RADIOSONDE HUMIDITY BIAS ADJUSTMENTS USING REANALYSIS BACKGROUND DEPARTURES

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WP4

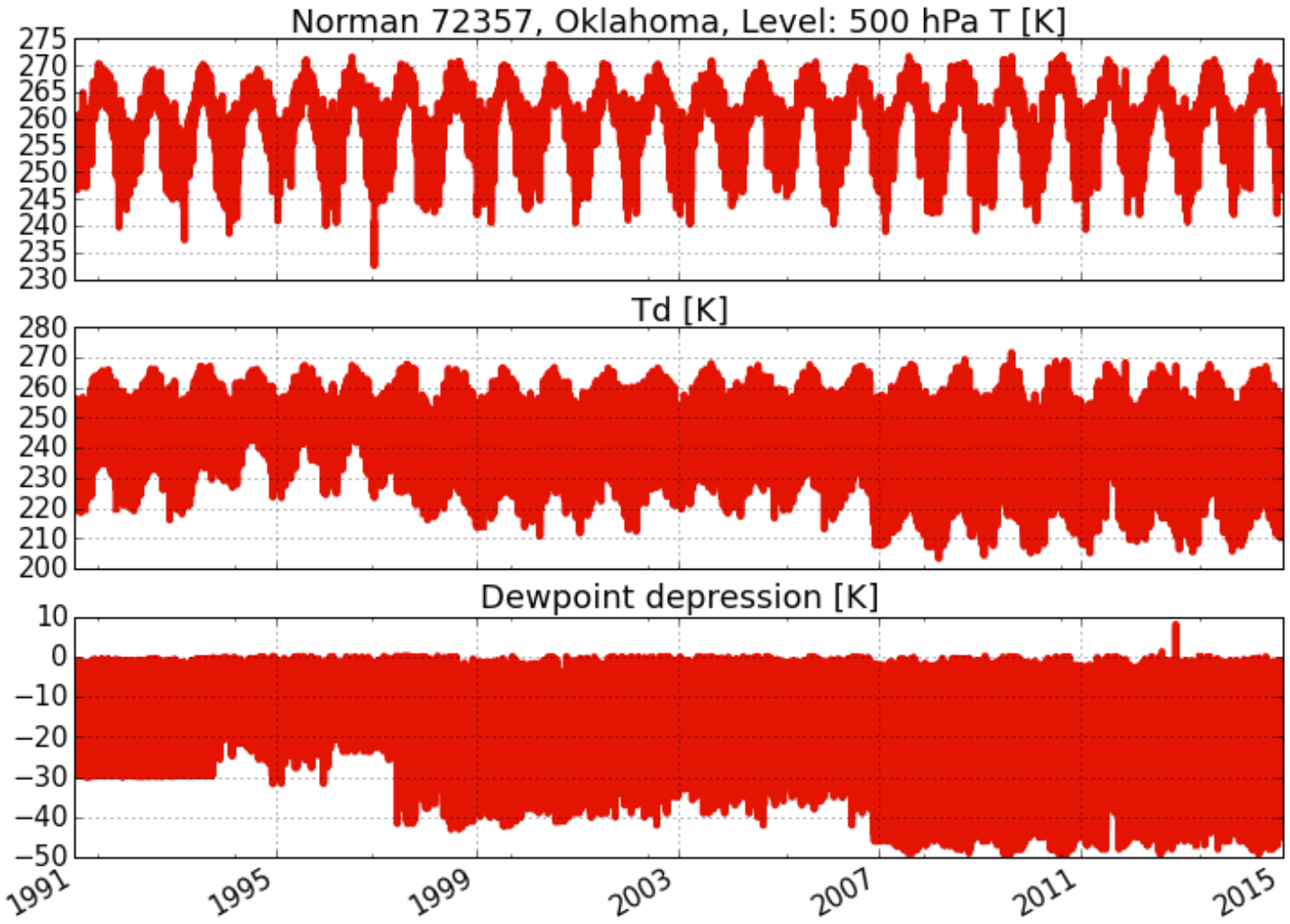
ERACLIM2 – General Assembly – Darmstadt

TASK

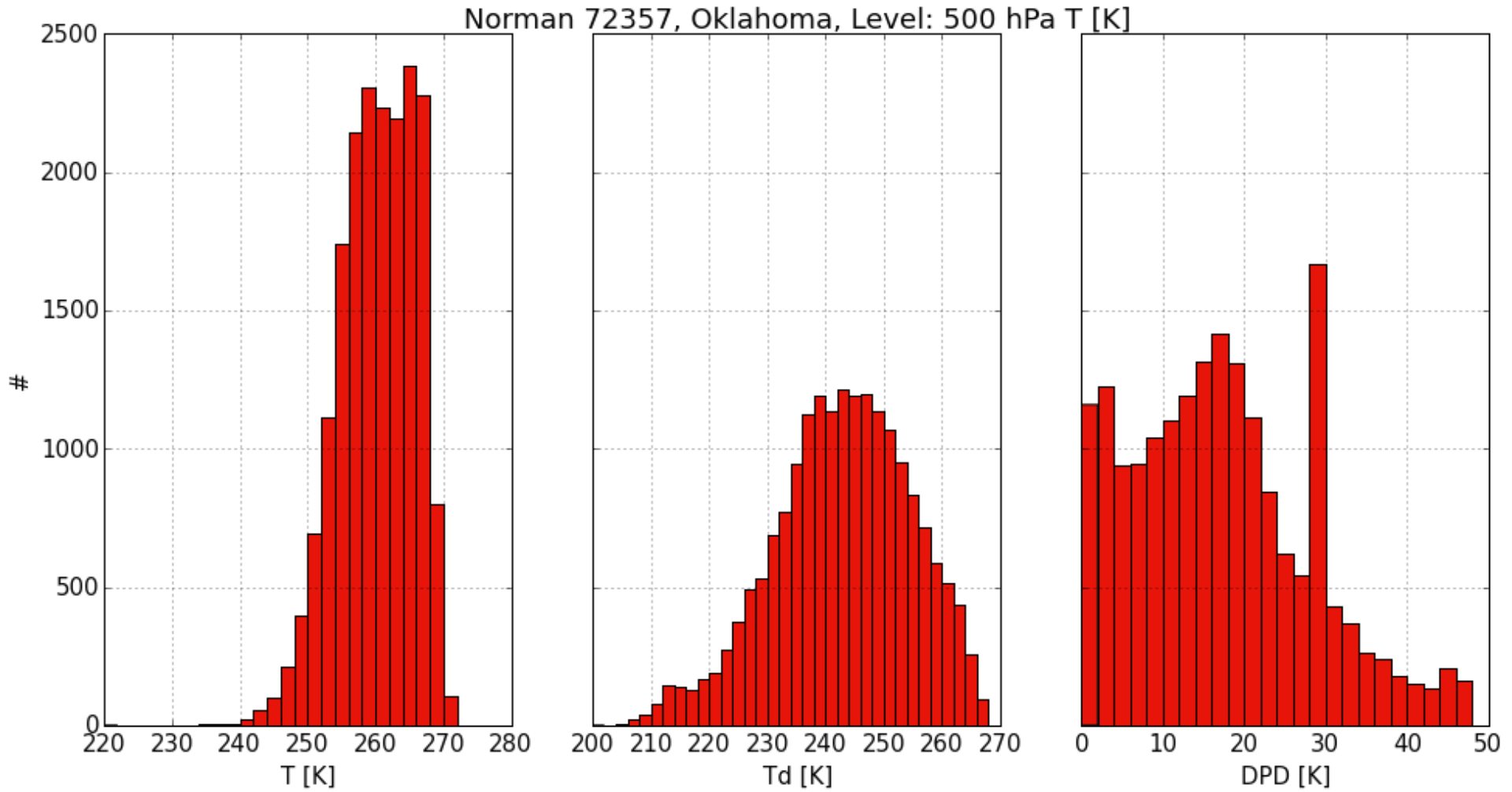
Bias-correct radiosonde dataset for reanalysis purposes

