Creating A Microwave-Based Upper-Tropospheric Humidity (UTH) FCDR

Z. Johnny Luo[1] (PI), W. B. Rossow[1](co-I), D. Kley[2,3](co-I), and Jeyavinoth Jeyaratnam[1]

[1]City College of New York, CUNY
[2]Colorado State University
[3]Research Centre Juelich GmbH, Germany

Correspondence: Johnny Luo, luo@sci.ccny.cuny.edu

CDR Team Meetin
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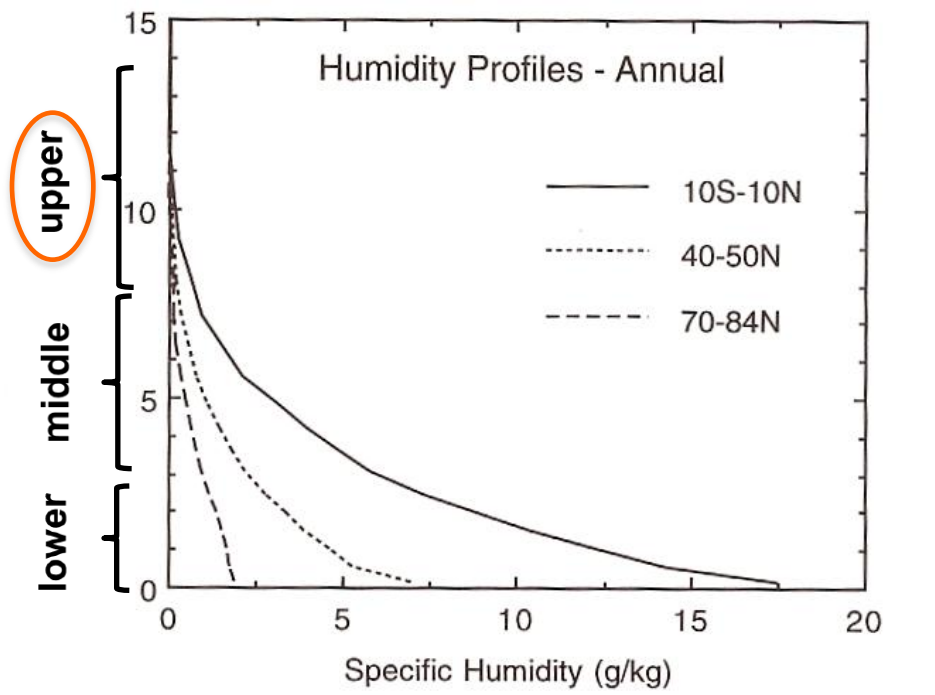
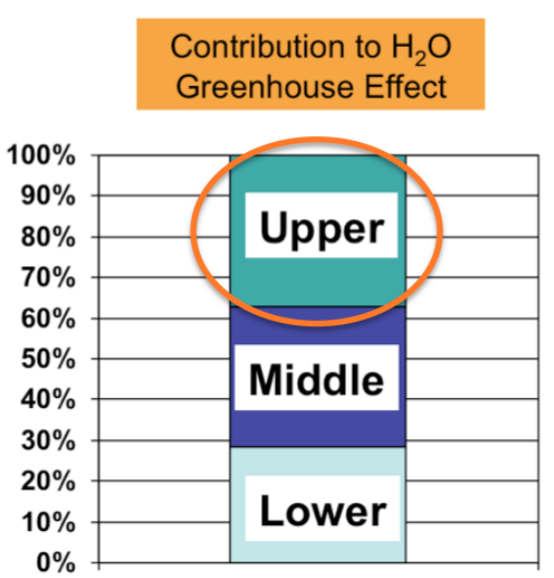
Outline

- Project Description
- Production and QA Approach
- Applications
- Schedule & Issues

Project Description

- Goal: "…bring together all the upper-tropospheric humidity (***UTH)-related radiance*** data from multiple satellites and process them to establish a long-term, global, inter-calibrated radiance record from which UTH can be retrieved and UTH research can be conducted."





Despite the small amount, UTH contributes significantly to H_2O greenhouse effect

Project Description

- Goal: "…bring together all the ***UTH-related radiance*** data from multiple satellites and process them to establish a long-term, global, inter-calibrated radiance record from which UTH can be retrieved and UTH research can be conducted."

