CloudSat mission

A climate-stable record of upper-tropospheric cloud changes from CloudSat 2006—2018

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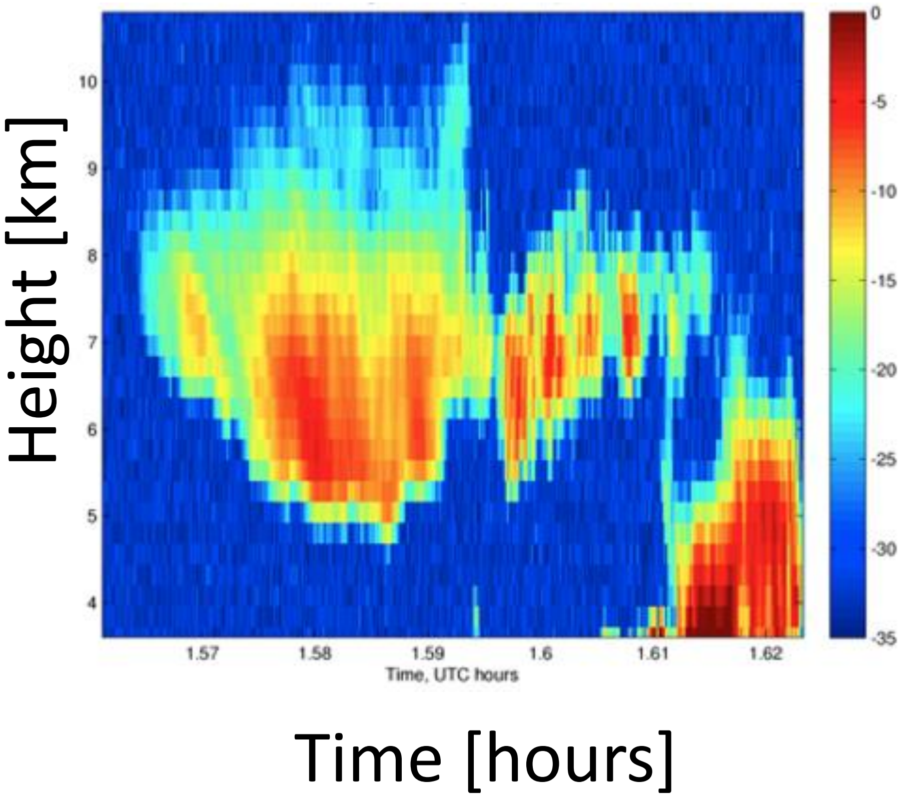
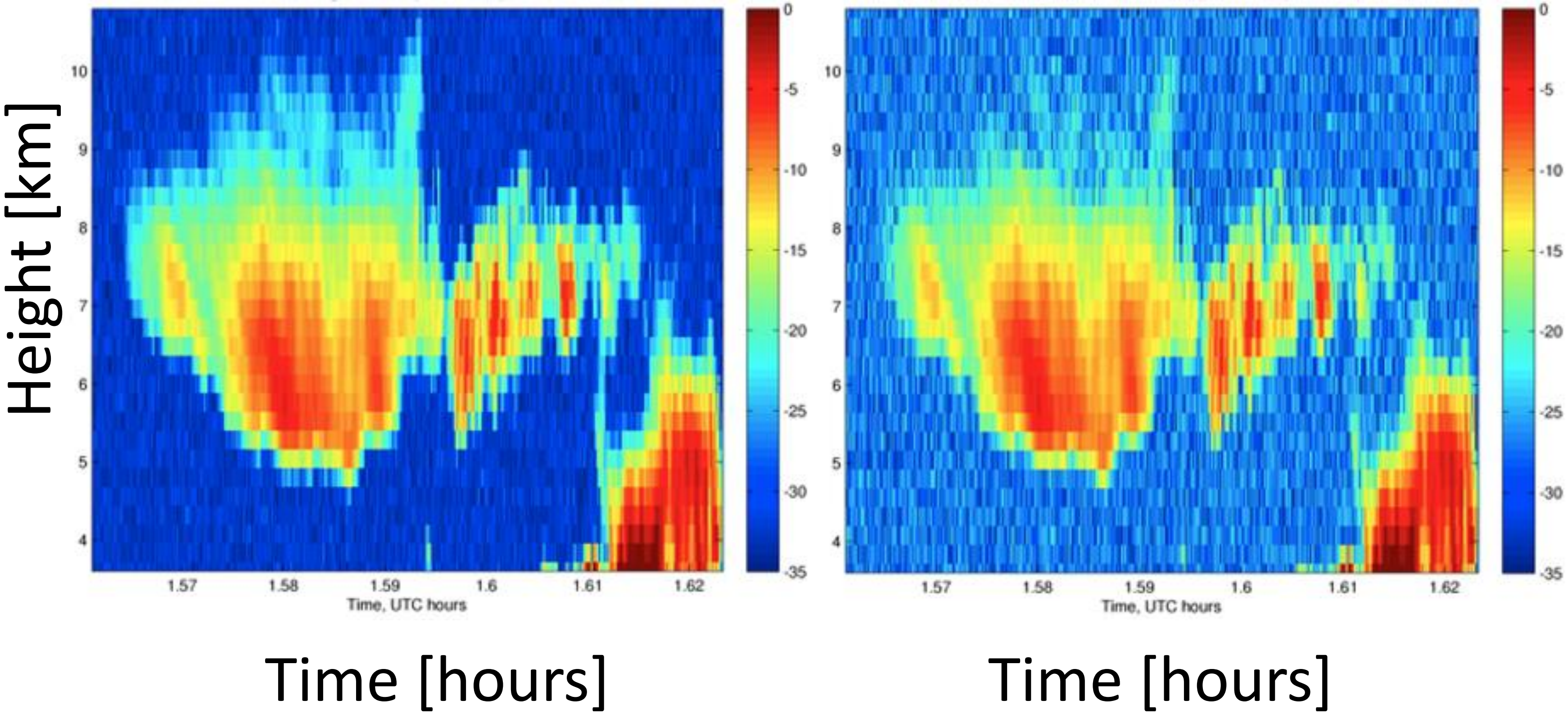
Jet Propulsion Laboratory
California Institute of Technology


Height [km]
10
9
8
7
6
5
4
1.57
1.58
1.59
1.6
1.61
1.62
Time, UTC hours
0
-5
-10
-15
-20
-25
-30
-35
Time [hours]