Focus on humidity

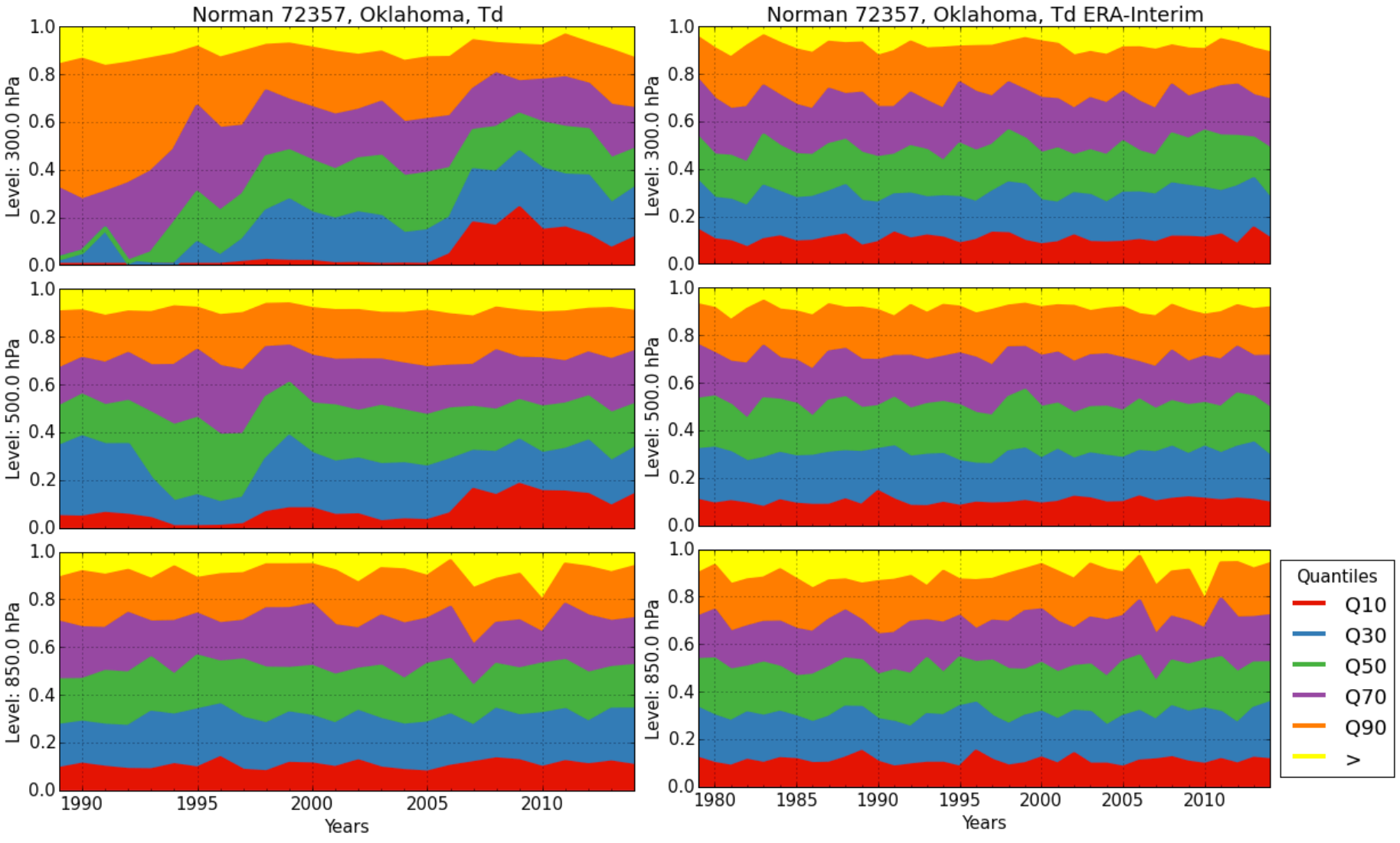
Motivation – Find & Define



Motivation – Distribution



Motivation – Occurrence Frequency



Previous attempts/methods for humidity bias correction/detection

- Dai et al. (2011)
  - Distribution changes of DPD > breakpoints
  - No reference
  - Per station, sampling effects, detrend > quantile matching (back in time) as bias adjustment
- McCarthy et al. (2009)
  - Metadata + ensemble KS-Test (T, RH, Q) > breakpoints
  - No reference
  - Neighbour-based, sampling effects (dry, cold)

Our Strategy

- Quantile Matching
- Detect breakpoints from time series of ERA-Interim Td-departures using SNHT
- Adjust quantiles of earlier data at breakpoints
  - Use Td (or DPD or Vp ...)