- Source Data for long-term UTH measurements
  1. HIRS ch12 (6.7 □m) ← Already an operational FCDR (Shi et al. 2011)
  2. Geostationary UTH channel (6.3-6.5 □m)
  3. SSM/T2, AMSU-B, … (~183 GHz) ← Focus of this project
  4. *MOZAIC (Measurement of ozone and water vapour by Airbus in-service aircraft)* ← One of the calibration bases

Project Description

CDR(s) (Validated Outputs)	Period of Record	Spatial Resolution; Projection information	Time Step	Data format	Inputs	Uncertainty Estimates (in percent or error)	Collateral Products (unofficial and/or unvalidated)
SSM/T2 UTH	1992 – 2008	~ 48 km at nadir		netCDF	Raw binary files from NOAA		Collocated ISCCP cloud info
AMSU-B UTH	2000 - present	~ 16 km at nadir		netCDF	The same as above		The same as above

Production Approach

(Use SSM/T2 as an example)

Uncalibrated, raw SSM/T2 data (there are two versions: one from NESDIS and the other from NGDC)

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Granularize and quality control

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Apply various calibration methods

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Append ISCCP cloud info

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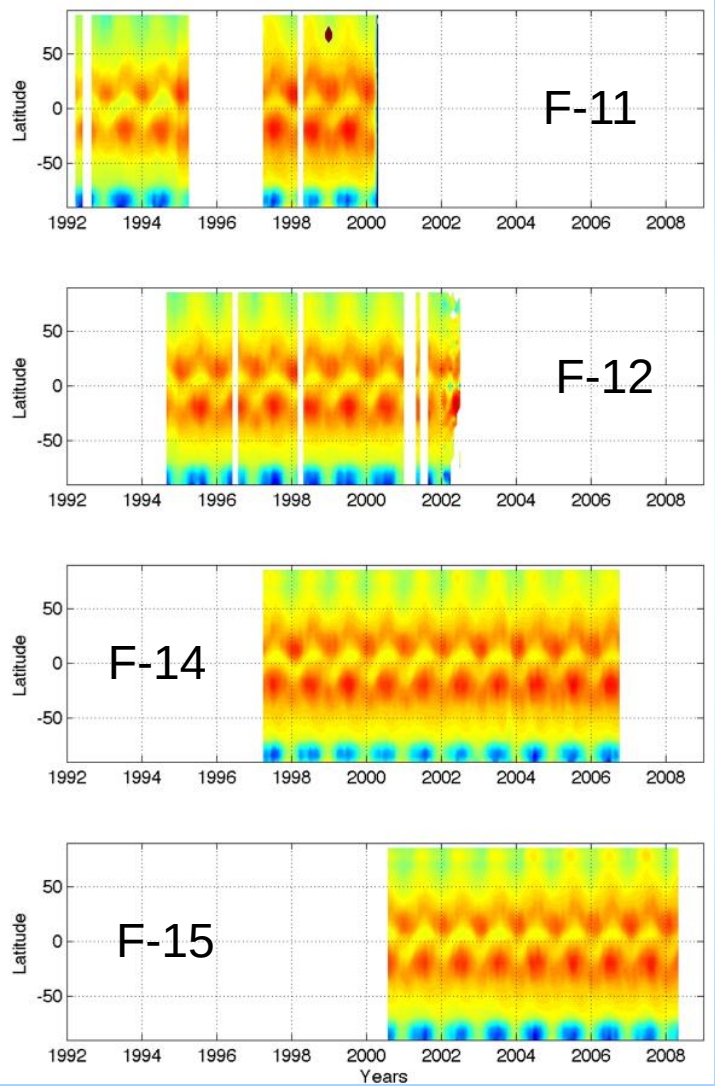
UTH FCDR

SSM/T2 TB(183±1 GHz), monthly, zonal means



Production Approach

(Use SSM/T2 as an example)

Inter-Satellite Calibration Methods:

