Reconstructing the inversion layer

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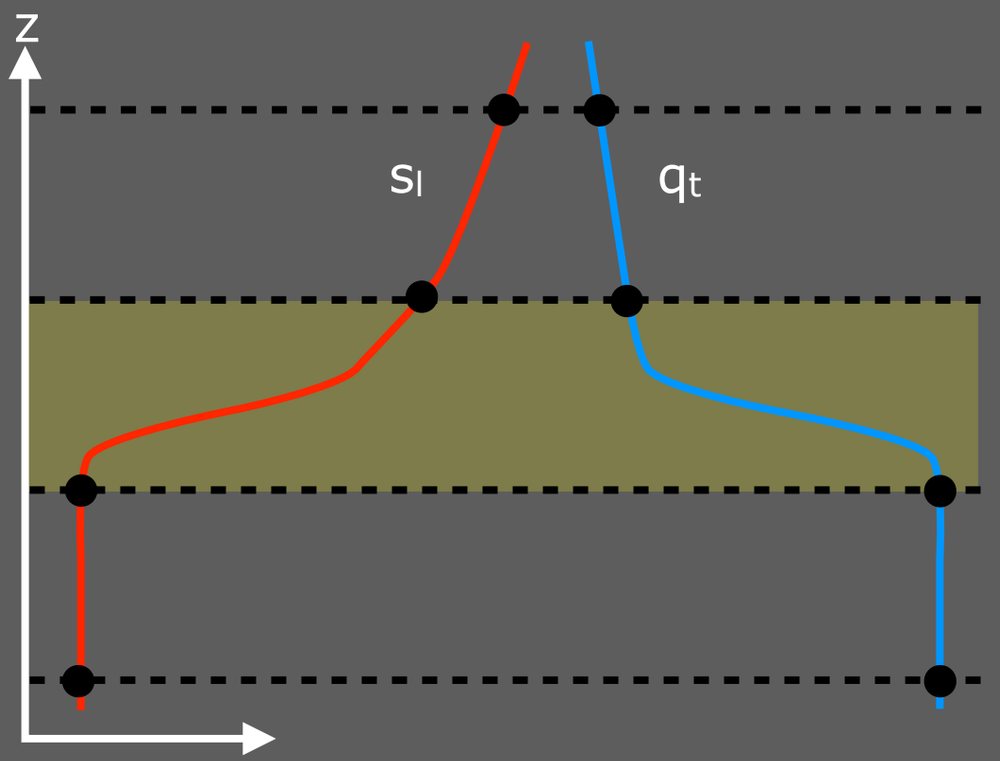