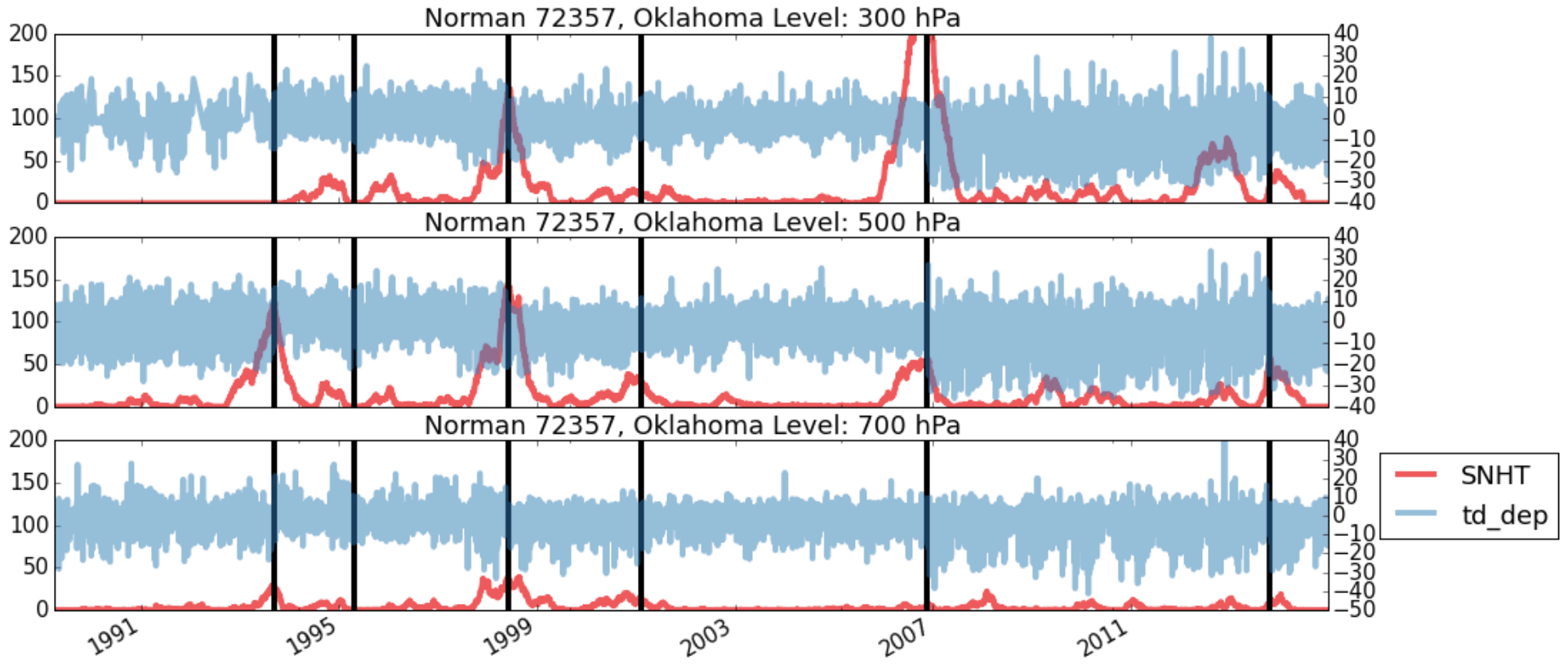
Pros

- ERA-Interim
  - no trend correction
- No neighbours / representative error
- Adjusting the distribution rather than the mean (outliers)

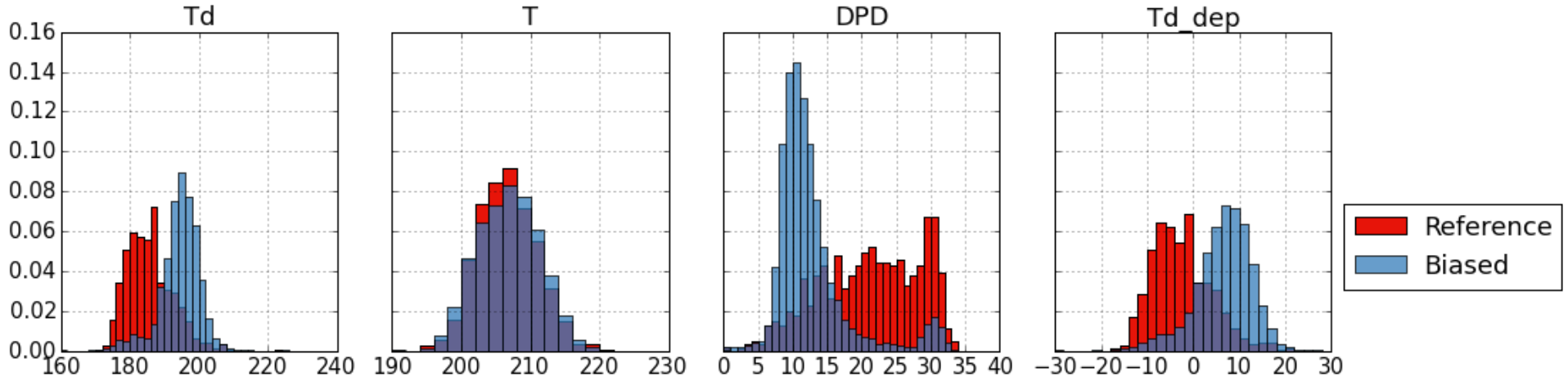
Cons

- ERA-Interim
  - depend on its trends, breaks, ...
- Verification with independent data

