Climatology of ShCu bulk entrainment at the SGP observatory

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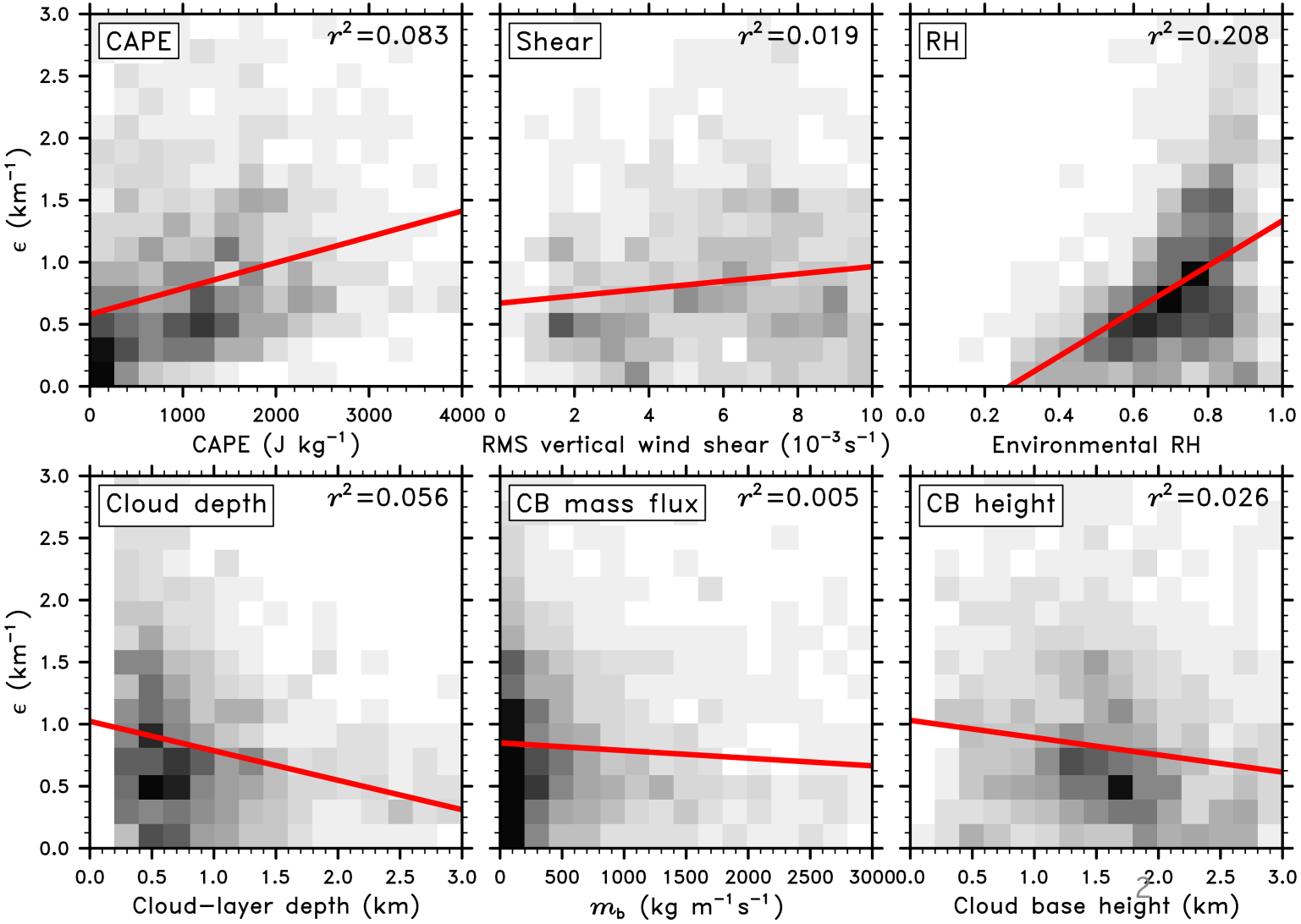
Shallow cumuli at the ARM SGP observatory

Method 1: Jensen and Del Genio (2006)

- 2021 individual ShCu clouds
  - Surface-based, cloud tops < 5 km, depths > 250 m
  - Computes fractional entrainment rate (ϵ) required for parcel LNB to match cloud-top height
- Notable sensitivites: CAPE (+), RH (+), shear (+), cloud-base mass flux (-)
  - No sensitivity to cloud width (not shown)