Height [km]
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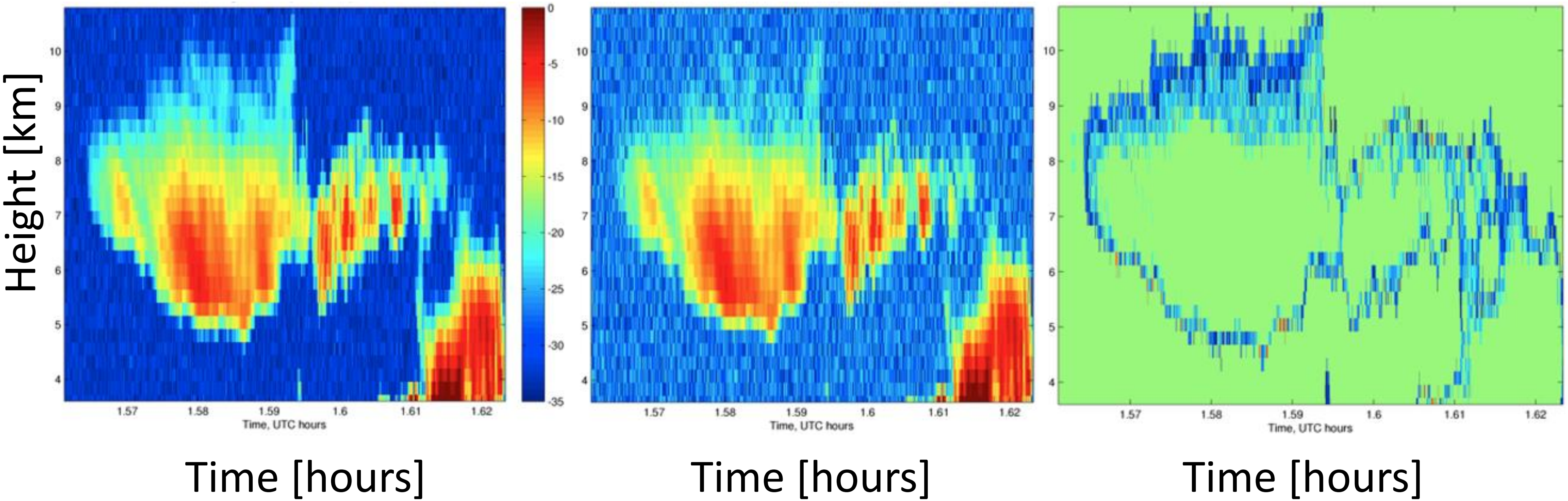
Time [hours]


Height [km]
10
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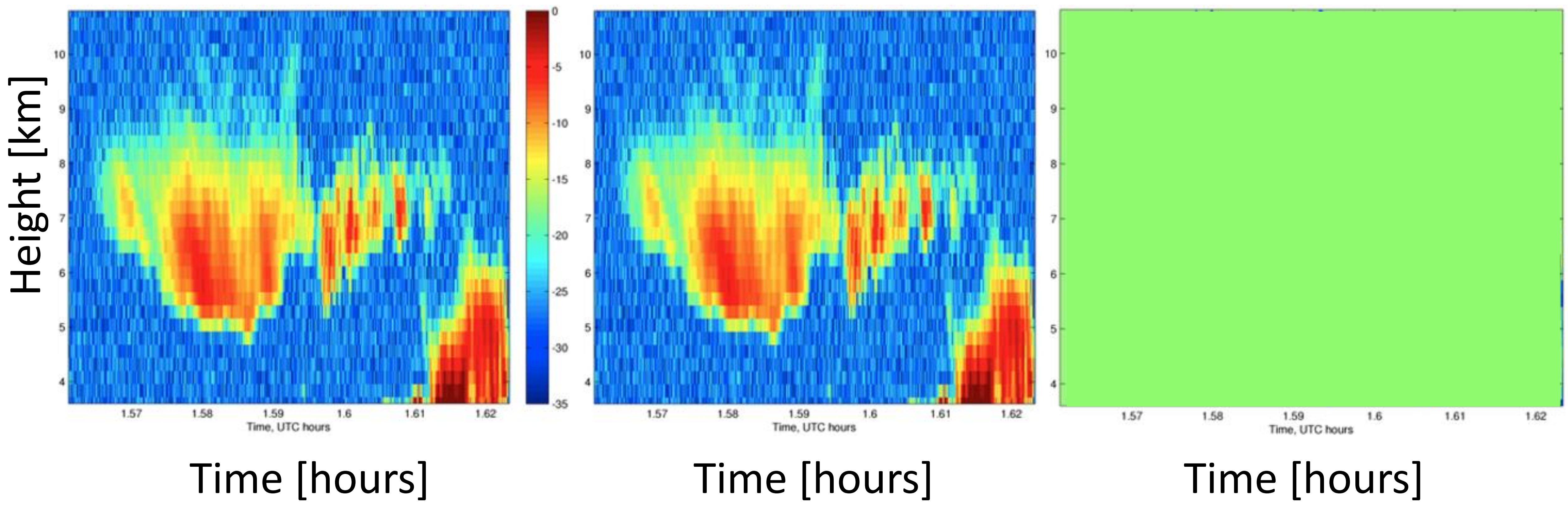
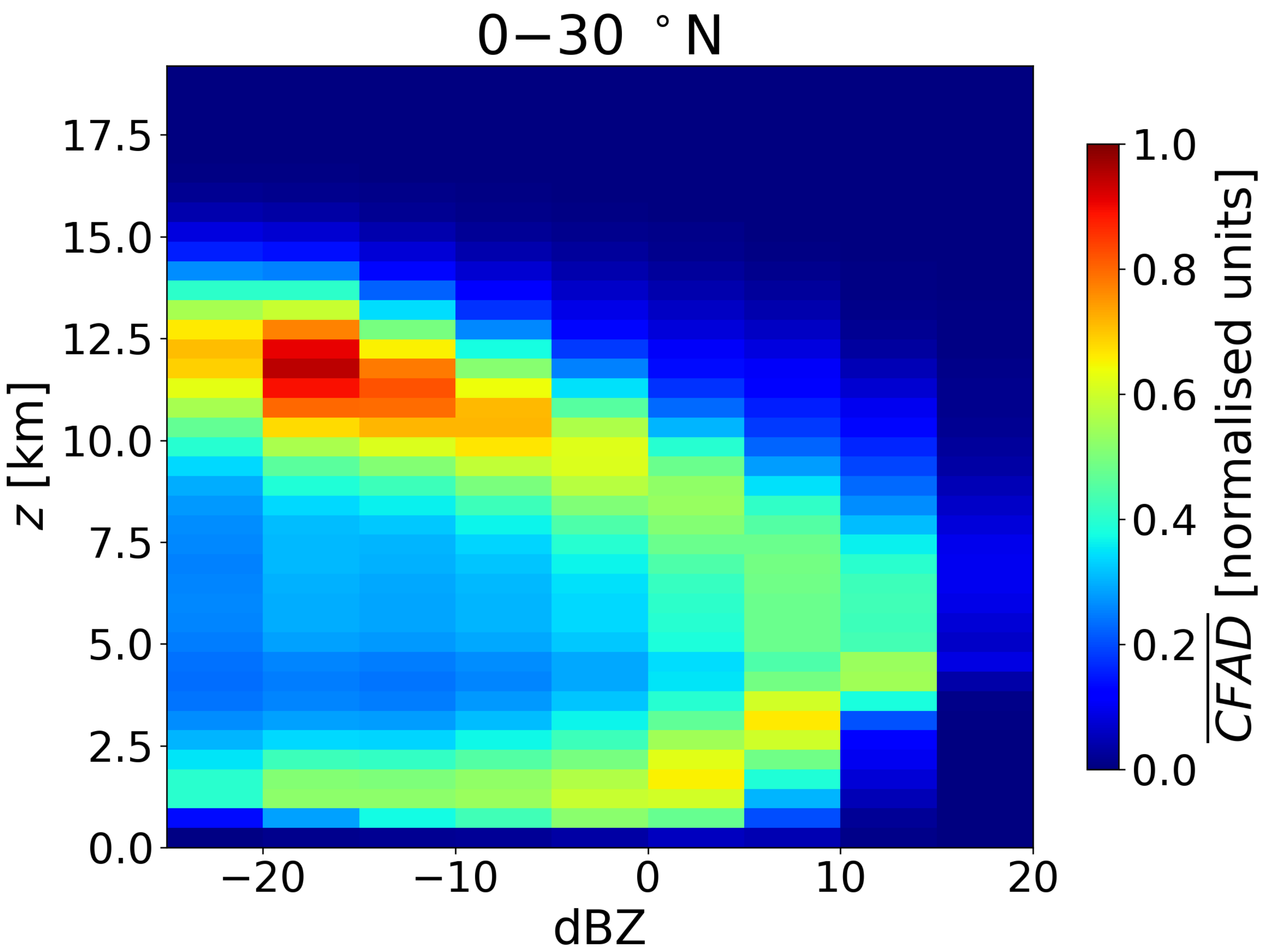
-25
-30
-35
1.57
1.58
1.59
1.6
1.61
1.62
Time, UTC hours
Time [hours]
Time [hours]
Time [hours]

