Supporting Information for "A consistent representation of cloud overlap and cloud subgrid vertical heterogeneity"

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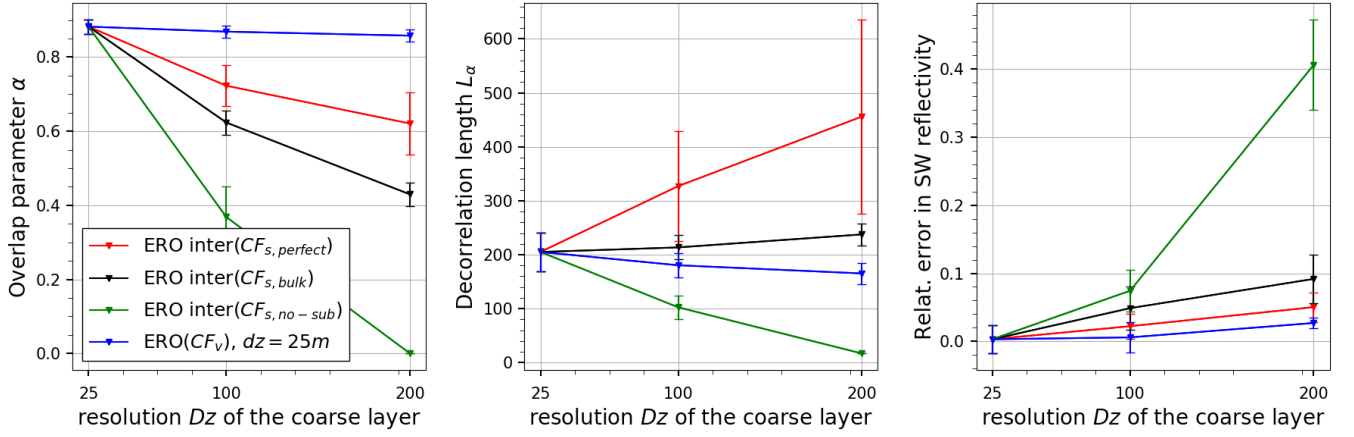
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Figure S1. Overlap parameters (left) and decorrelation lengths (middle) for the BOMEX simulations (hours 1 to 15), for different coarse resolutions Dz and for different reconstructions using ERO. The daily mean value is shown. The overlap parameters are computed to match the total cloud cover of the LES. The right panel shows the corresponding relative error in SW cloud albedo at TOA compared to that of the