#1: Breakpoint detection

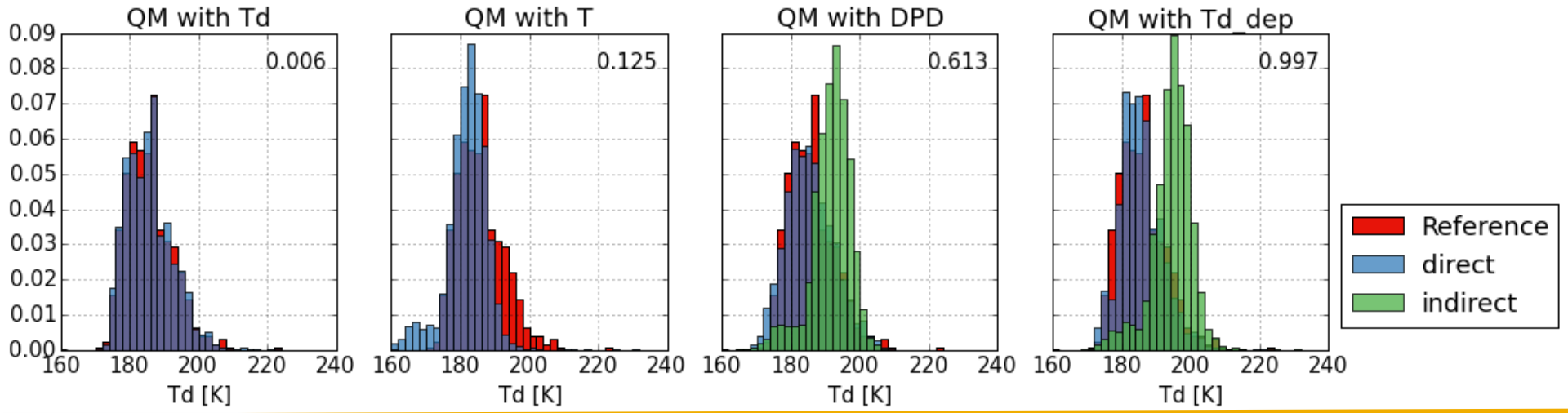


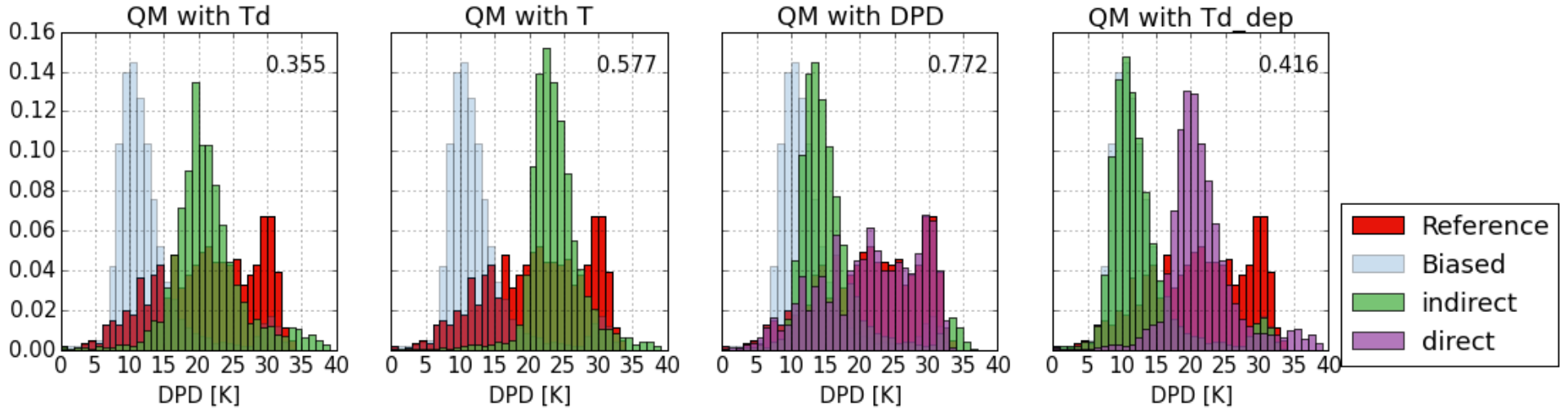
#2: Break Analysis: Histograms



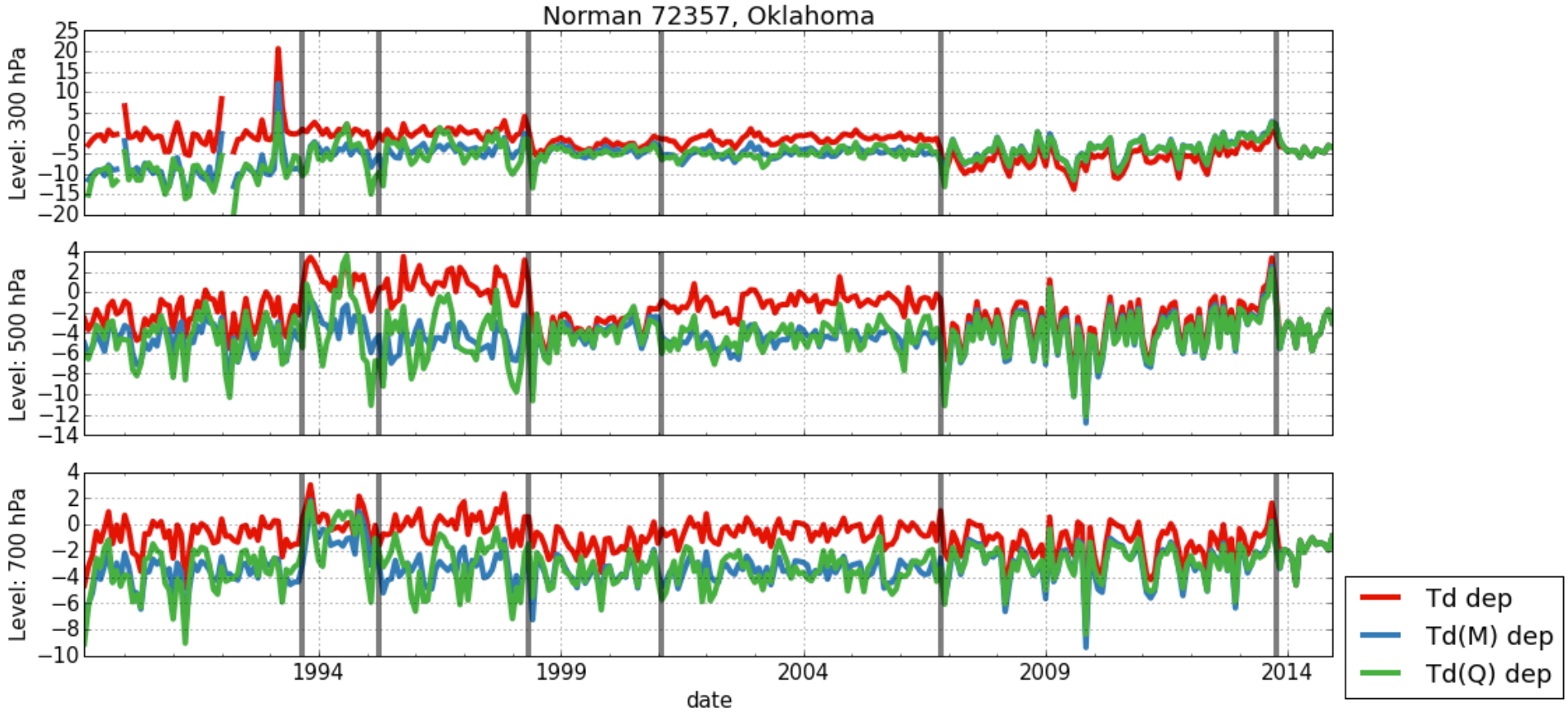
- direct
  - Td with Td, or DPD with DPD
- indirect (assume there is a connection)
  - Td with DPD or Td_dep