Solution: add time-varying noise through mission to ensure consistent interpretation of cloud objects

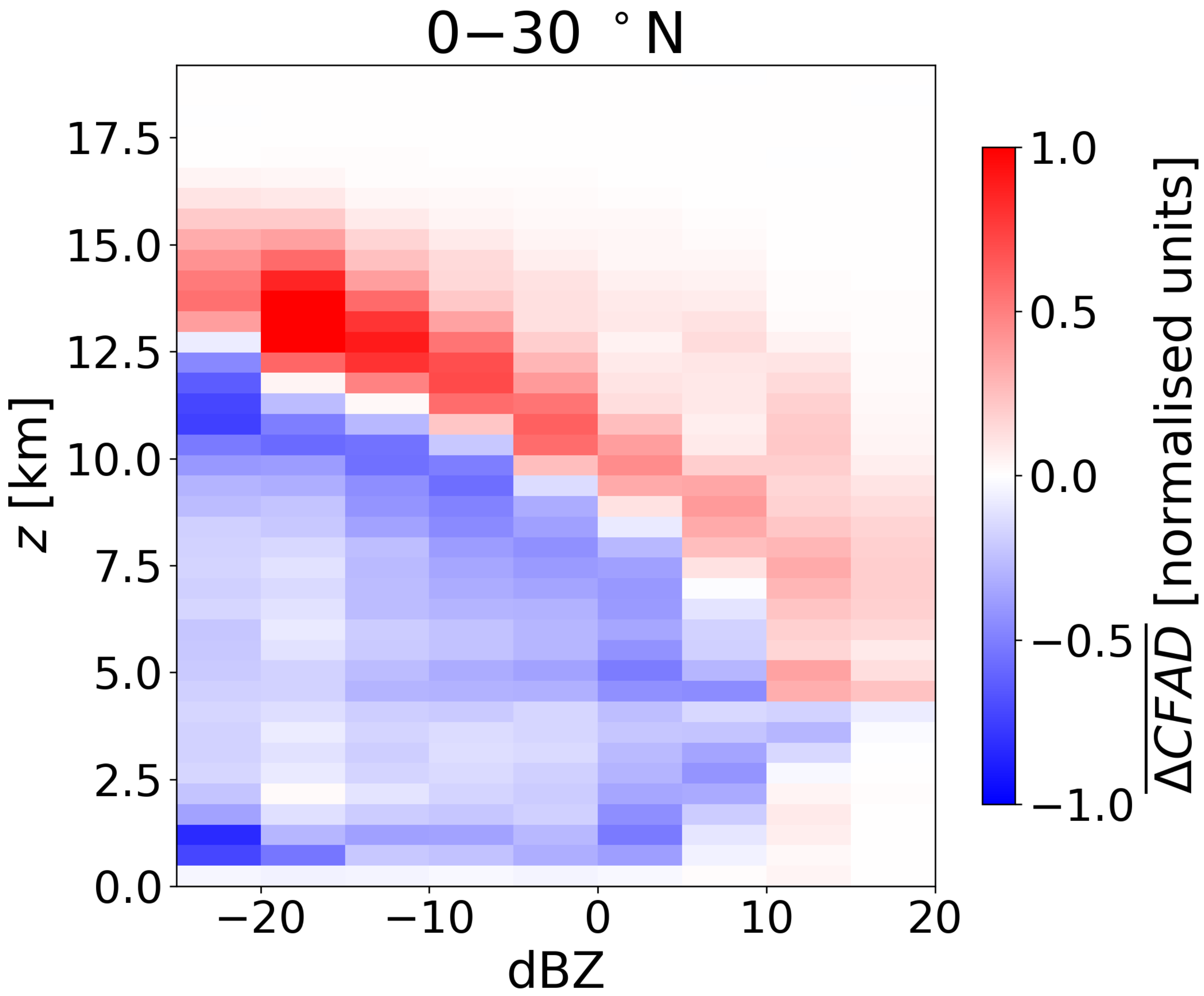


Contoured
Frequency (by)
Altitude
Diagram

Histogram of many radar beams over time/place (here: 0—10 °N, 2006--2015)