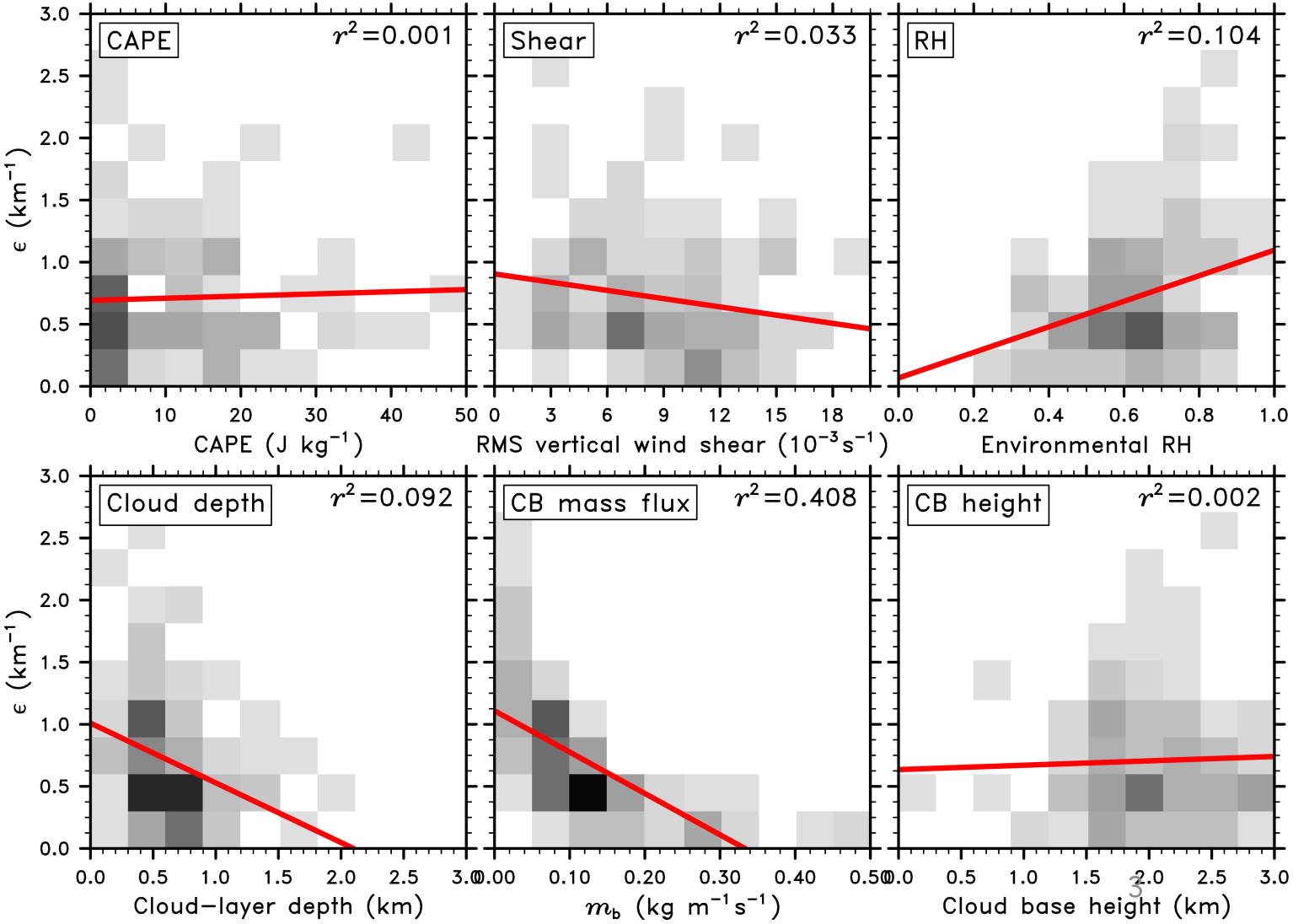


Method 2: Drueke et al (2019; TKE)

- 128 1-h ShCu periods
  - Surface-based, cloud tops < 5 km, depths > 250 m
  - Use scaling of equilibrium TKE budget to estimate ϵ

$$\epsilon \sim \frac{\mathrm{CAPE}^{1/3}}{m_b^{2/3} z_{\mathrm{cld}}}$$

- Strong dependence on RH (+), m_b (-) and cloud-layer depth (-)



Preliminary conclusions and future work

- Two simple bulk entrainment retrievals give different perspectives on ShCu entrainment
  - Individual clouds vs cloud ensembles
- Robust positive sensitivity to environmental CAPE and RH, negative sensitivity to z_{cld} and m_b
  - Also, positive sensitivity to vertical wind shear in JDG parcel method
- Future work:
  - Other environmental sensitivities?
  - Dimensional analysis: nondimensional controlling parameters
  - ERICA retrieval (Wagner et al 2013)
  - Repeat climatology at ENA site