#3: Quantile Matching

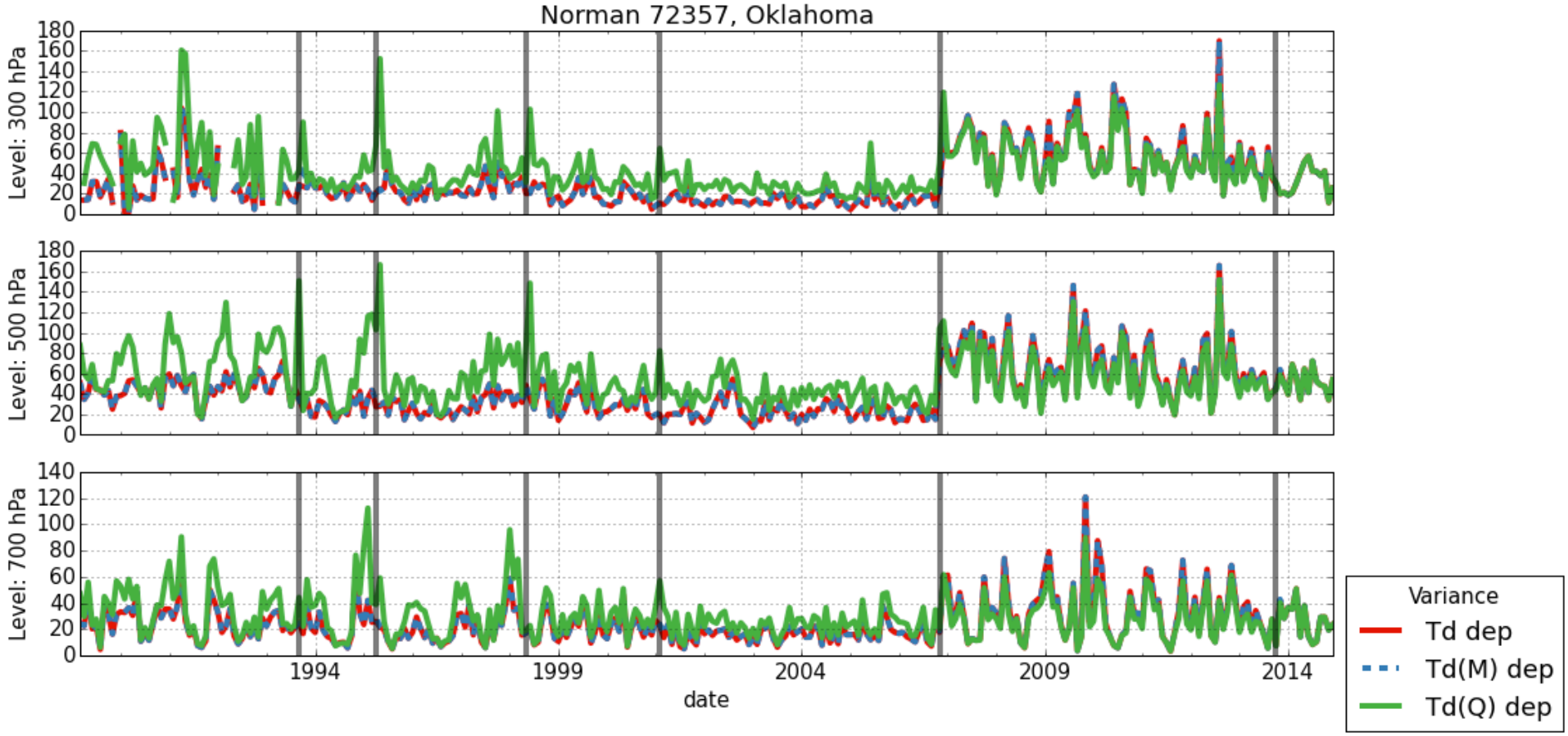




Results – Departures

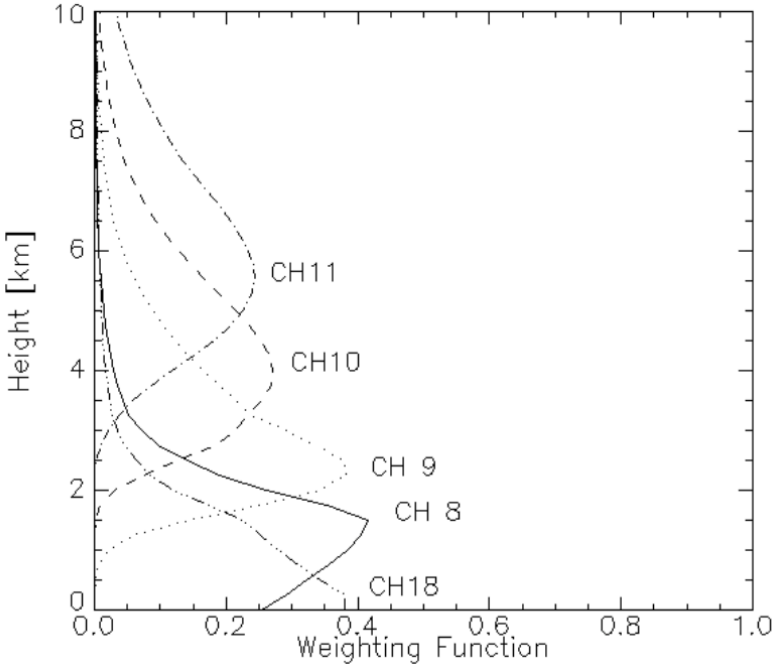


Results – Variance



Comparison with Microwave Satellites

- Basic technique:
  - BT from RTTOV fwd model
  - Need T, p, Q
  - # levels is critical