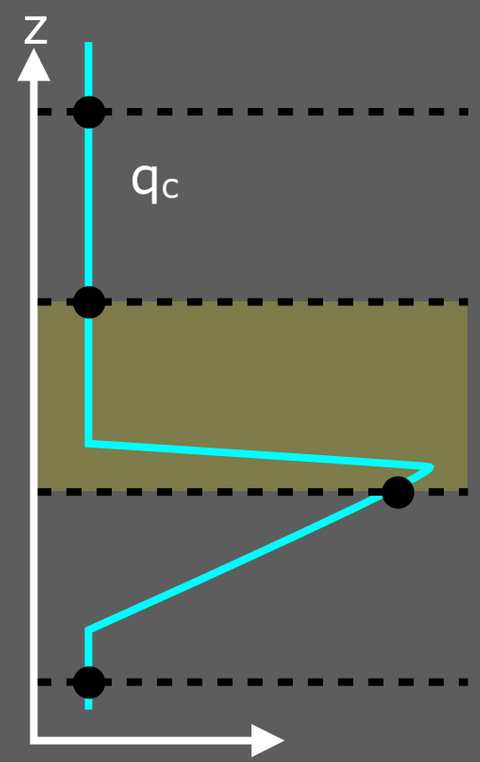
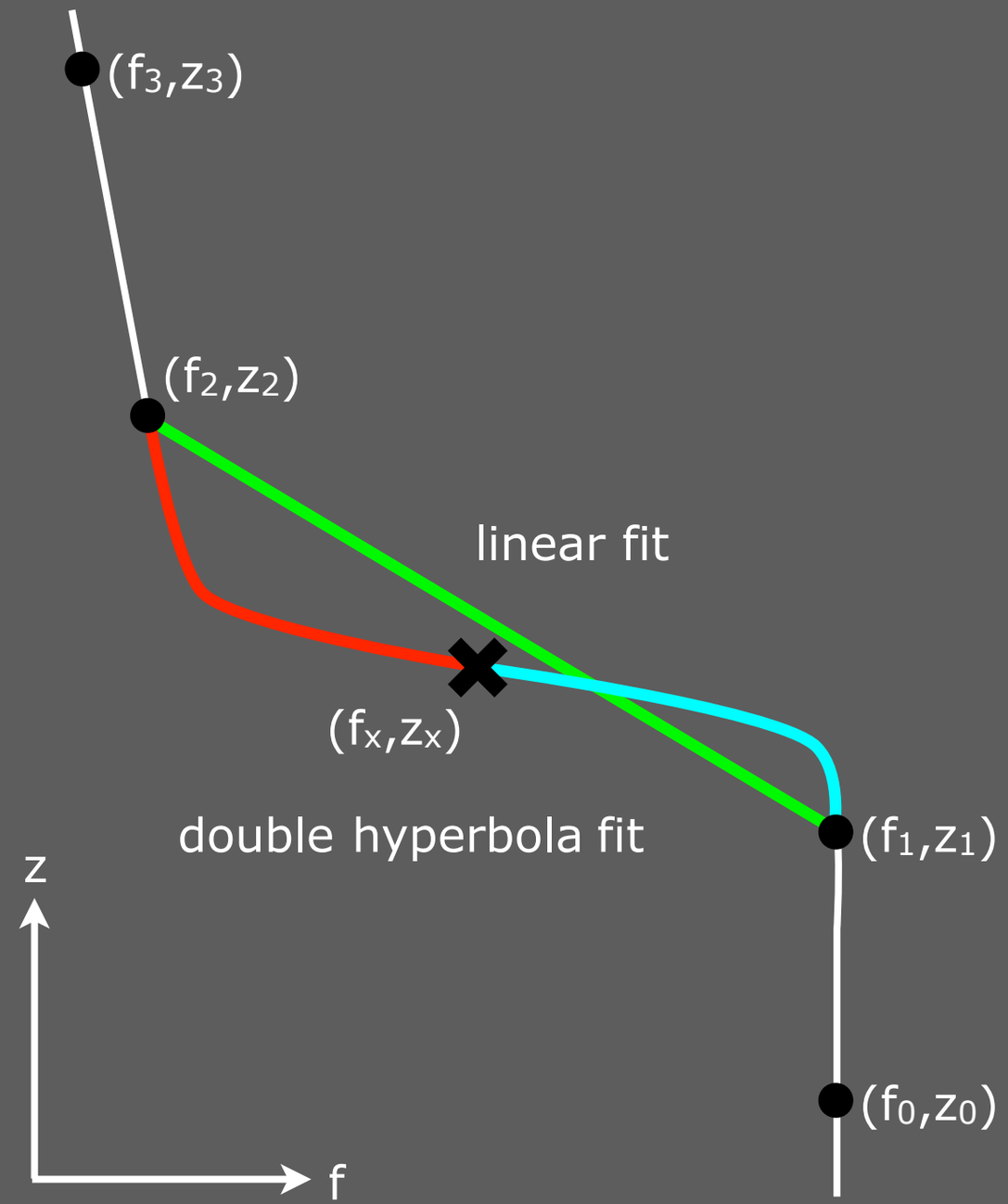
For large Δz, the inversion layer itself is SGS.