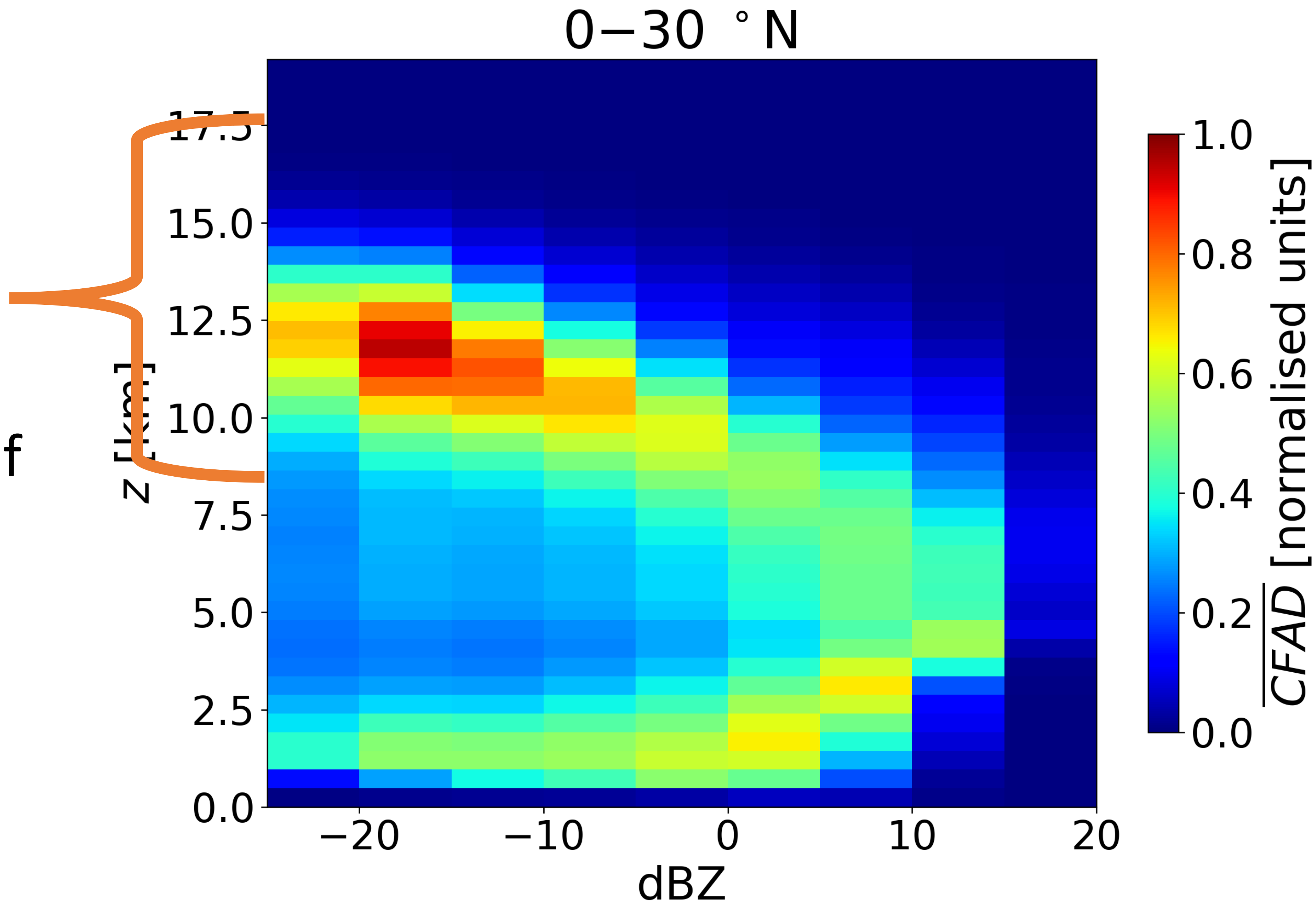


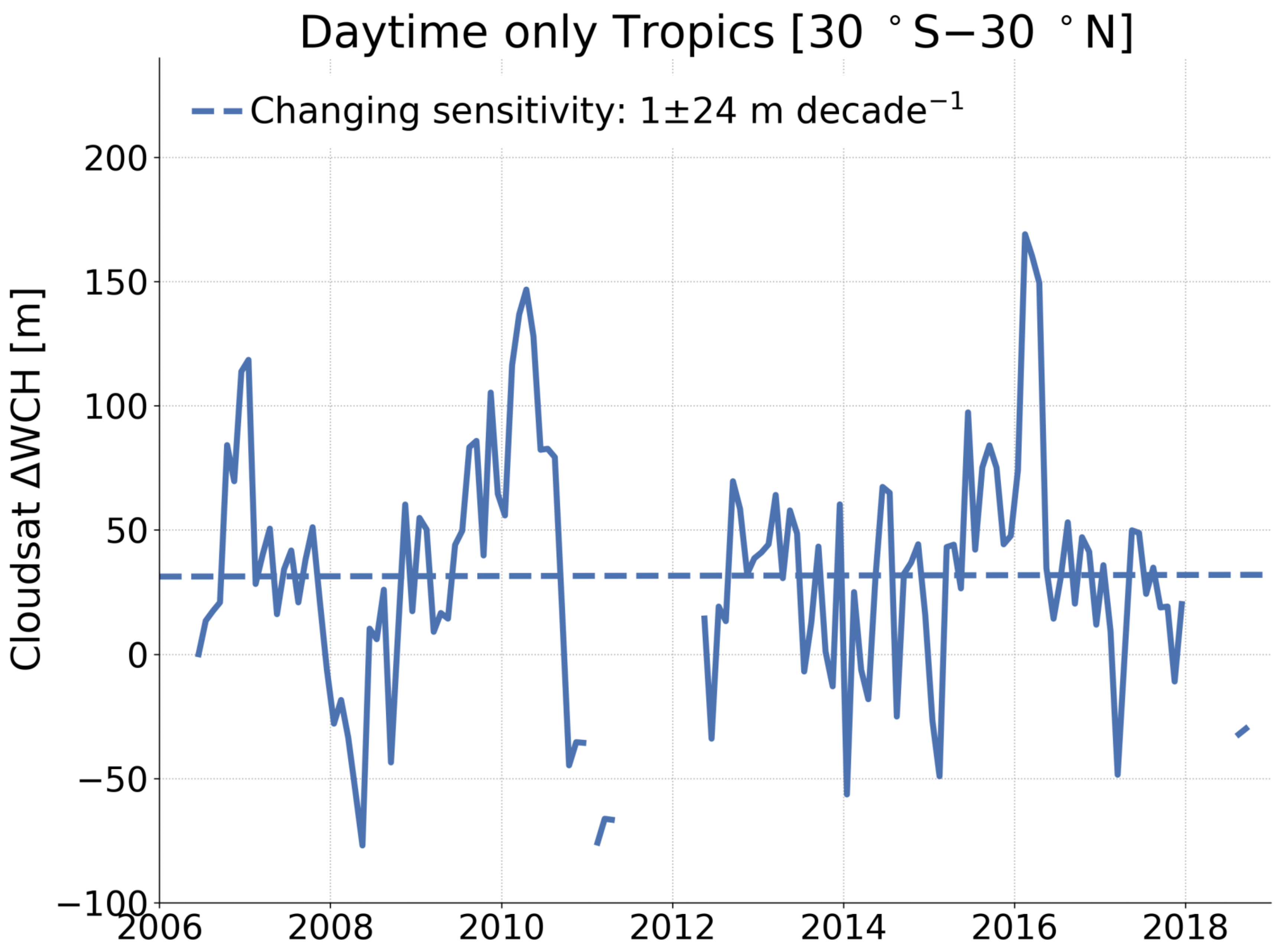
Changes between first and second half of CloudSat Record