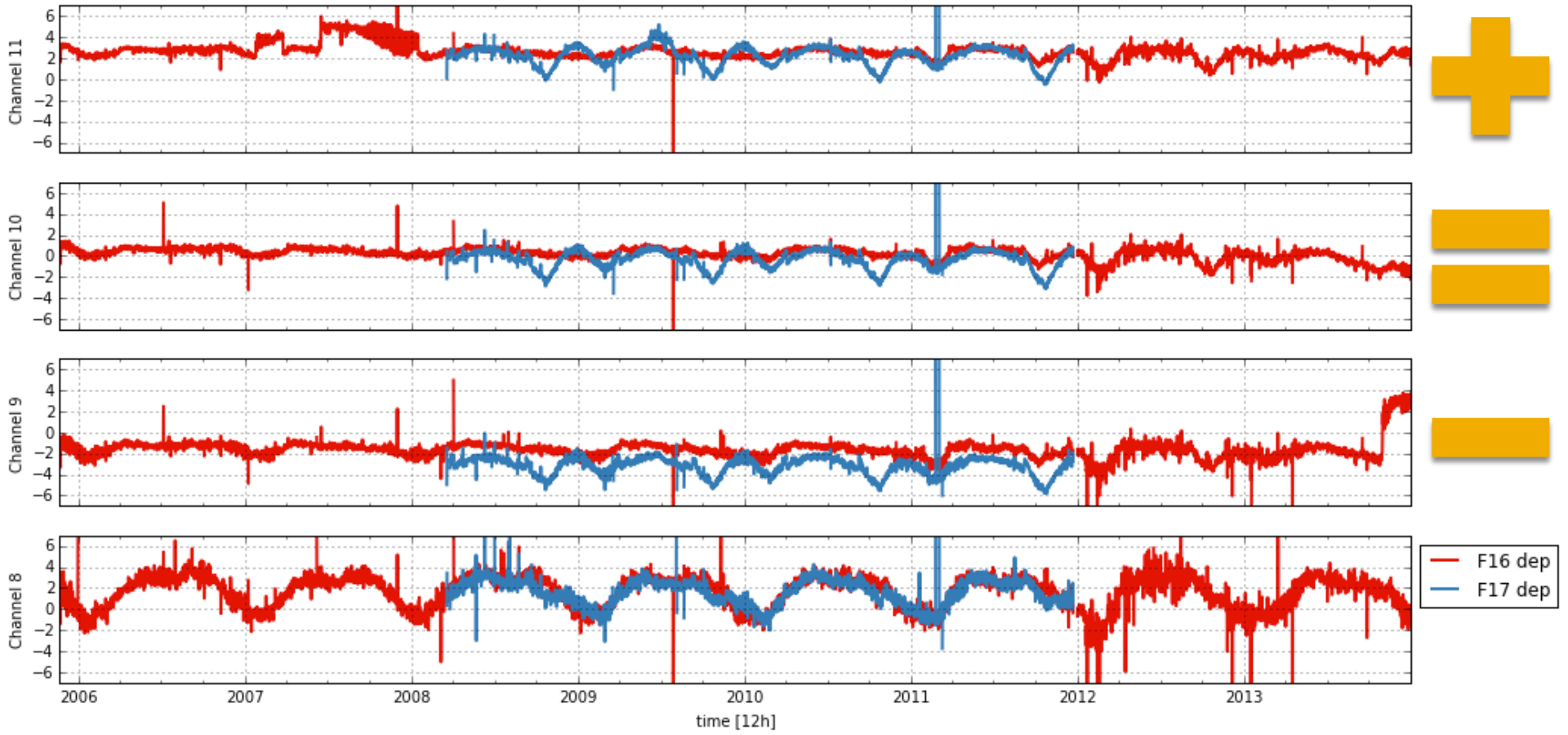


- SSM T2 (1994 – 2008)
  - Reprocessed at ECMWF

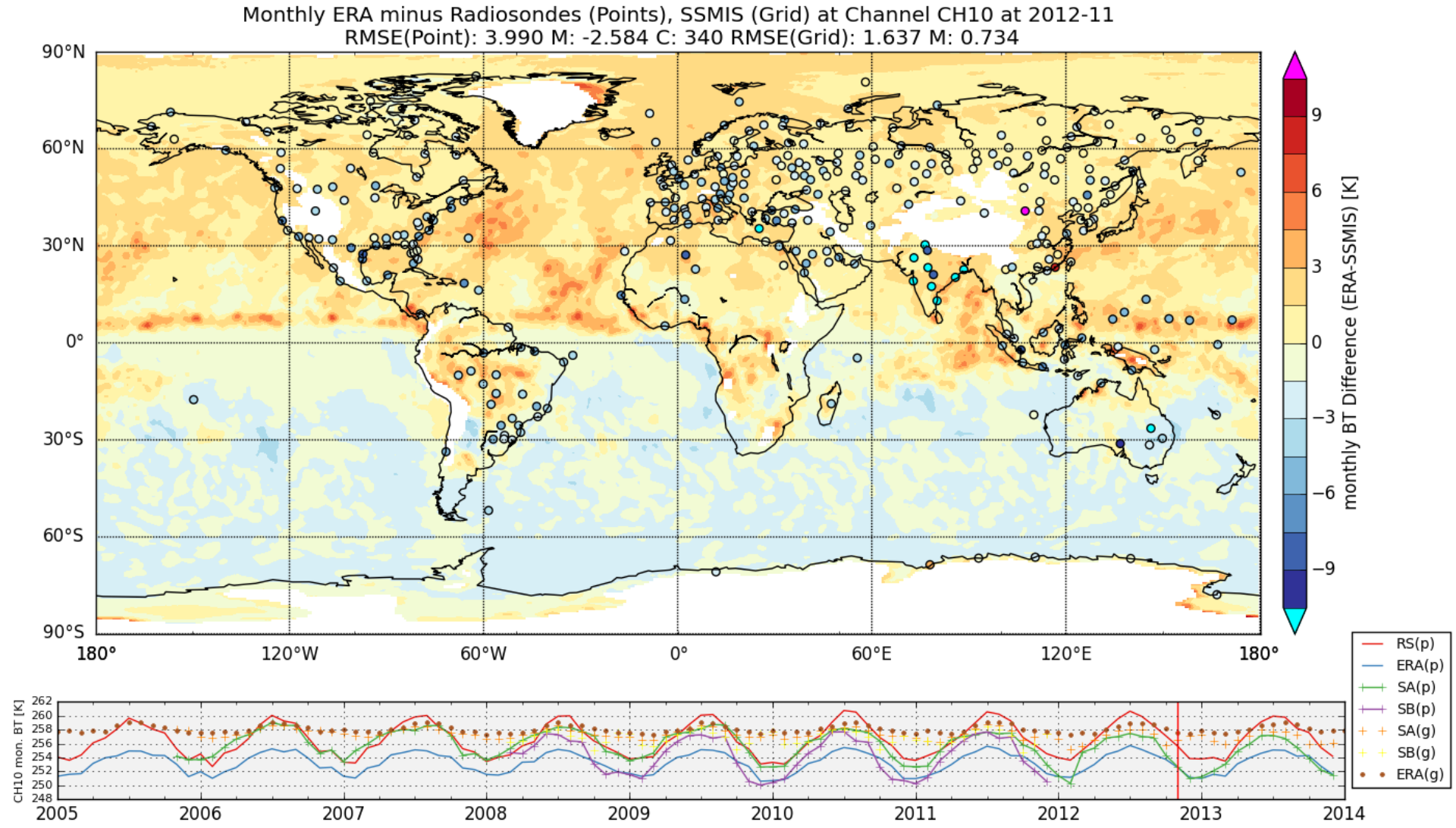
  (S. Kobayashi, ERA Report #21)
- SSMIS (2005 – 2014+) (updated: CM SAF <?> NOAA)
  - humidity channels (#4) of Special Sensor Microwave Imager/Sounder (SSMIS) on DMSP F-16 and F-17
  - RTTOV 11.2 forward model