- Inversion layer: sharp for stratocumulus PBL
- Coarse Δz, especially GCMs
  - radiative cooling
  - df/dz
- Grenier & Bretherton (2001, MWR) reconstruct the inversion profile to get better radiative cooling.



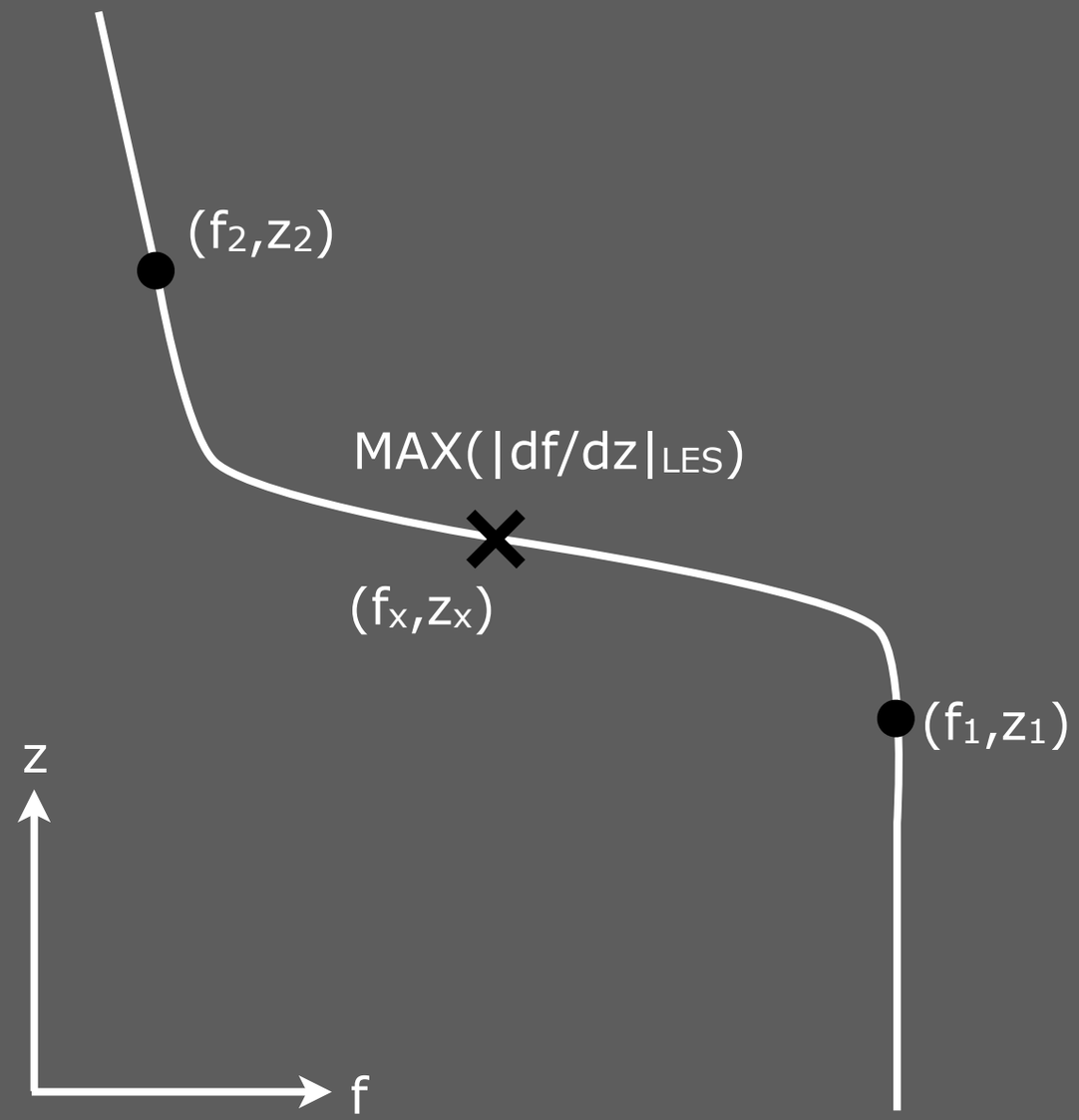


Alternative fit function



- General form of hyperbola was considered and discarded. Too complicated.
- Rectangular hyperbola: (z-h)(f-k)=m
- m characterizes shape.
- h, k, & m can be obtained with 3 levels.
- Alternatively h & k can be obtained with m and 2 levels.
- Problems:
  - How to set f_x and z_x?
  - How to set m_1 and m_2?
- GASS ASTEX Lagrangian (P. Blossey): SAM, LES, 40 hours, diurnal cycle

Temporal treatments



- z_x is temporally specified at the mean level of MAX(|df/dz|) for s_l and q_t computed with the LES level values.
- If z_x is between 2 GCM levels, temporally assign LES value at z_x as f_x.
- Set z_x and f_x to the GCM value if the inversion layer contains 1 GCM level.
- Temporally, m_1 and m_2 are optimized with the LES profile with iteration by incrementing m_1 and m_2.