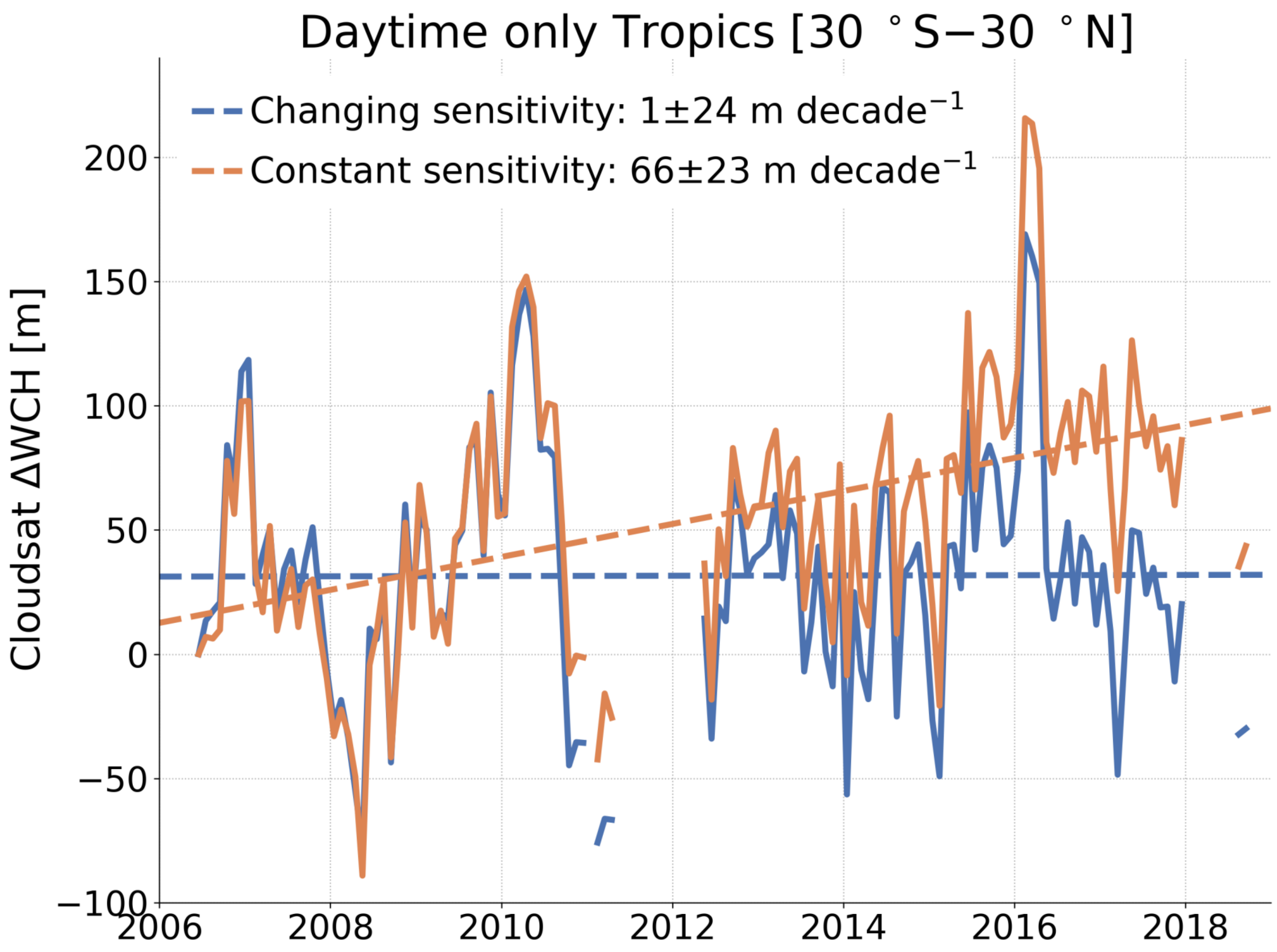
Weighted
Cloud
Height

Average height of the upper-troposphere part of this histogram



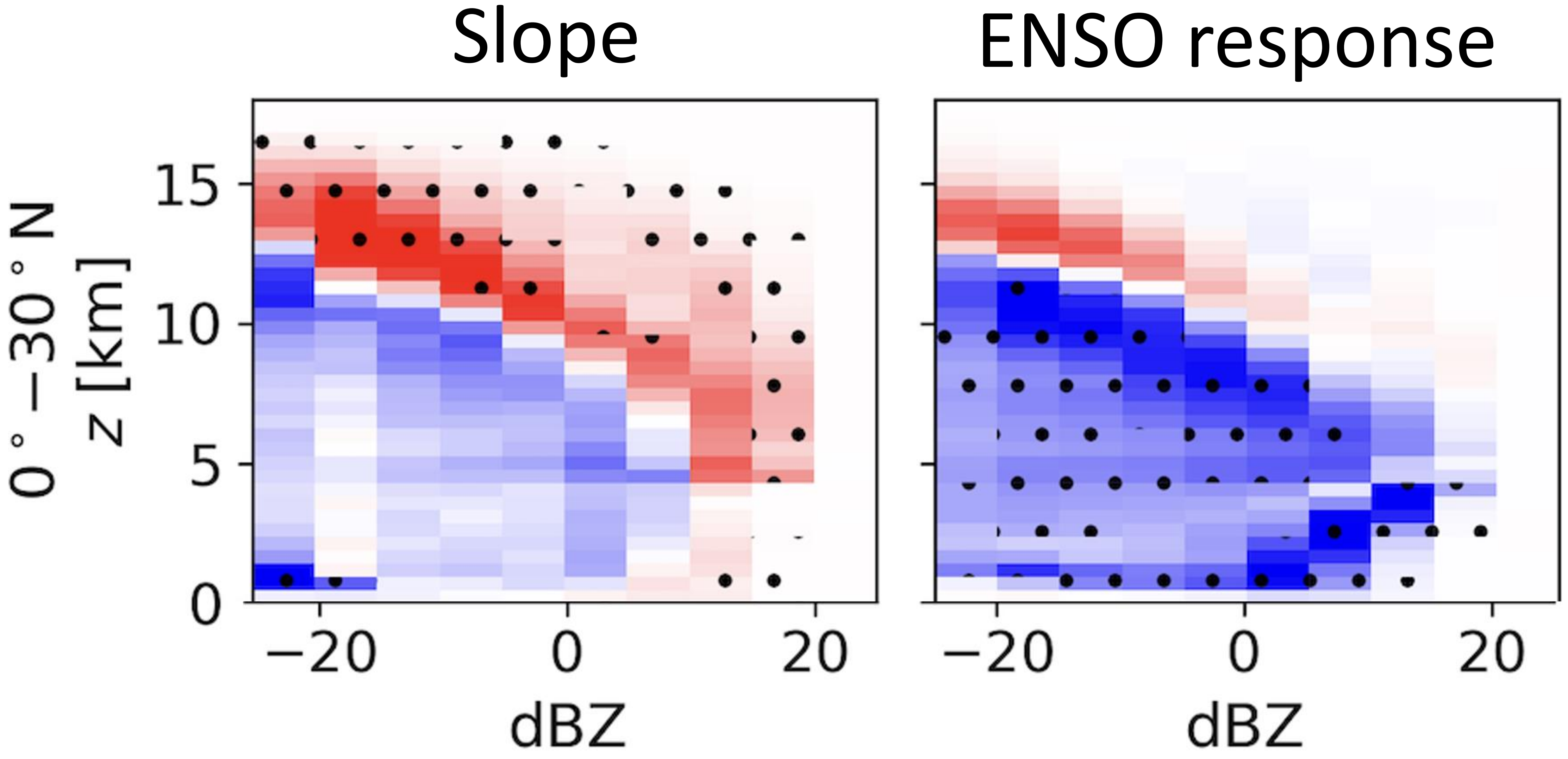


Daytime only Tropics [30 °S−30 °N]
Changing sensitivity: 1±24 m decade^{-1}
Cloudsat ΔWCH [m]
200
150
100
50
0
−50
−100
2006
2008
2010
2012
2014
2016
2018