LES when using those overlap parameters to generate the scenes. For each plot, the standard deviation due to the different simulation times is shown as an error bar.
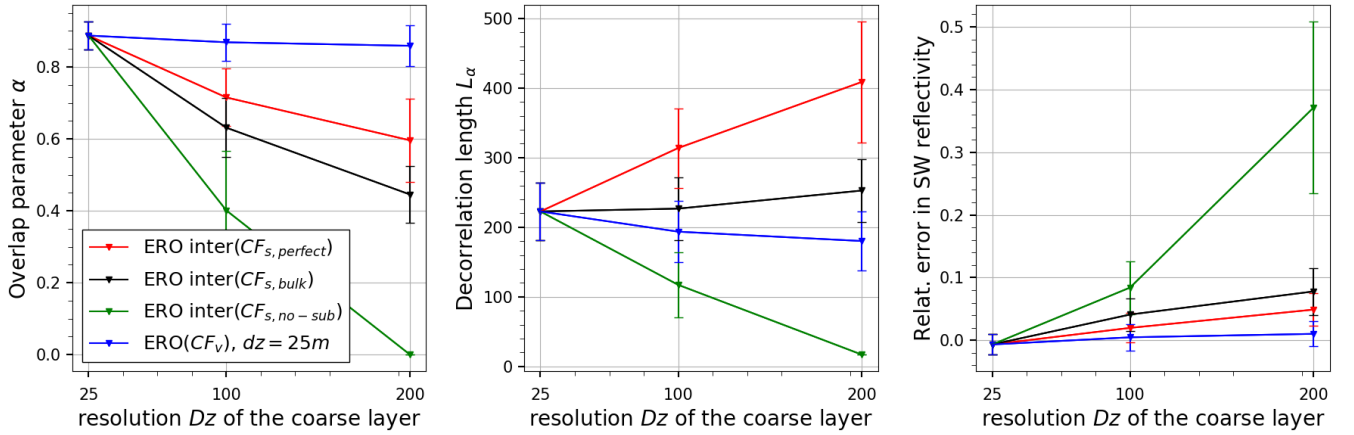

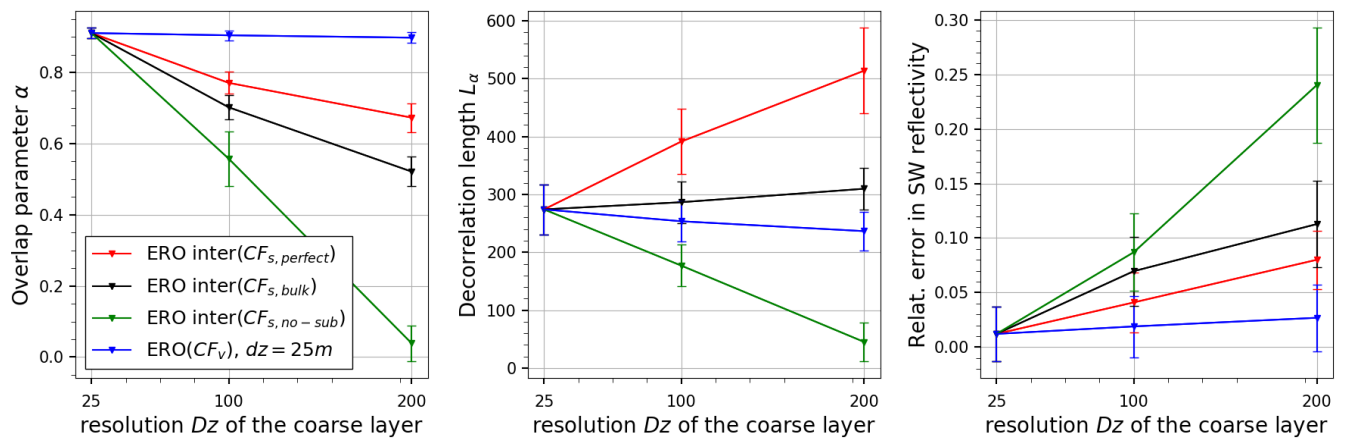**Figure S2.** Same plots for the RICO simulations (hours 1 to 15)

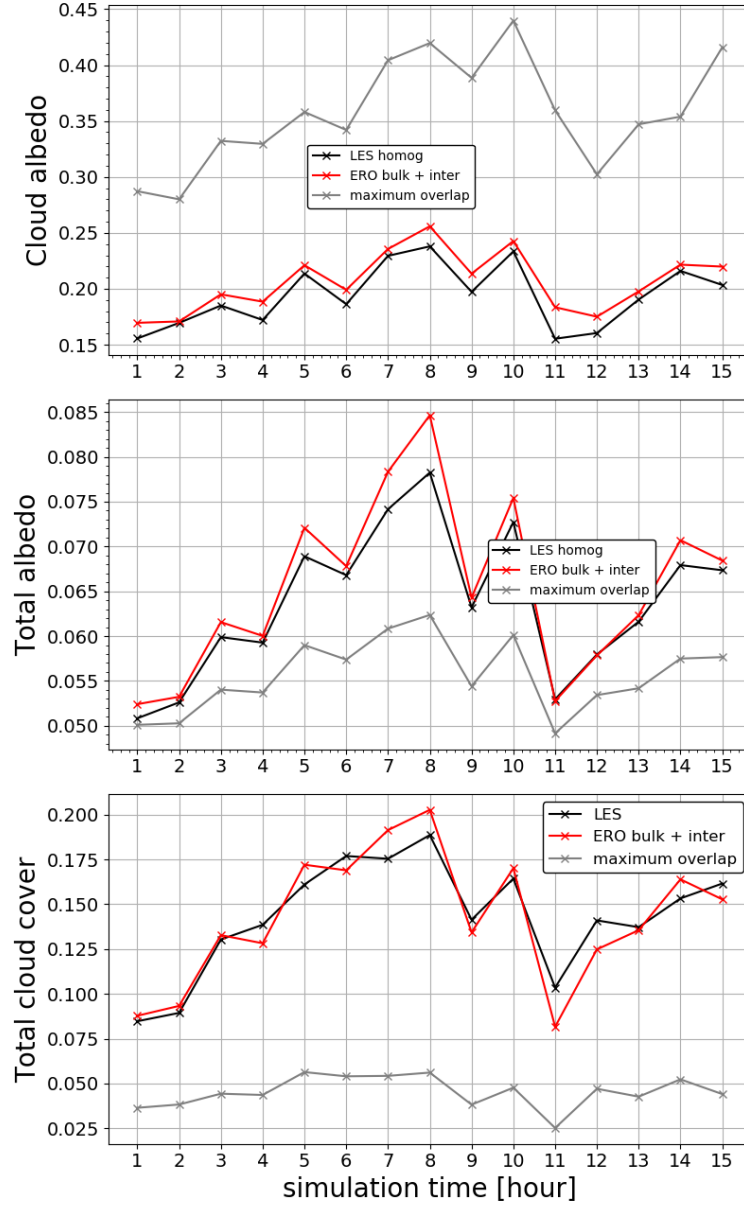**Figure S3.** Same plots for the SCMS simulations (hours 2 to 12)

Figure S4. Cloud albedo (top panel), total albedo (middle panel) and total cloud cover (lower panel) for the LES (in red), our reconstruction using ERO (in black) and a maximum overlap reconstruction (grey). The constant decorrelation length used here