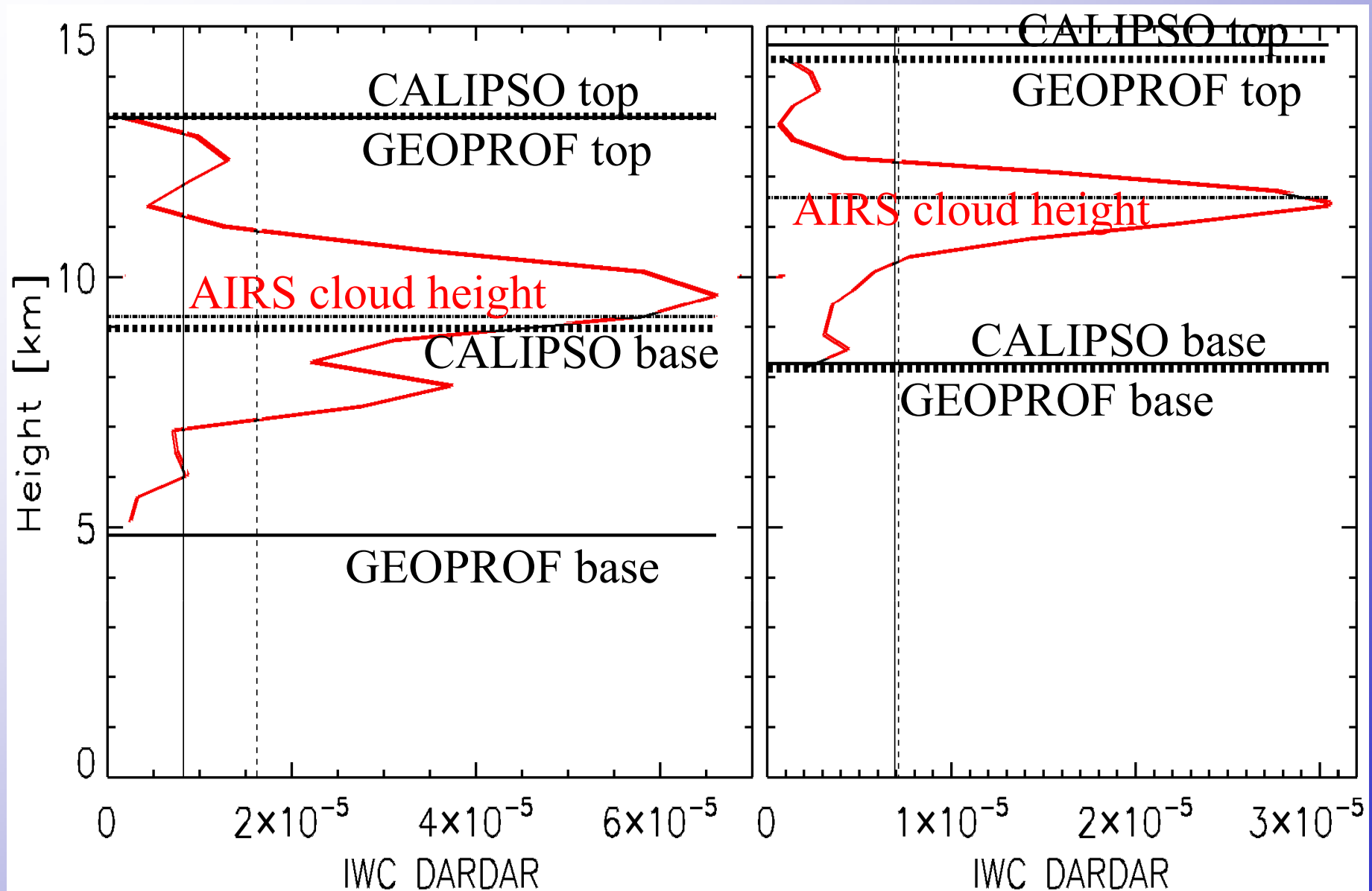
DARDAR: (Delanoë and Hogan, JGR, 2010)

CloudSat radar + CALIPSO lidar. Produces the vertical distributions of IWC, effective radius, cloud type.