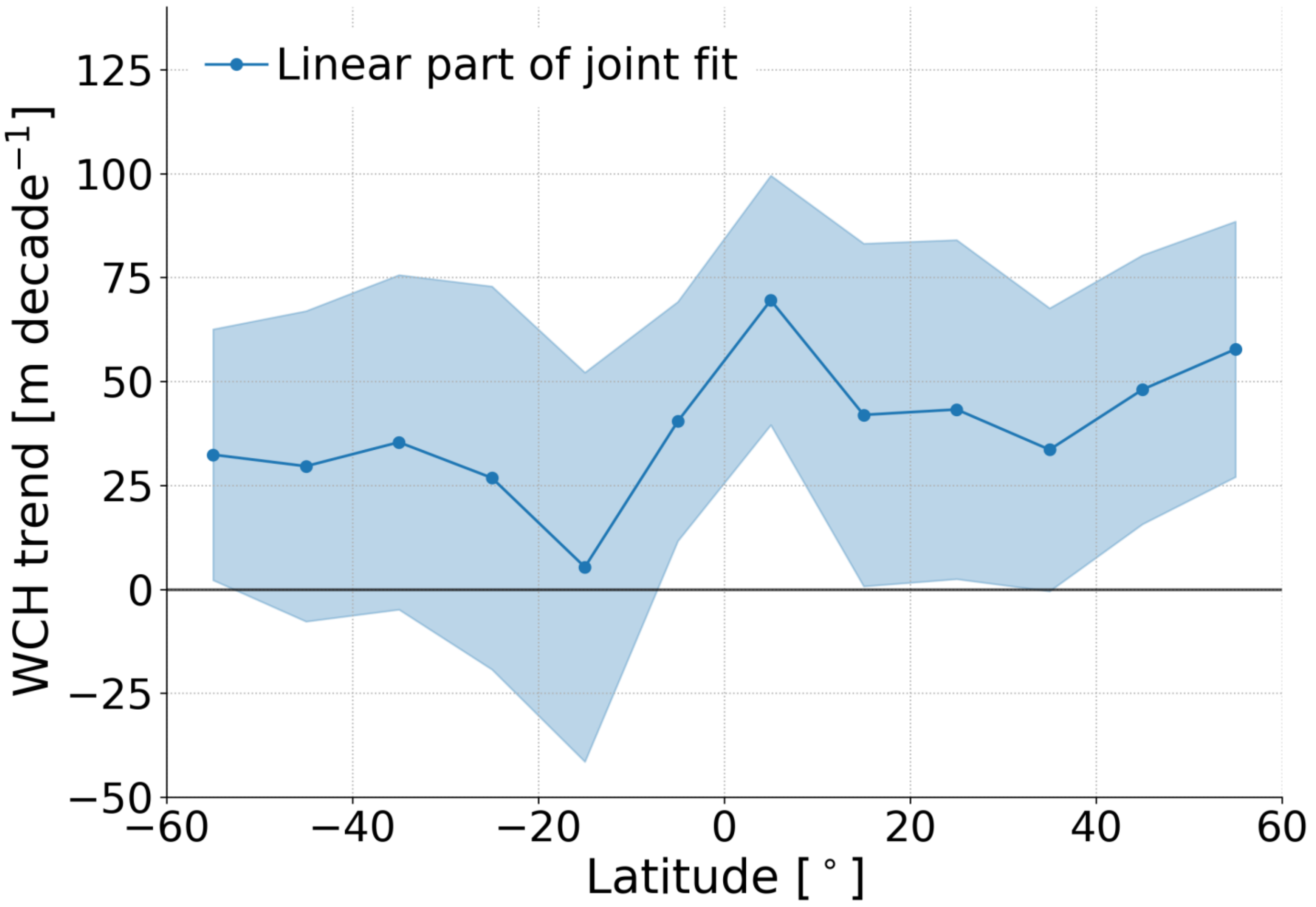


Daytime only Tropics [30 °S−30 °N]
Changing sensitivity: 1±24 m decade^{-1}
Constant sensitivity: 66±23 m decade^{-1}
Cloudsat ΔWCH [m]
200
150
100
50
0
−50
−100
2006
2008
2010
2012
2014
2016
2018