ASTEX

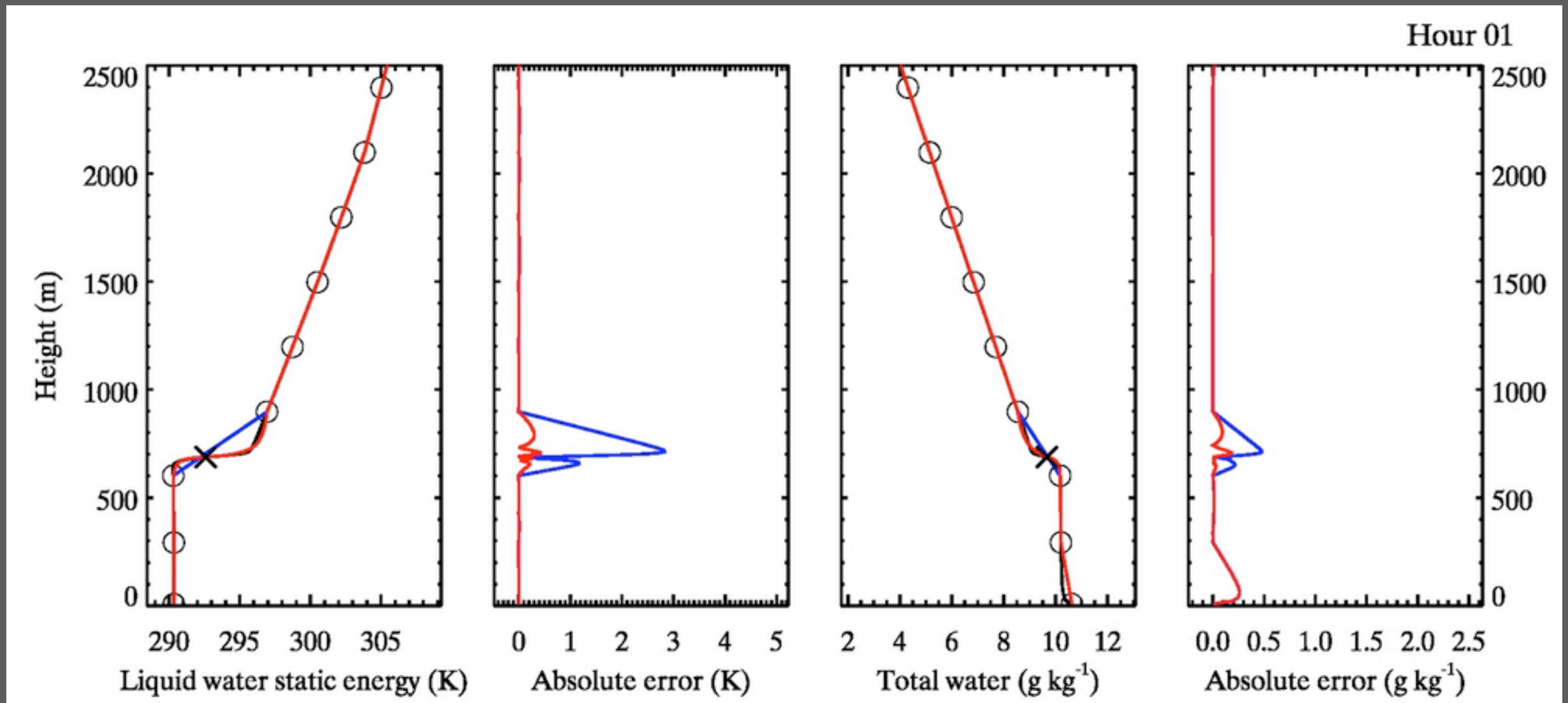
○ - hypothetical GCM level (Δz=300 m)