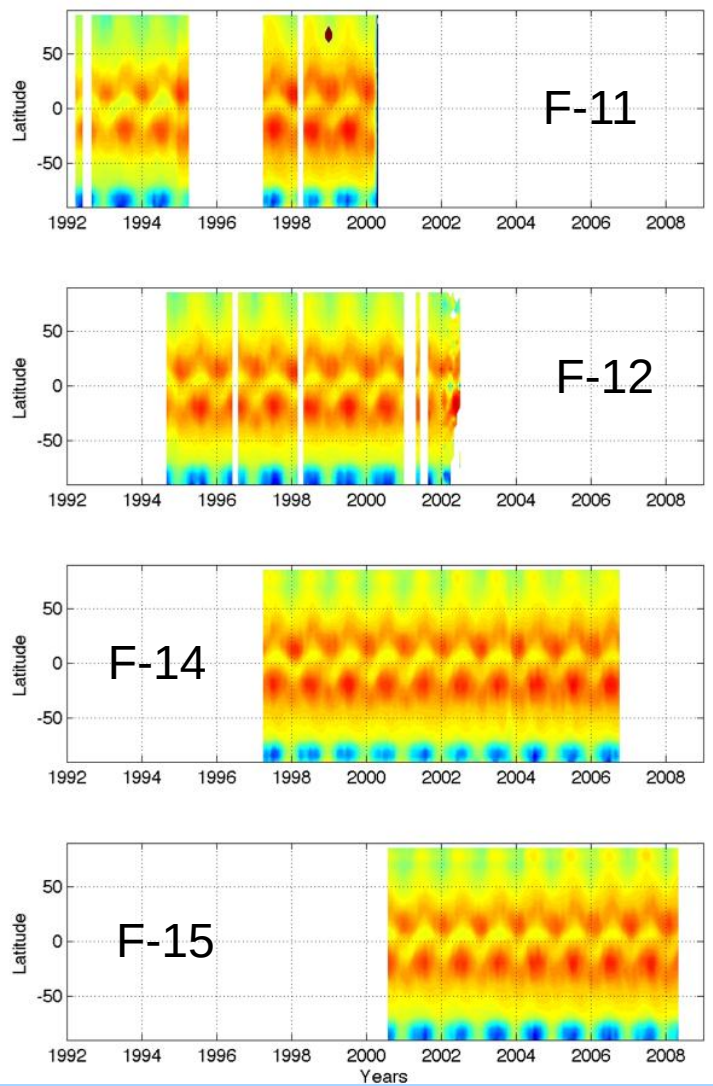
Method 1: simultaneous nadir overpass (SNO)

Method 2: Compare with simulated TBs based on collocated MOZAIC take-off & landing profiles

Method 3: Compare monthly/zonal means for the overlapping periods

Goal: seek consistency between different calibration methods

SSM/T2 TB(183±1 GHz), monthly, zonal means

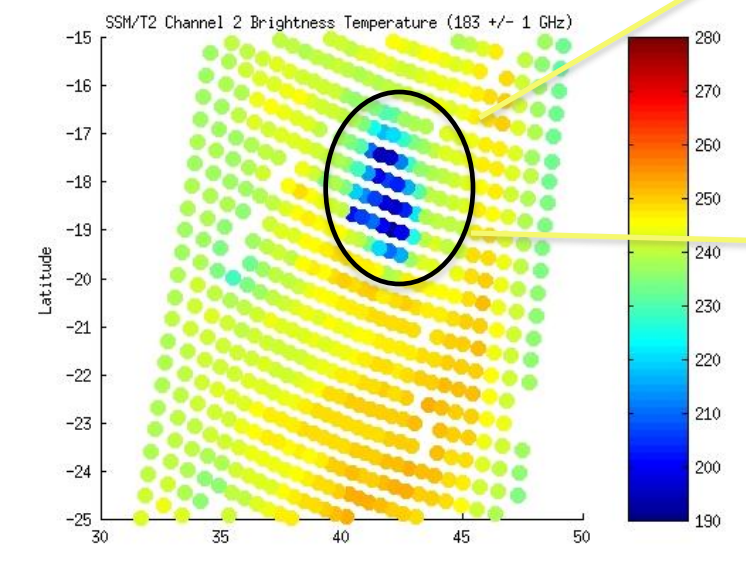


Production Approach

(Use SSM/T2 as an example)

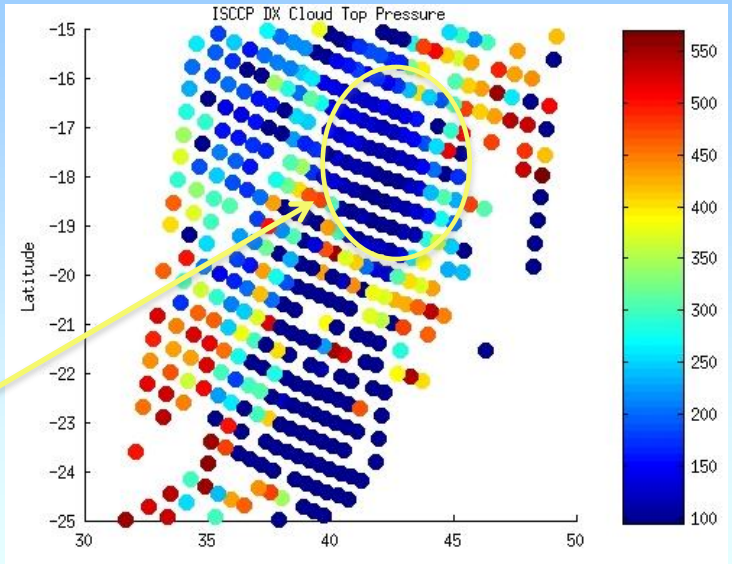
An important ancillary data for UTH is clouds, because certain clouds (e.g. deep convection) can contaminate UTH radiances and need to be marked up.