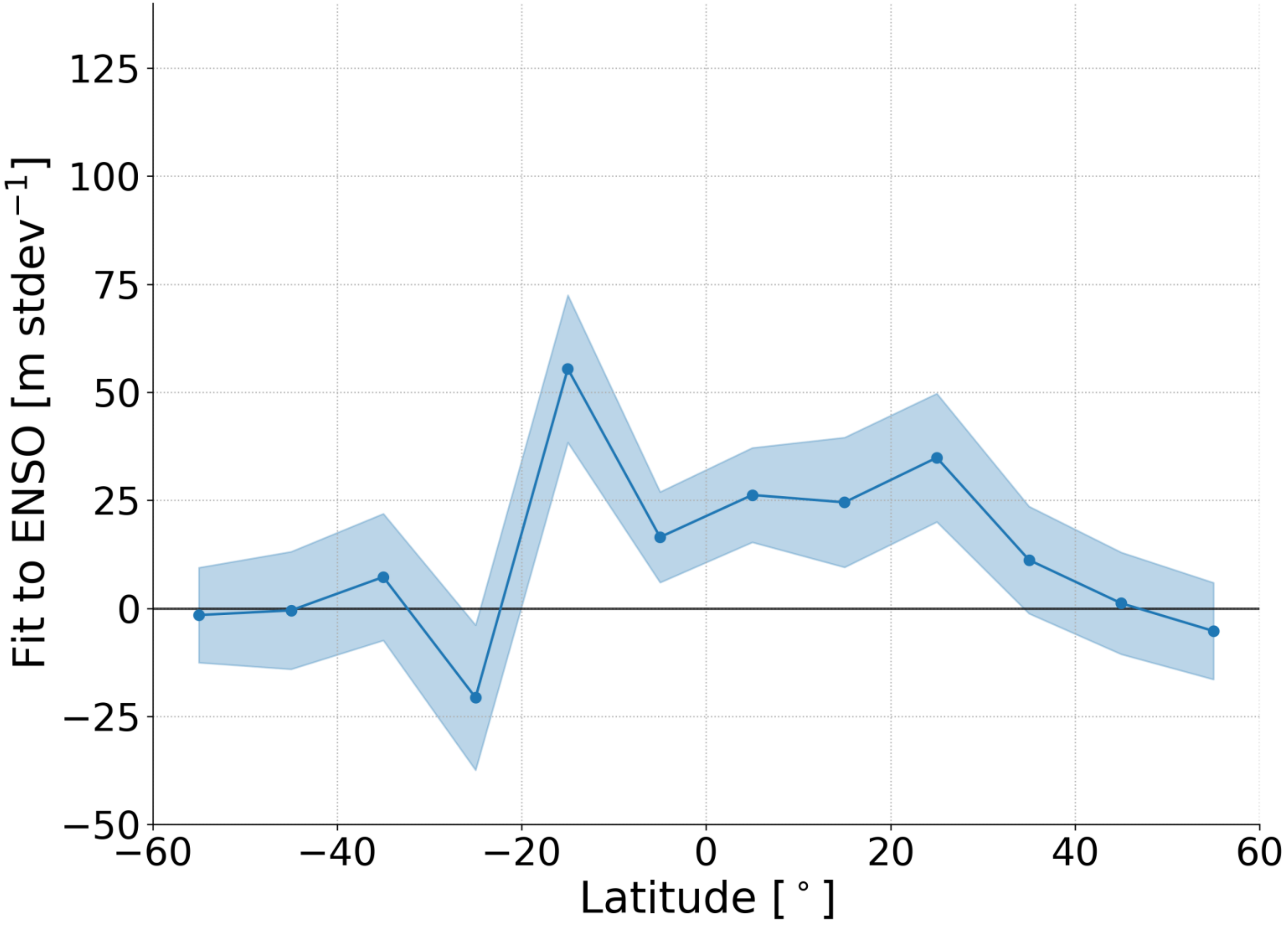
0—30 °N daytime only



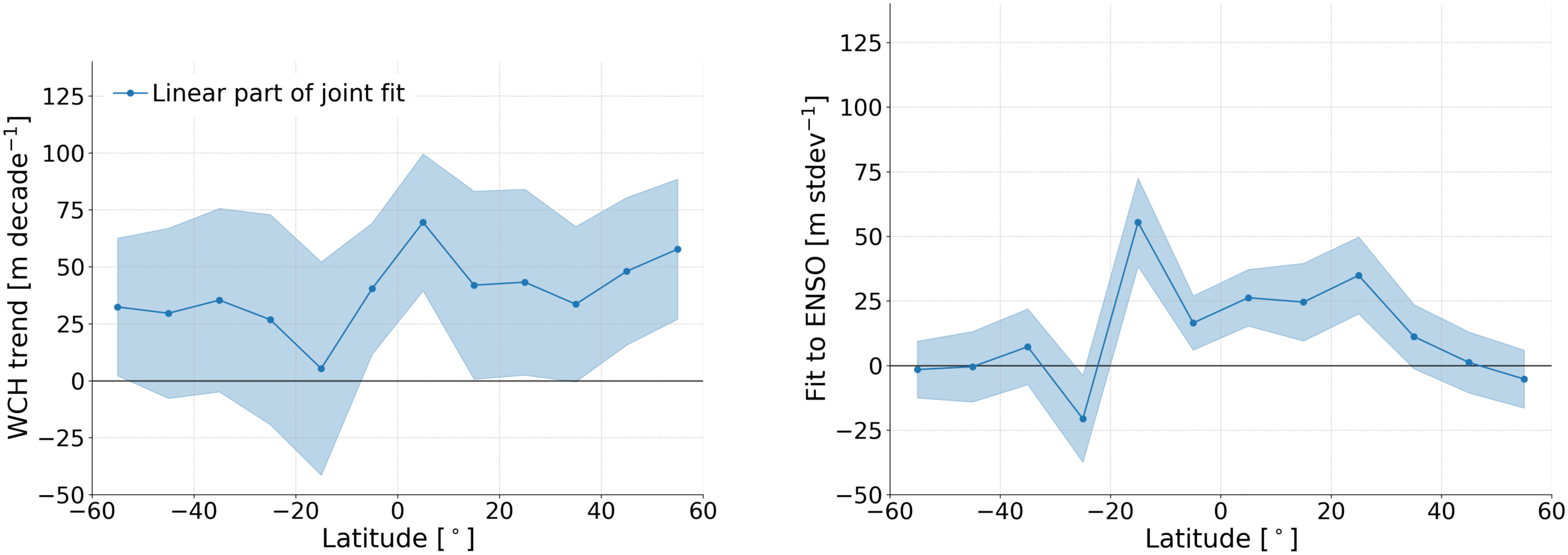
Linear fit by latitude ±2σ blue line is what you get when also fitting to an El Nino index



Latitude response to 1 stdev change in El Nino index



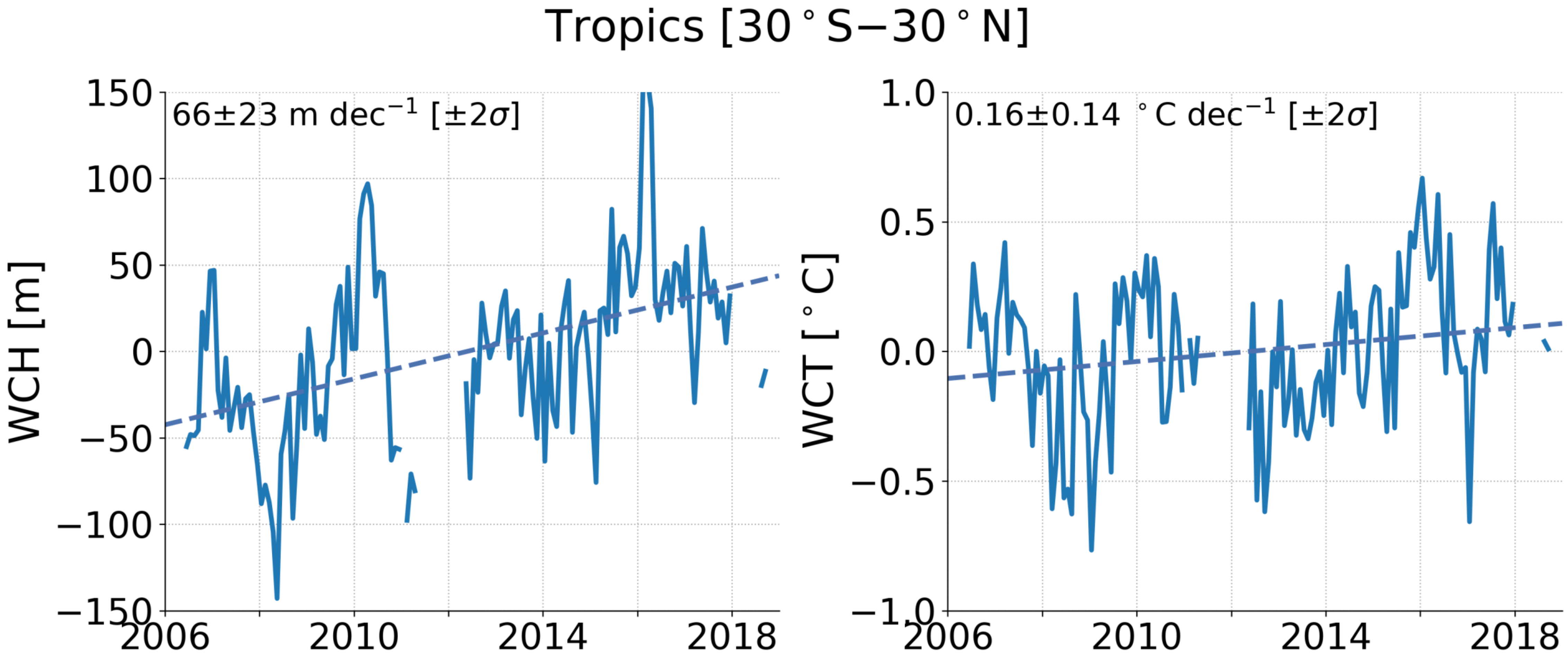
Possibly interesting – NH extratropics show significant trend and barely any ENSO response