both for the subgrid computation of the surface cloud fraction profile and its interlayer overlap is L_α=202 m. The cloud albedo of the ERO reconstruction shows a relative error of 7% on the whole day compared to the LES cloud albedo. The scenes used are the BOMEX case (simulation hours $h \in [1, 15]$). In all scenes the LWC is homogeneous at each vertical level.
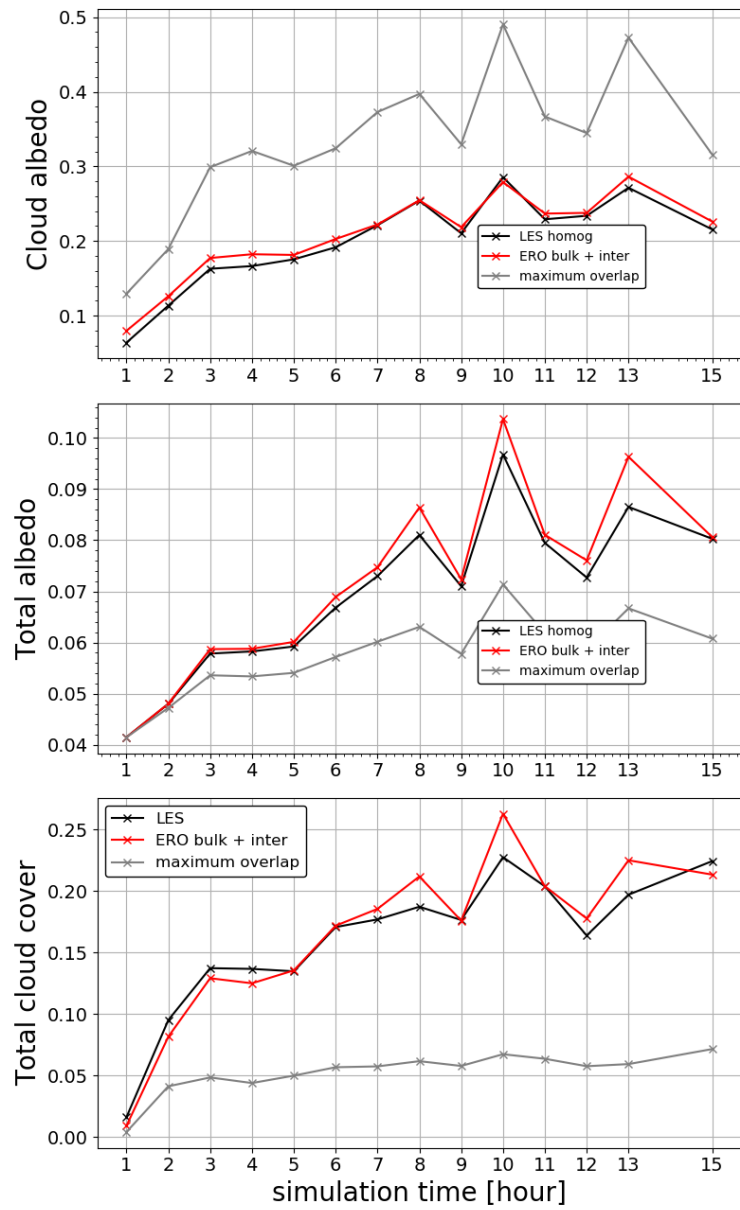
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Figure S5. Same plots for the RICO case (simulation hours $h \in [1, 15]$) with L_α=217 m. The cloud albedo of the ERO reconstruction shows a relative error of 6% on the whole day compared to the LES cloud albedo.