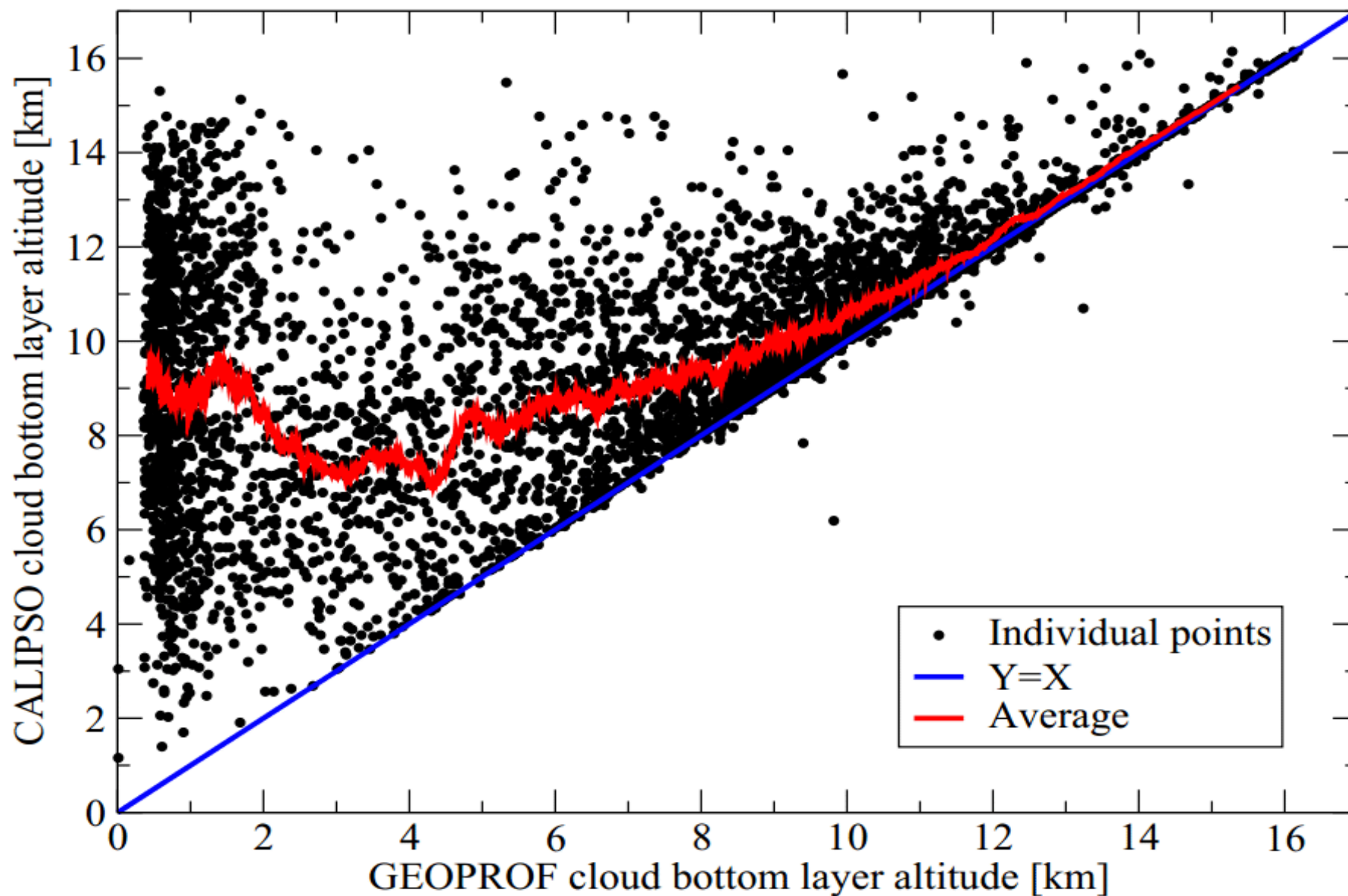
Co-location criteria

- Time overlap: < 10 min (only the same “train”)
- Spatial overlap: < 0.1 degree in latitude/longitude for the middle of the AIRS “golf ball” and any of the compared scans.
- Quality flags checking for each data set
- Only the scans, which satisfy all of the criteria above, are stored.