SSM/T2 TB(183±1 GHz) swath data

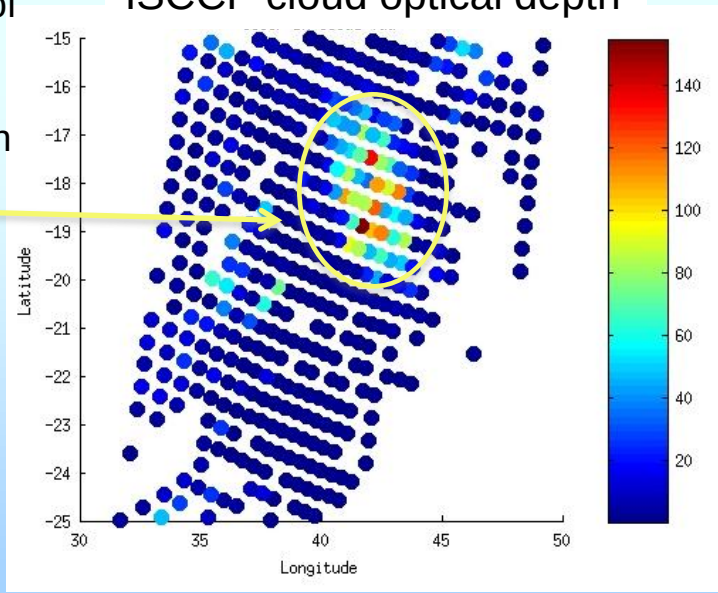


An example of deep convection contamination

ISCCP Cloud-top pressure



ISCCP cloud optical depth



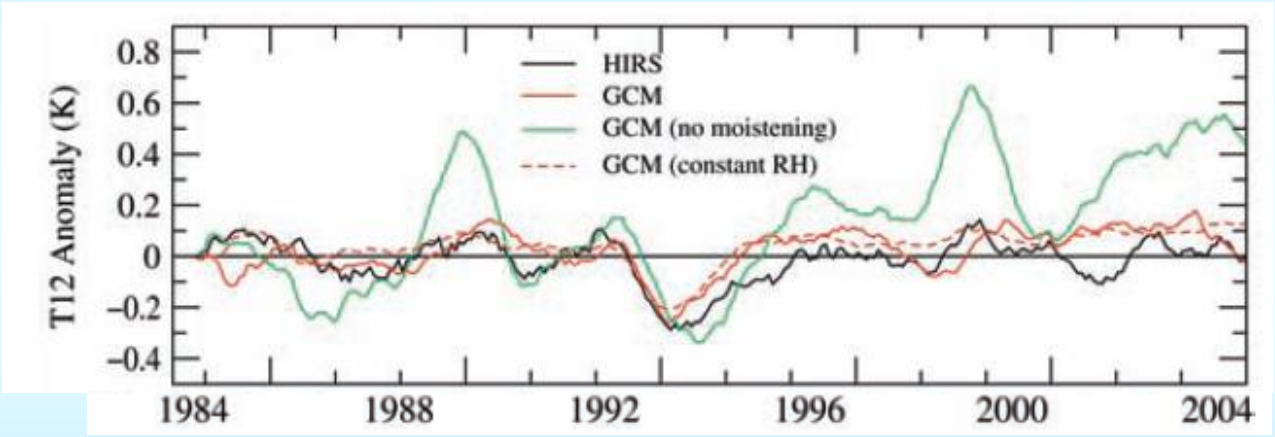
Quality Assurance Approach

Possible ways to determine product quality for future data

1. Compare TB histogram against long term statistics
2. Compare with simulated TBs using collocated MOZAIC profiles

Applications

Because UTH contributes to ~ 1/3 of the H_2O greenhouse effect, it will help better monitor and understand global warming to have a reliable long-term UTH CDR. MW-based UTH measurements have the advantage of being less sensitive to clouds.



Soden et al. (2005), Science.

HIRS Ch12 is an IR UTH channel, which is easily contaminated by high-level clouds. We will supplement it with an MW-based UTH record (which is less affected by clouds).

Schedule & Issues

(**Year 1**)

1. Explored various methods to calibration SSM/T2 (e.g., SNO, MOZAIC+CRTM);
2. Started the effort of re-archiving SSM/T2 data.

(**Year 2**)

1. Continue to re-archive SSM/T2 (thanks to Hilawe Semunegus of NCDC and Dan Kowal of NGDC)
2. Append SSM/T2 with ISCCP cloud info

(**Year 3)**

1. Bring in AMSU-B and inter-calibrate them against SSM/T2
2. Bring in IR UTH data (e.g., from GEOs);
3. Package up the MW-based UTH CDR and deliver it to NCDC.

Acknowledgements

We'd like to thank Hilawe Semunegus of NCDC and Dan Kowal of NGDC for help provide the raw SSM/T2 data.