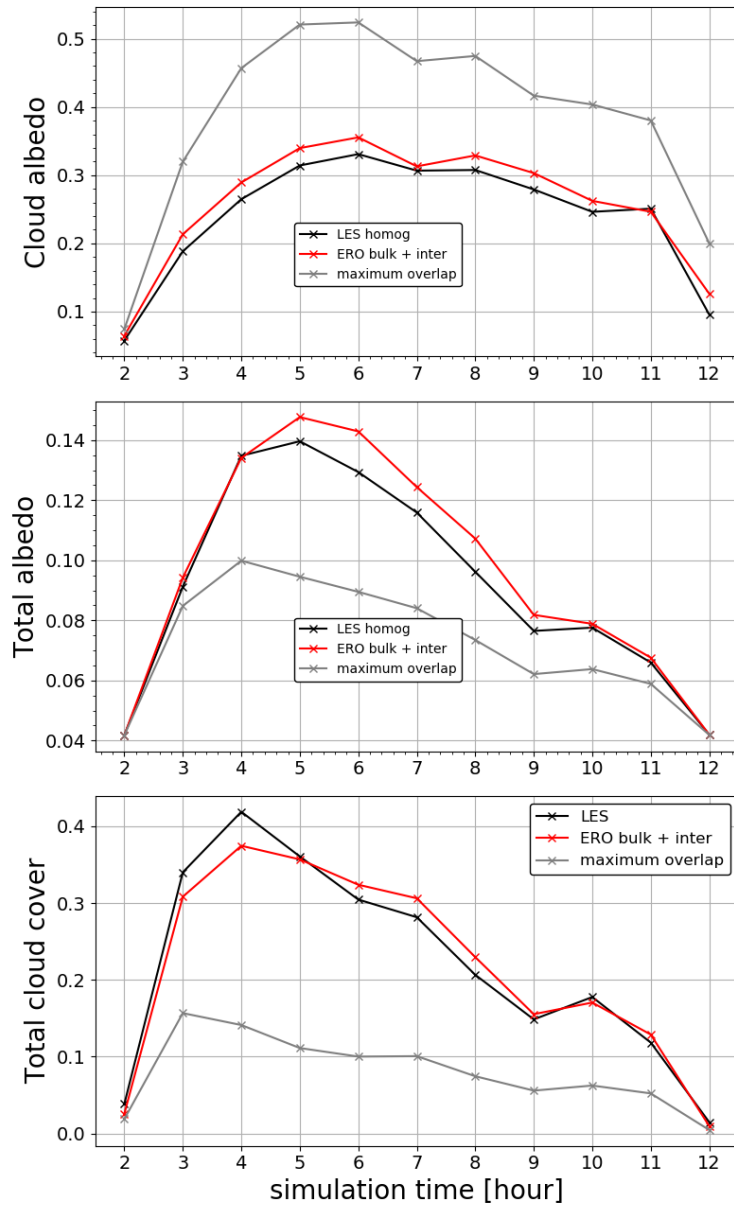
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Figure S6. Same plots for the SCMS case (simulation hours $h \in [2, 12]$) with L_α=273 m. The cloud albedo of the ERO reconstruction shows a relative error of 10% on the whole day compared to the LES cloud albedo.

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