× - z_x

black - LES

blue - linear fit

red - double hyperbola fit



ASTEX

○ - hypothetical GCM level (Δz=300 m)

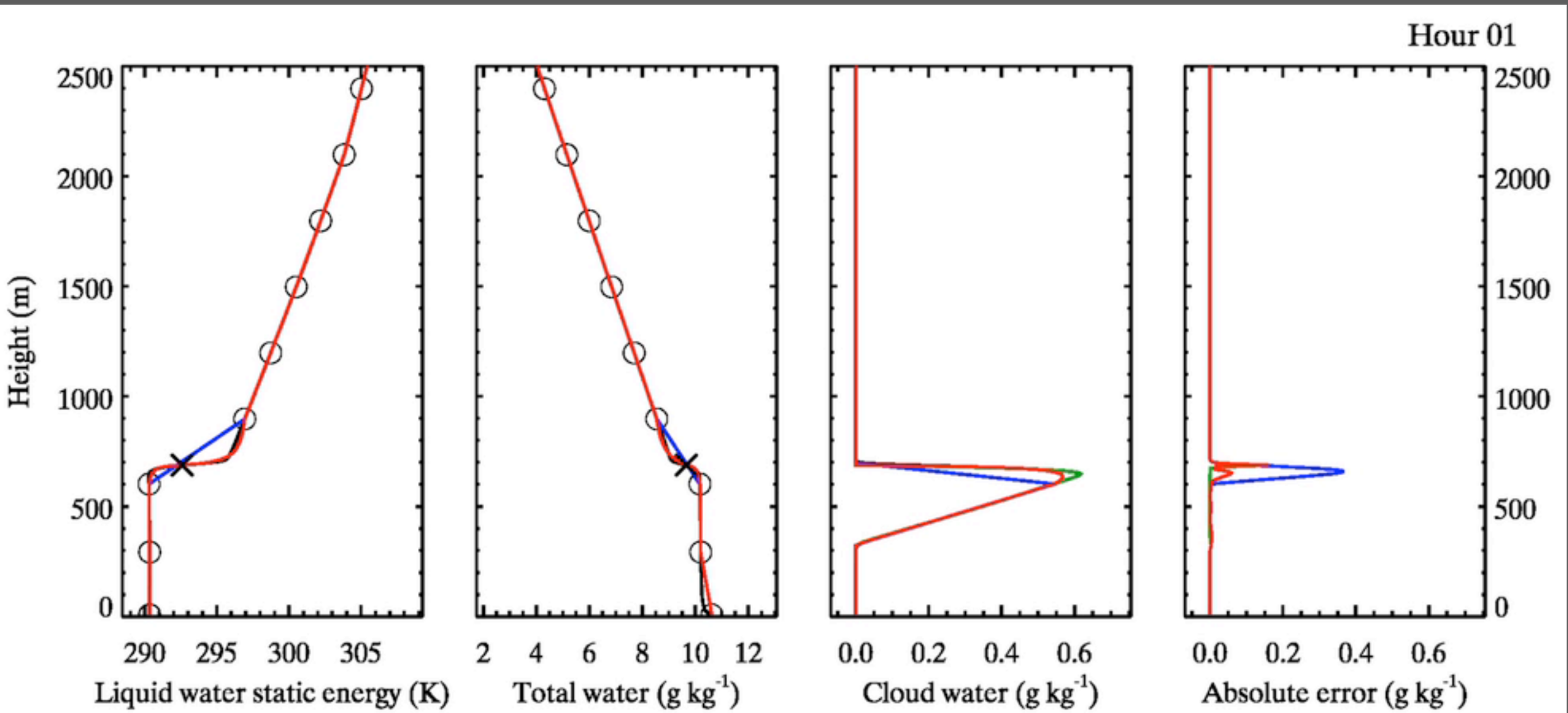
× - z_x

black - LES

green - q_c with saturation adjustment with LES s_l & q_t

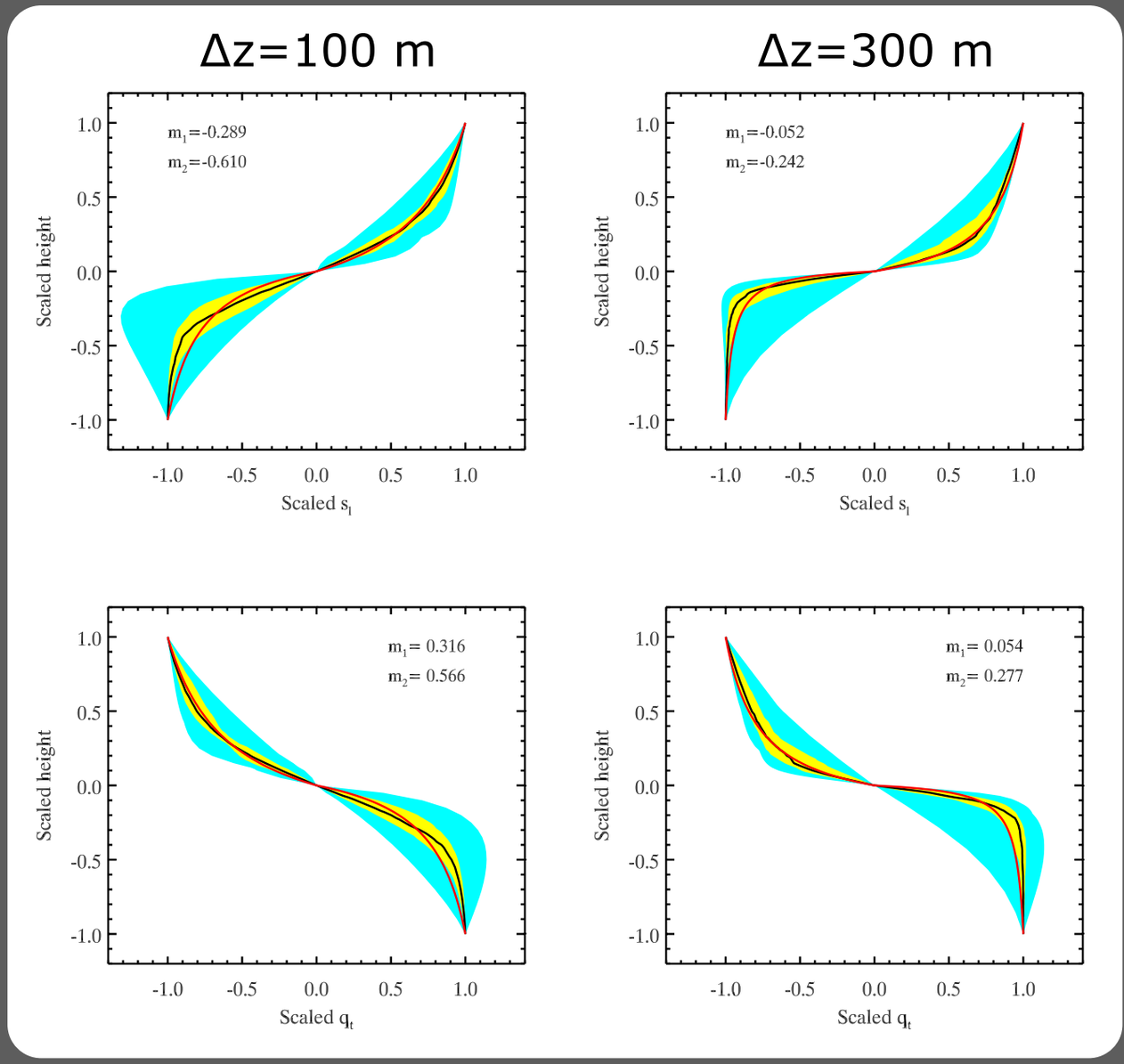
blue - q_c with saturation adjustment with linearly fitted s_l & q_t

red - q_c with saturation adjustment with double hyperbola fitted s_l & q_t



Parameterizing m_1 and m_2

- For generality, scale both f and z between -1 and 1, and 0 at (f_x,z_x).
- Δz ↑, m ↓
- $m_2 > m_1$
  - m_1: mixed profile in the cloud layer
  - m_2: dependency on the free atmospheric df/dz → probably |df/dz| ↑, then m_2 ↑
- Further analysis is ongoing.