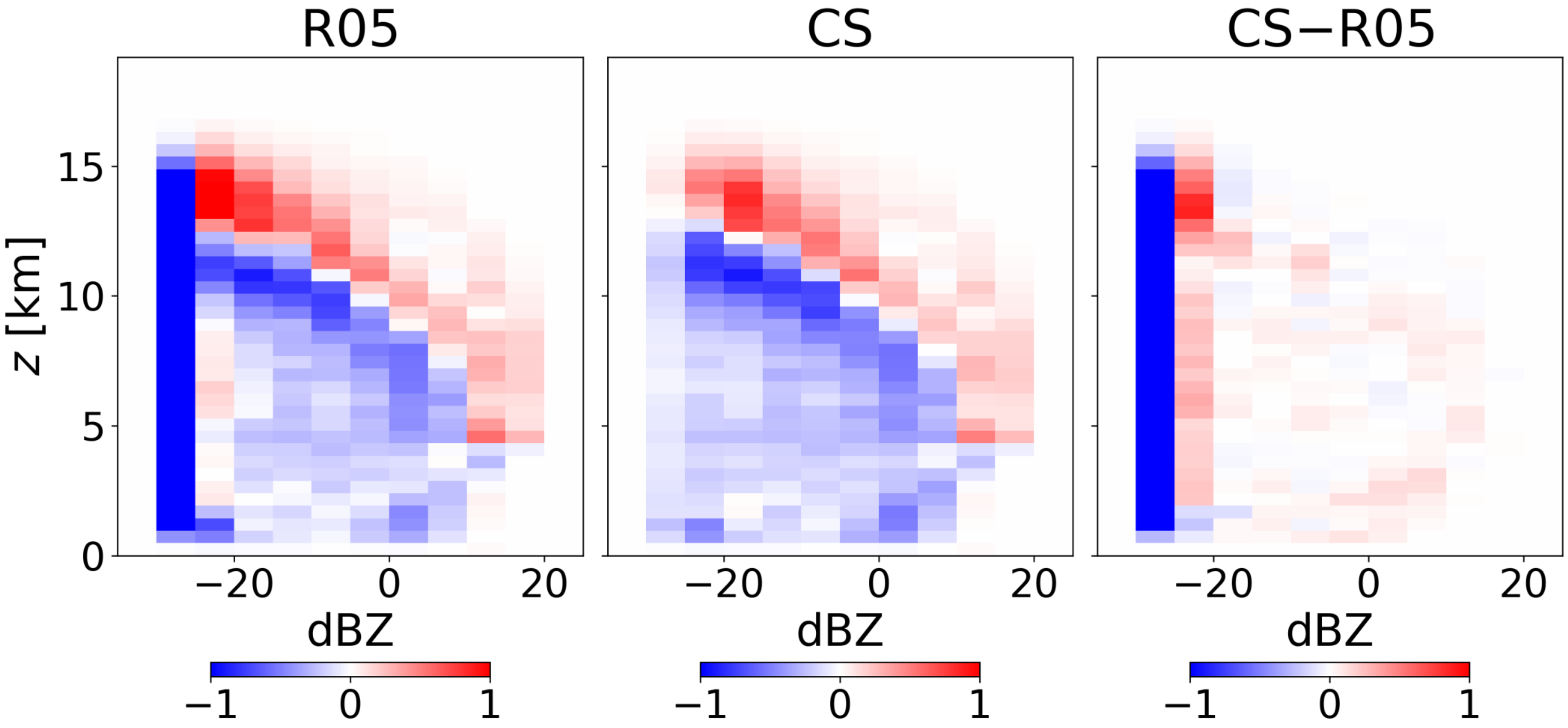
Conclusions

- CloudSat constant sensitivity is coming, thanks to Roj Marchand!
- Can now do consistent analysis across the full CloudSat mission (2006—2020)
- Efforts to continue through EarthCARE products would be helpful
- CloudSat's weighted cloud height trends are positive when sensitivity drift is removed

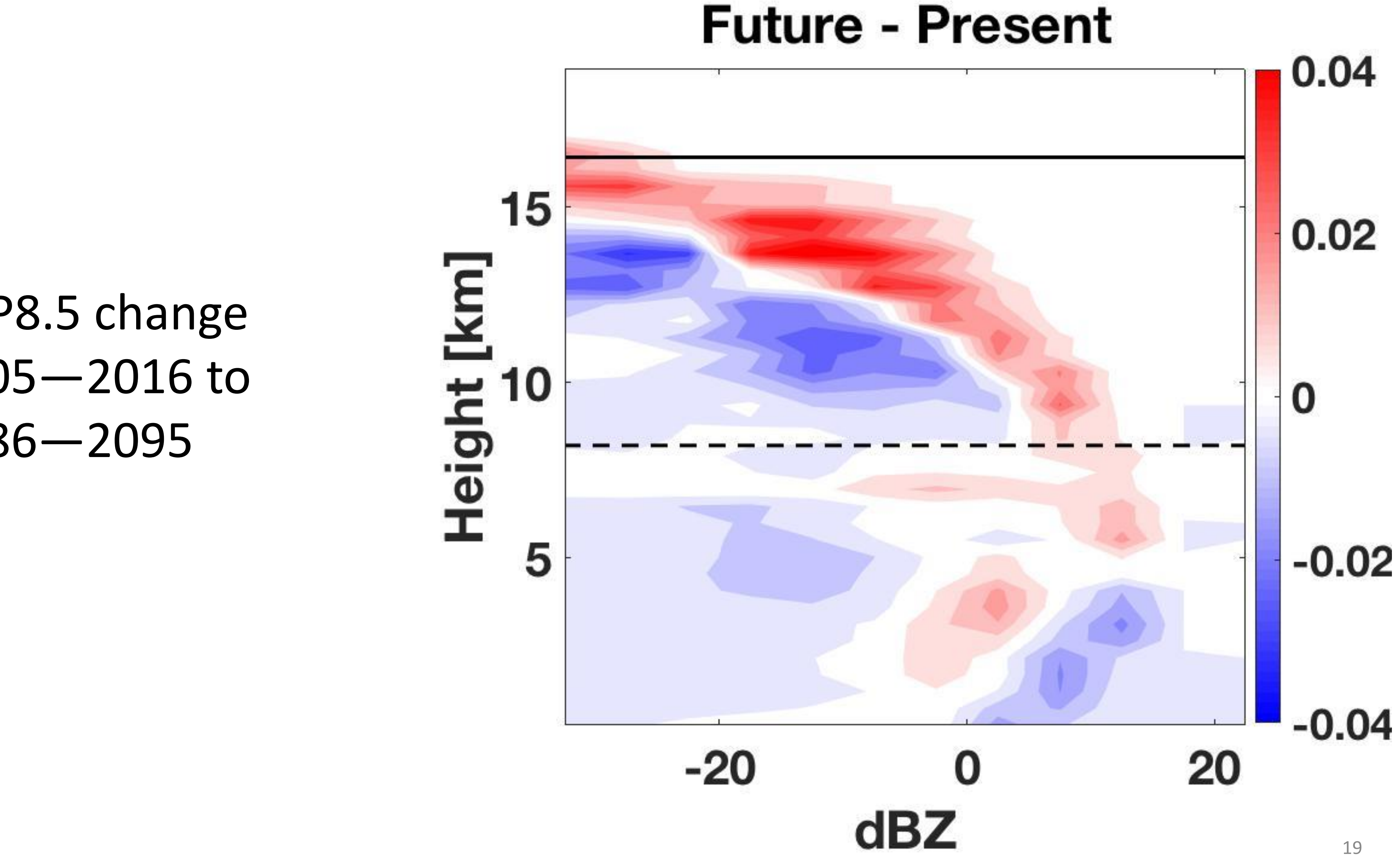
HEIGHT TEMPERATURE



CFAD bin trends for R05, constant sensitivity (CS), and difference



RCP8.5 change
2005—2016 to
2086—2095



Spatial responses