Example of co-located data



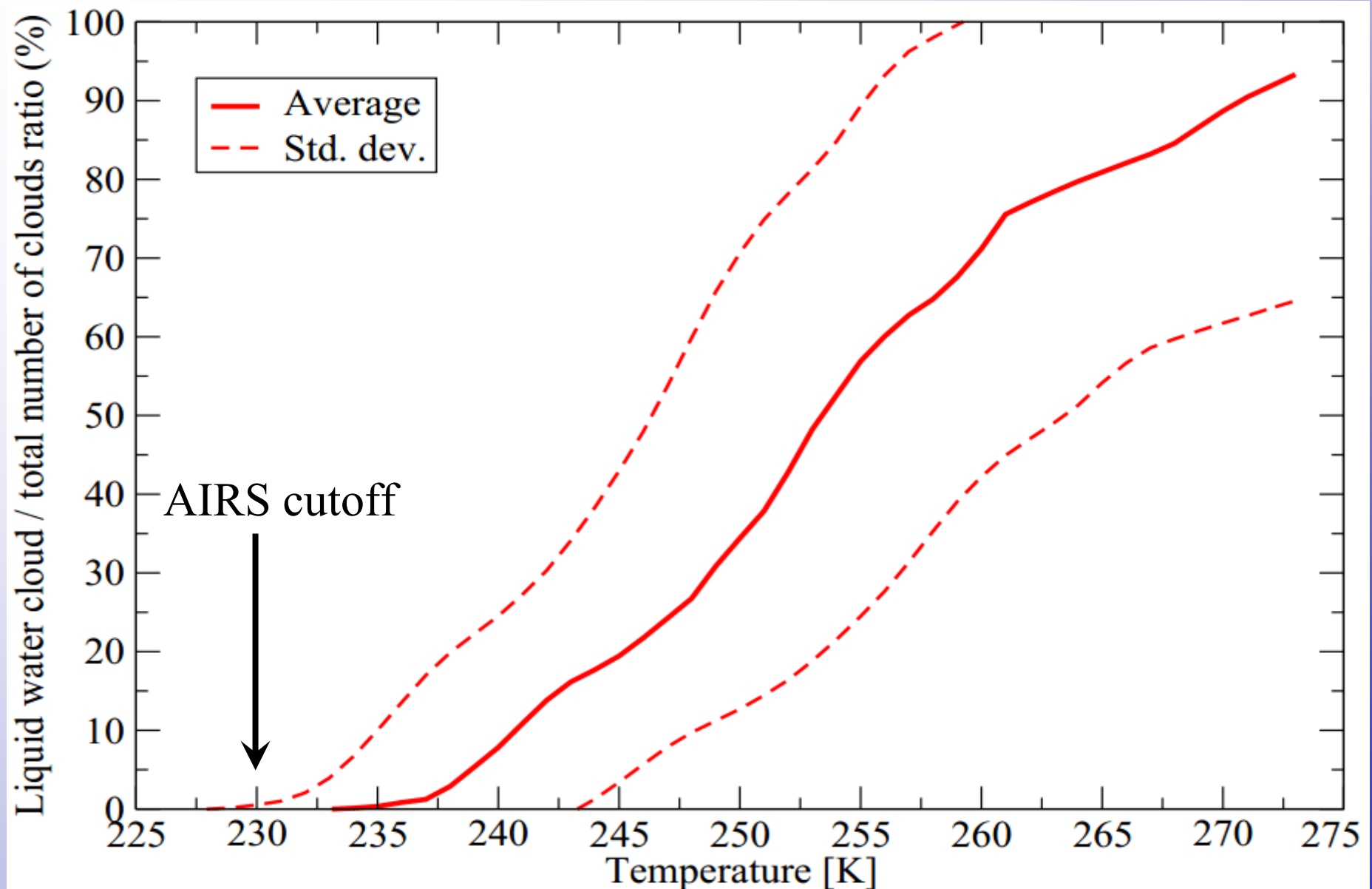
Cloud base level: CALIPSO vs GEOPROF



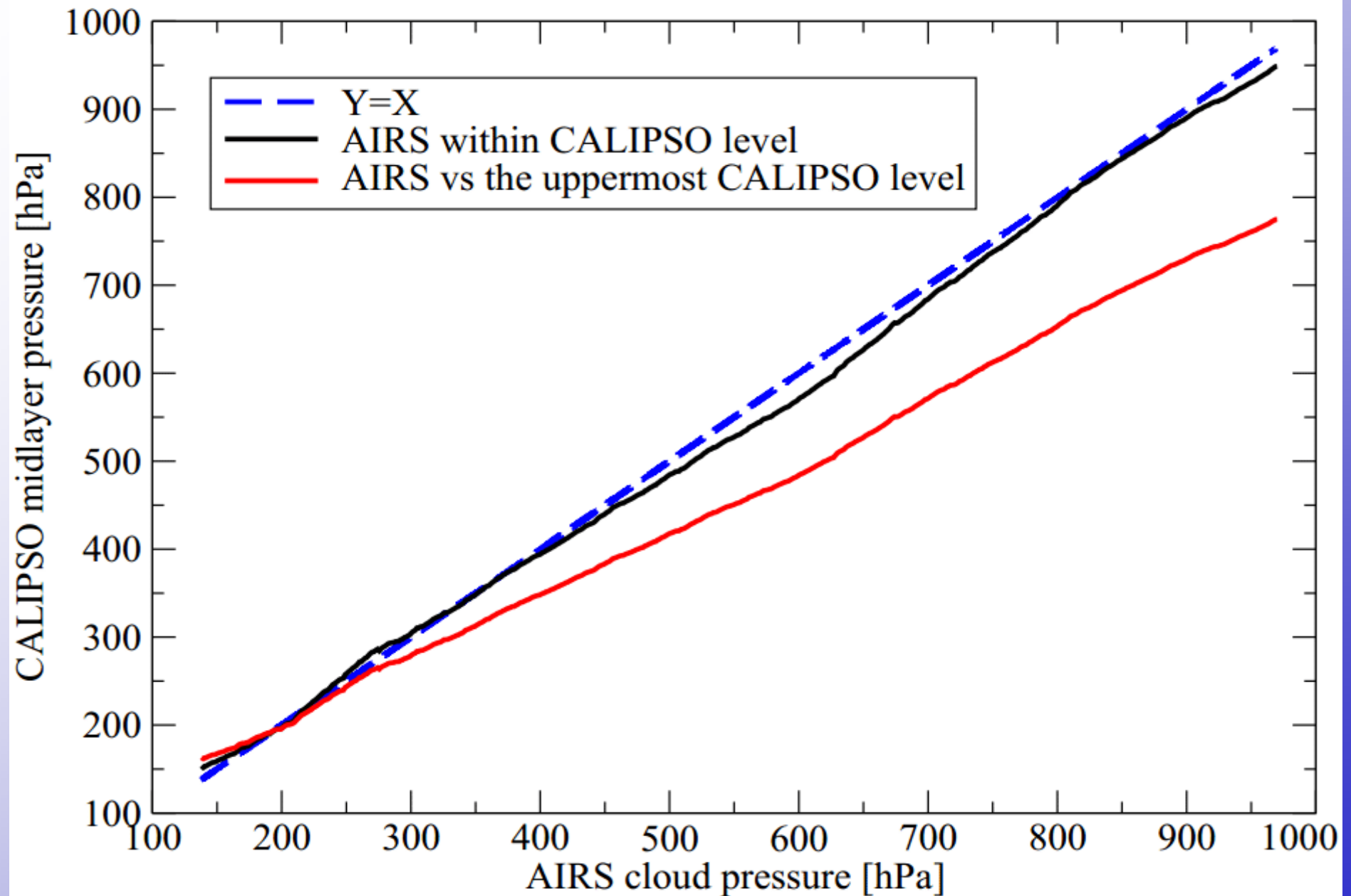
Output data

- The list of stored variables contains 86 items.
- Data available for August 2006 – December 2009
- Data are stored in binary format (the IDL reading routines can be provided).
- $\sim 1e5$ co-located events per month.
- $\sim 300\text{Mb}$ per month