Parameterizing m_1 and m_2

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- $\Delta z \uparrow$, $m \downarrow$
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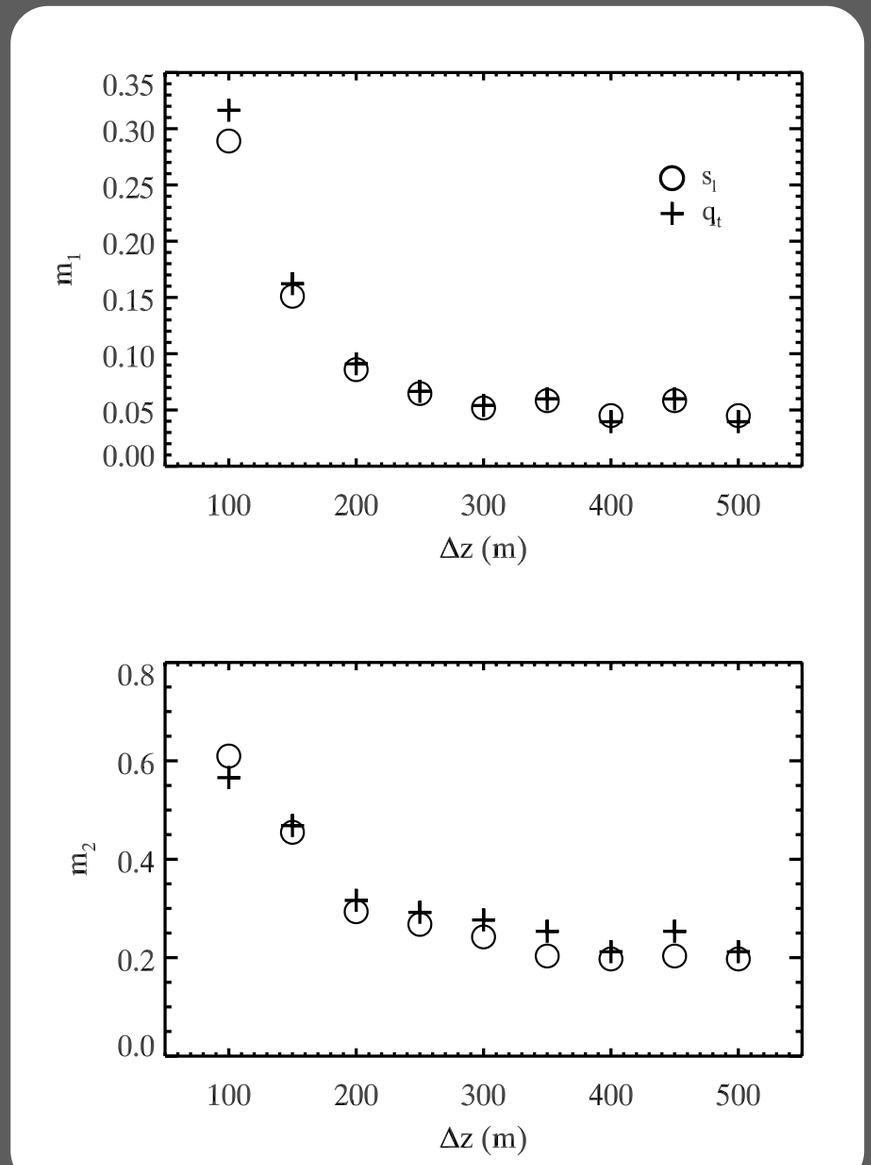

Long way to go

- z_x and f_x - diagnostic, or prognostic?
- m_1 and m_2
- Model levels in the inversion
- Possible applications
  - Radiation
  - df/dz
  - SCM with adaptive Δz?
    stratocu → use finer Δz around the inversion → fit → turbulence, radiation, microphysics?
- SCM, CSRM, GCM
- Treatment for shallow cu?