Global Satellite Intercomparison – SSMIS

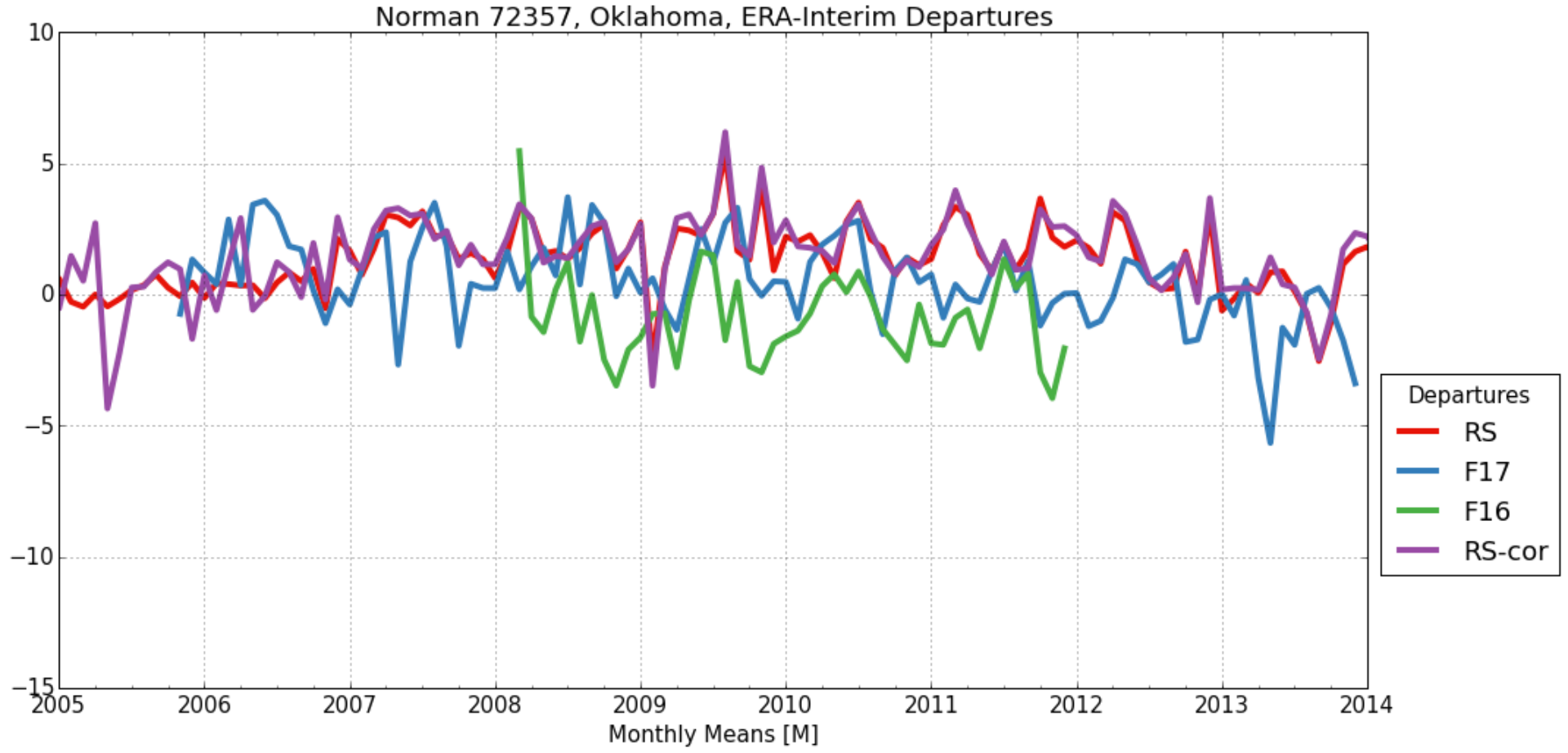
Departures from ERA Interim



SSMIS spatial comparison - Ch.10

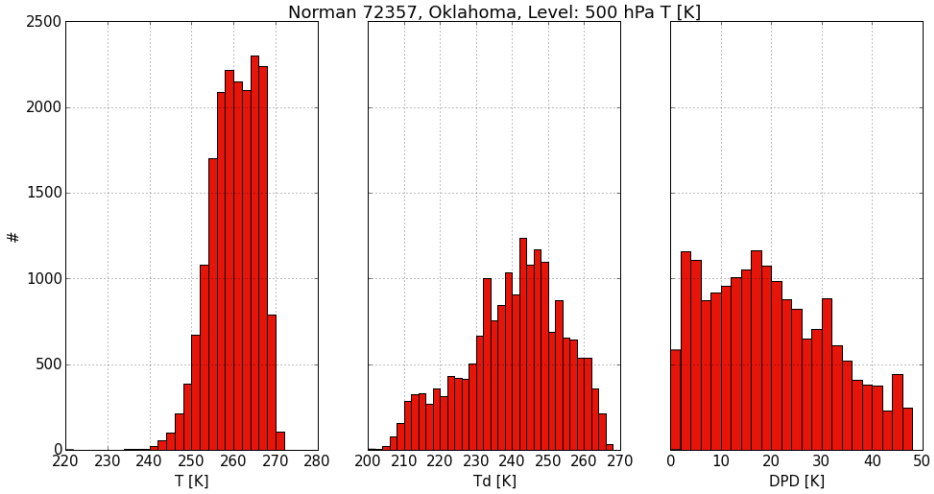


Results – Norman BT

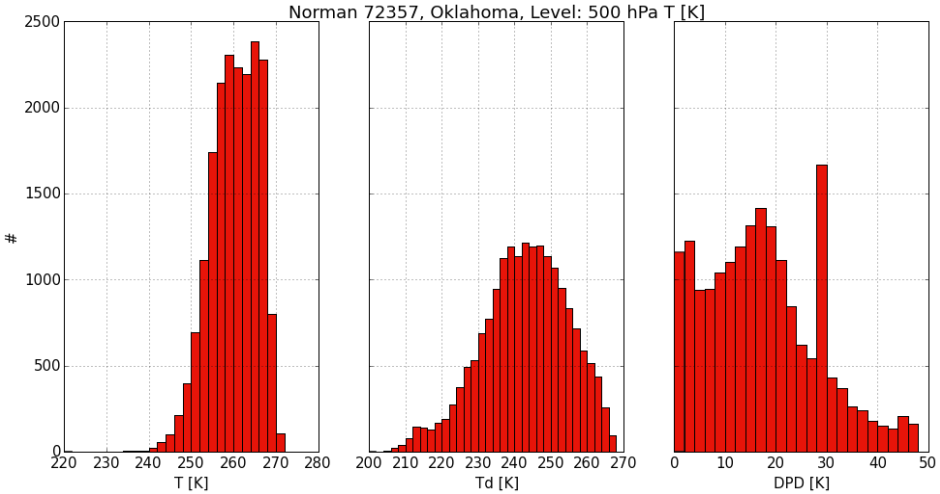


Td bias corrected

corrected



biased / raw



Outlook

- Application to all available radiosonde stations / data
- Evaluation with previous datasets (methods)
- Evaluation with spatial homogeneity
- Evaluation with SSMIS / SSM-T2 (Update)
- Evaluation with GPSRO (TIME?)
- Evaluation with ATOVS (spec. humidity 6 channels) (EUMETSAT) (TIME?)

- Deliverables:
  - Radiosonde dataset with bias adjustments (humidity)