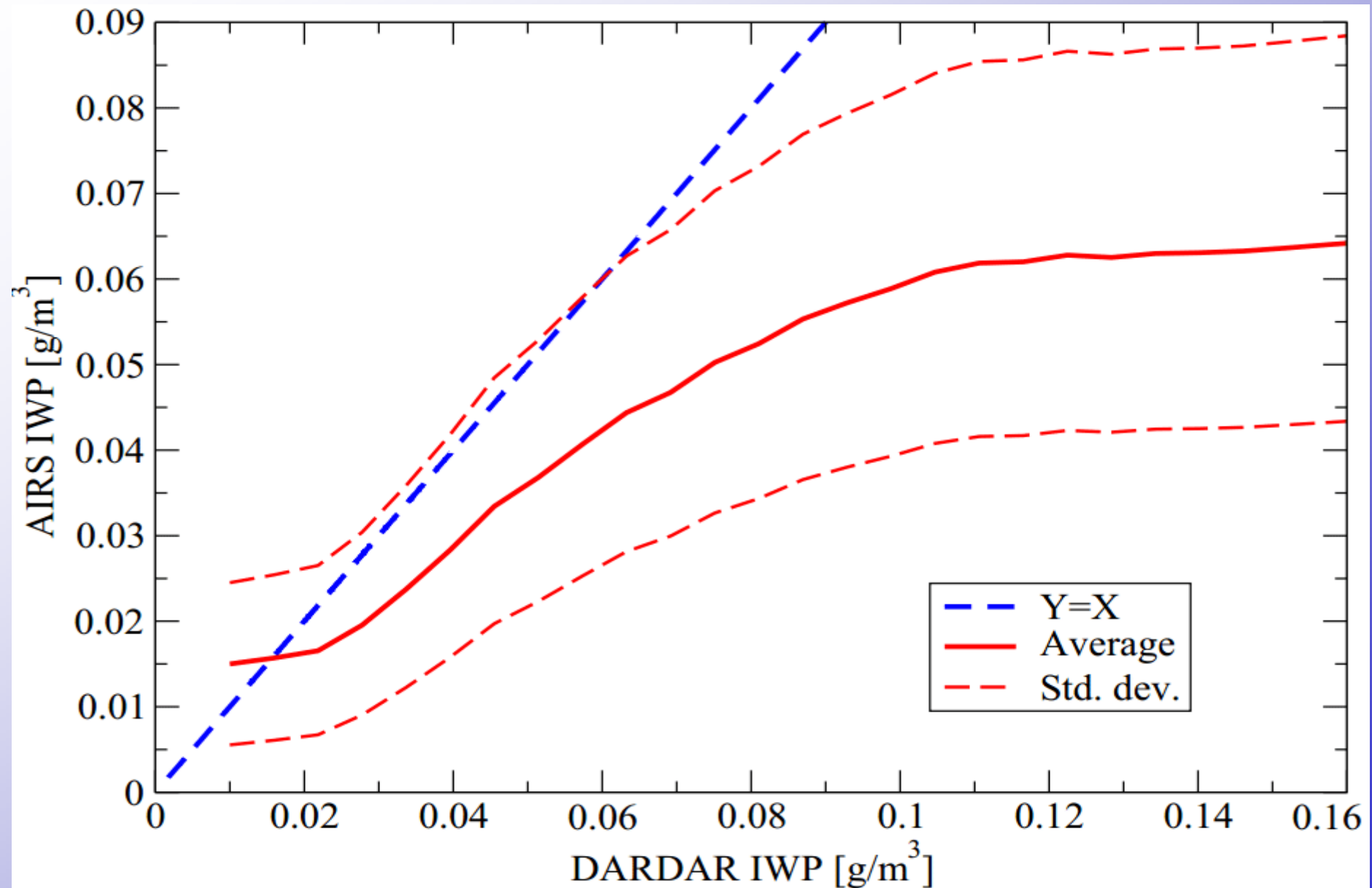
AIRS temperature vs CALIPSO cloud phase



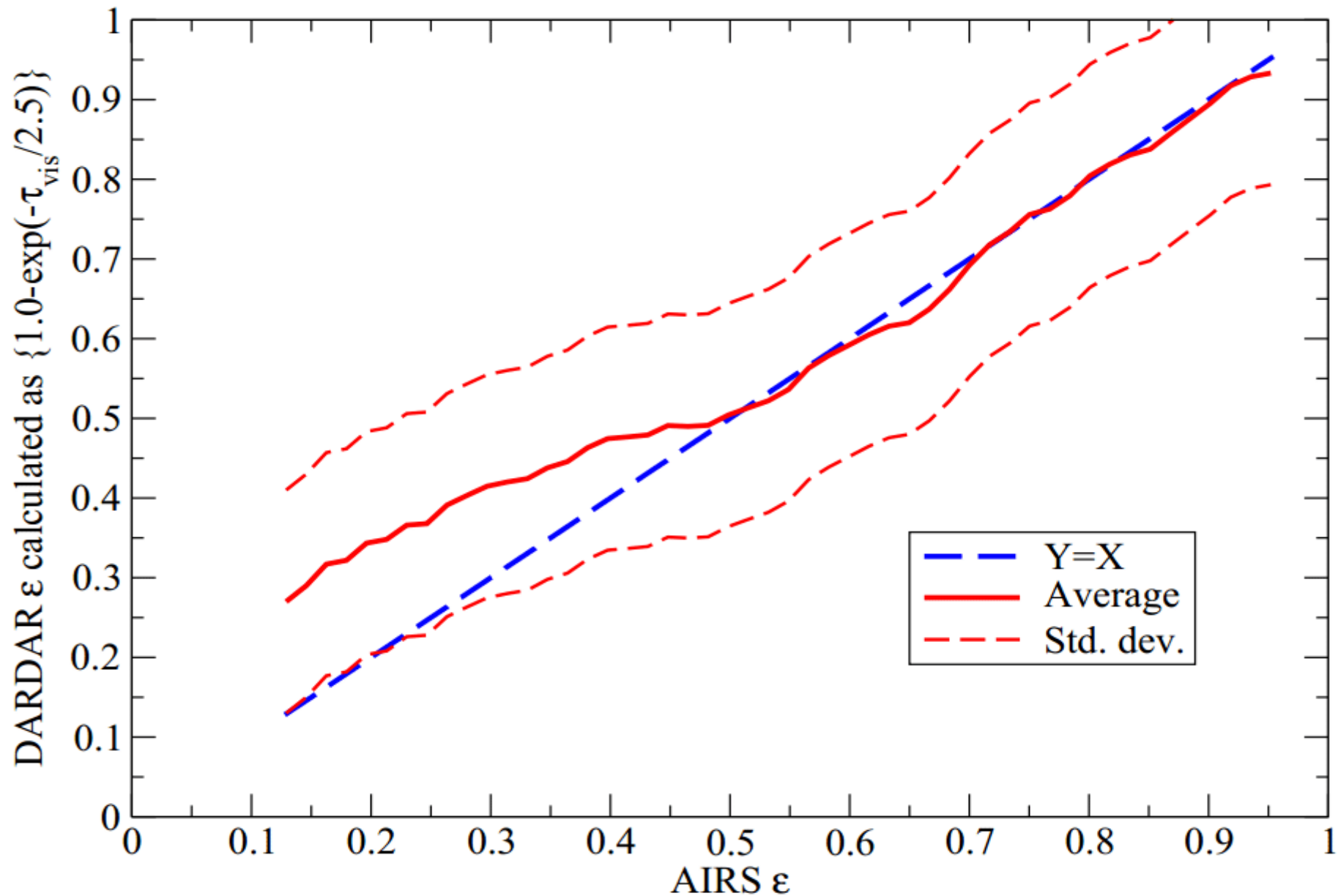
Cloud pressure: CALIPSO vs AIRS



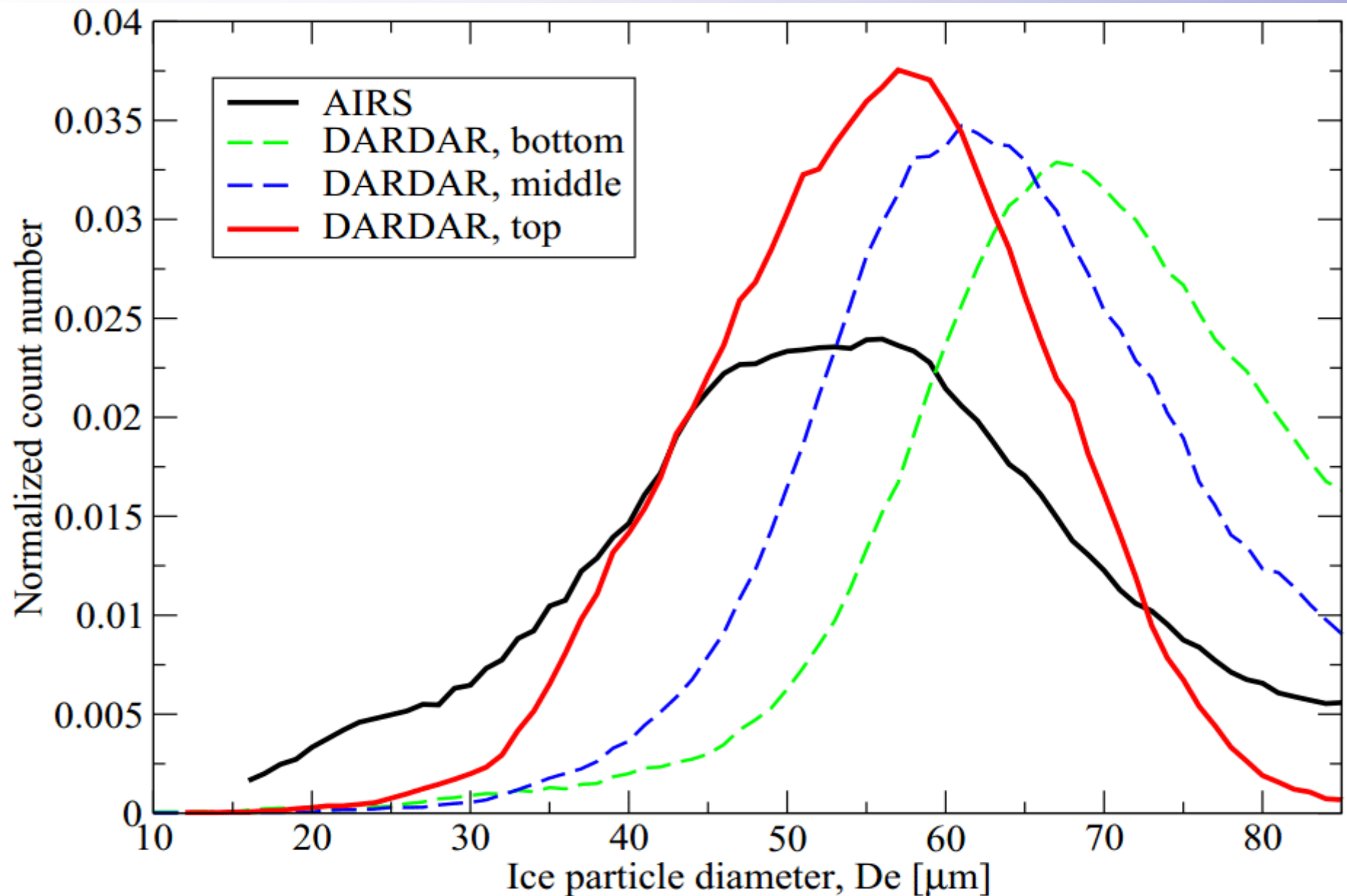
Ice water path: AIRS vs DARDAR



Cloud emissivity: DARDAR vs AIRS



Ice particle size: DARDAR vs AIRS



Conclusions

- The AIRS, CALIPSO, GEOPROF, and DARDAR data sets supplement each other and their synergy expands knowledge about clouds.
- These data sets have been co-located for the period of 08.2006-12.2009.
- The co-located data set helps to identify the “safety” limits for the retrieved parameters.
- The first intercomparisons demonstrate good qualitative agreement for macro- and microphysical characteristics of the clouds.
- Quantitatively, the differences are explained by the sensitivities of the instruments involved into comparison.