Thanks

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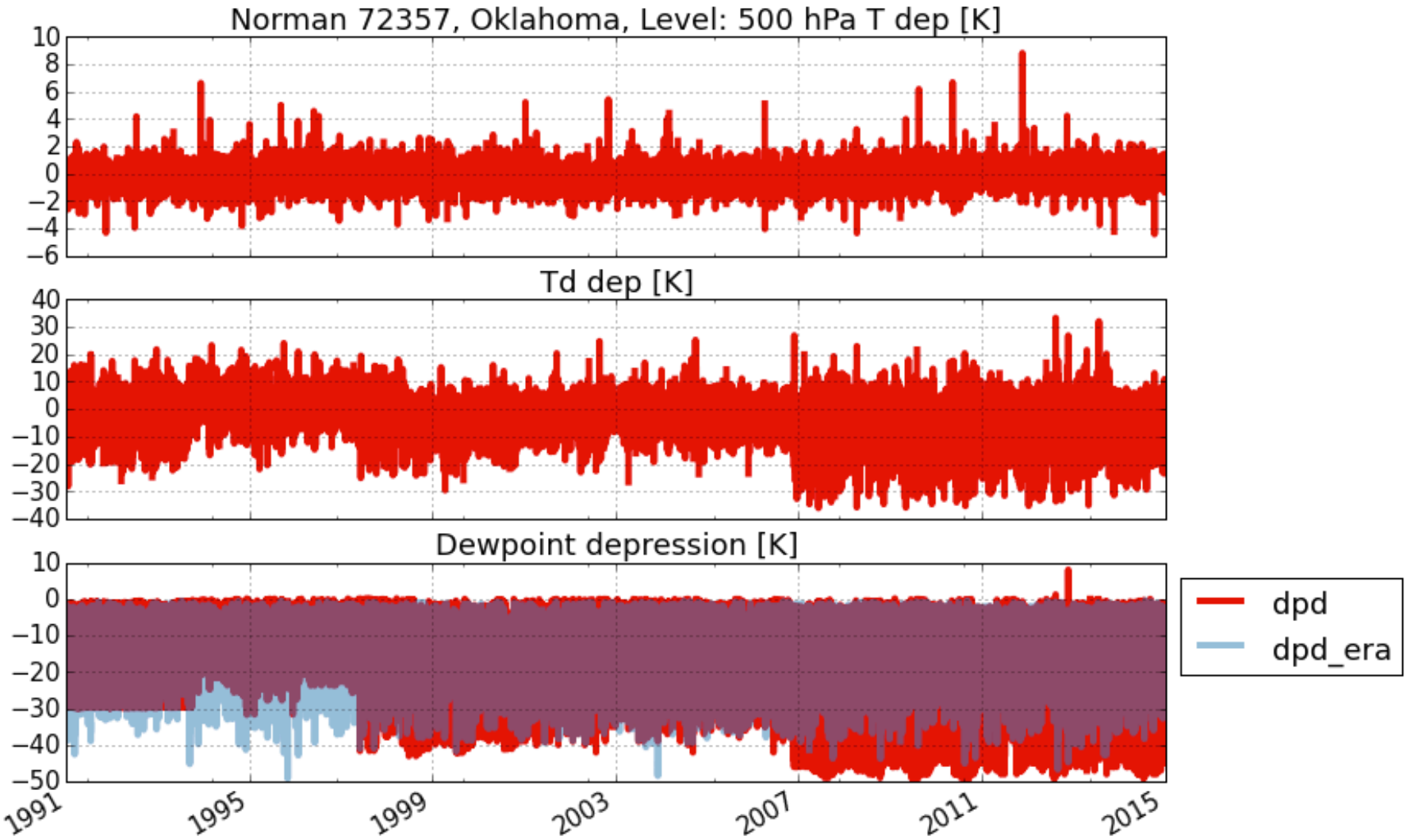
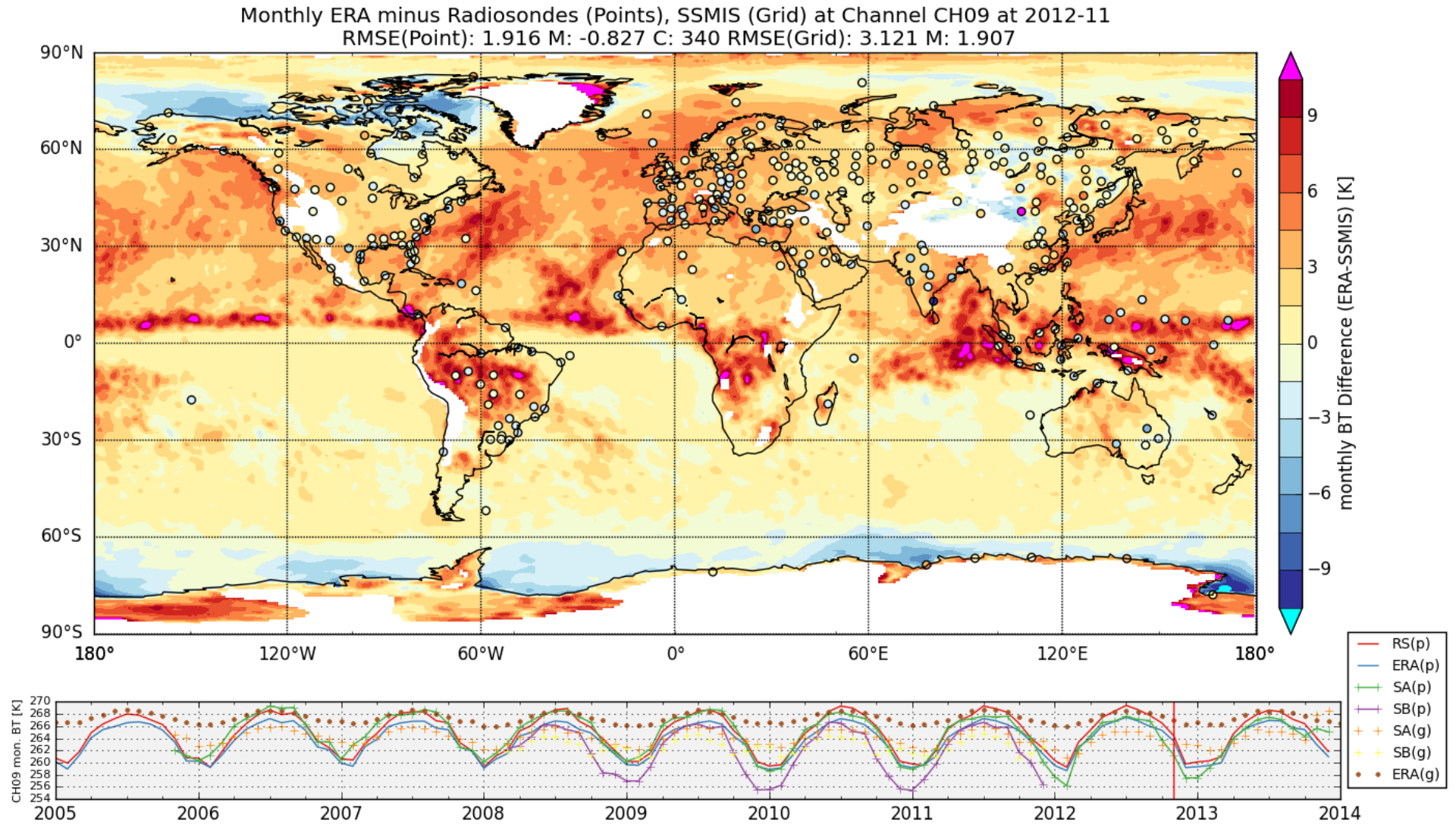
Motivation - Departures



SSMIS – Ch.09


Monthly ERA minus Radiosondes (Points), SSMIS (Grid) at Channel CH09 at 2012-11
RMSE(Point): 1.916 M: -0.827 C: 340 RMSE(Grid): 3.121 M: 1.907
90°N
60°N
30°N
0°
30°S
60°S
90°S
180°
120°W
60°W
0°
60°E
120°E
180°
9
6
3
0
−3
−6
−9
monthly BT Difference (ERA-SSMIS) [K]
CH09 mon. BT [K]
270
268
266
264
262
260
258
256
254
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
RS(p)
ERA(p)
SA(p)
SB(p)
SA(g)
SB(g)
ERA(g)