paper draft: supersat

K. Latimer

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1 Introduction

introductory notes.

2 Theory + Simulation

- brief statement of quasi steady state formula
- we see agreement between actual and QSS supersaturation under the conditions (see figs 1 and 2):
  - T >273K (we're not including ice in the theory)
  - w >2 m/s (reasonably strong updrafts)
  - cloud LWC >1e-4 g/g (in the convection core)
- *to discuss* don't see the same distinction as from CAIPEEX between bulk and edge wrt high supersaturation values (see figs 3 and 4)

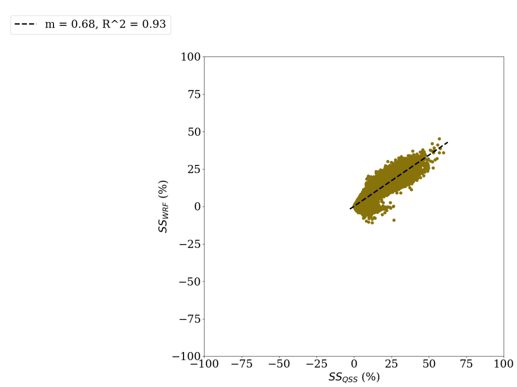

Figure 1: Actual (SS_{WRF}) vs predicted (SS_{QSS}) supersaturation in unpolluted case.

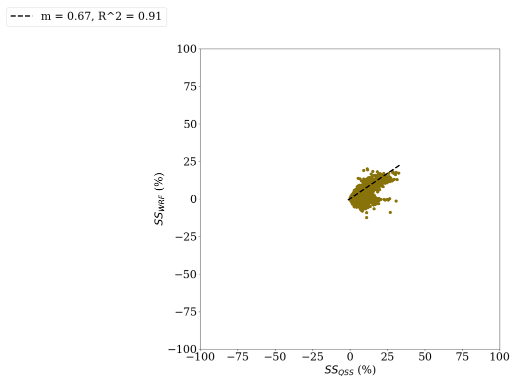

Figure 2: Actual (SS_{WRF}) vs predicted (SS_{QSS}) supersaturation in polluted case.

3 Experimental data

- using criteria from second bullet point of section 2, SS_{QSS} distribution from HALO data looks like fig 5.
- using criteria from second bullet point of section 2, SS_{QSS} distribution from CAIPEEX data looks like fig 6.

4 TODO / remaining questions

- equivalent of figs 4 / 3 for experimental data
- error analysis for experimental data
- look into commensurate binning in simulation / experiment comparisons?
- analytical justification for why actual and QSS supersaturation is still in linear relation
- how much do HALO and CAIPEEX histograms change taking out raindrops / ventilation corrections?

This is a reference [1].

References

[1] J. Fan, D. Rosenfeld, Y. Zhang, S. E. Giangrande, Z. Li, L. A. T. Machado, S. T. Martin, Y. Yang, J. Wang, P. Artaxo, H. M. J. Barbosa, R. C. Braga, J. M. Comstock, Z. Feng, W. Gao, H. B. Gomes, F. Mei, C. Pöhlker, M. L.

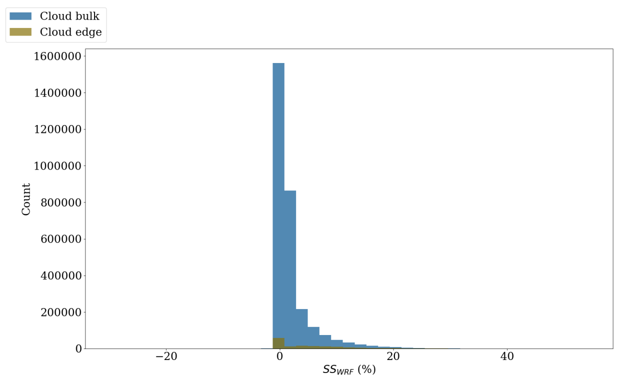

Figure 3: Actual (SS_{WRF}) supersaturation distribution in unpolluted case. "Edge" points are lowest 5th percentile LWC of all cloud points in the same altitude slice.

Pöhlker, U. Pöschl, and R. A. F. de Souza, "Substantial convection and precipitation enhancements by ultrafine aerosol particles," *Science*, vol. 359, pp. 411–418, 1 2018.

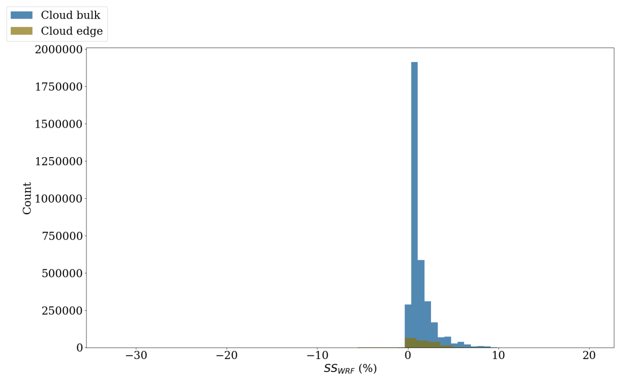

Figure 4: Actual (SS_{WRF}) supersaturation distribution in polluted case. "Edge" points are lowest 5th percentile LWC of all cloud points in the same altitude slice.

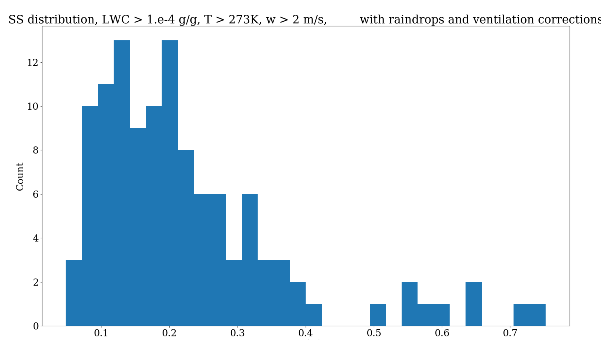

Figure 5: Predicted (SS_{QSS}) supersaturation distribution from HALO field campaign (all flight dates). Using filtering criteria outlined in section 2.

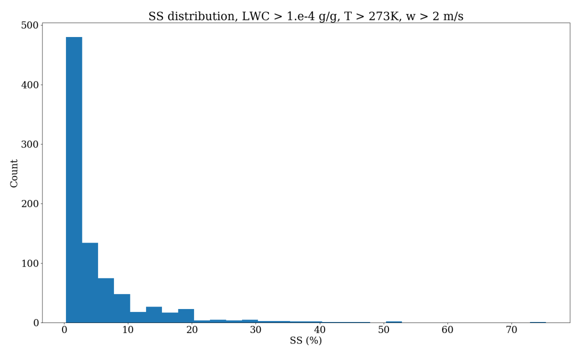

Figure 6: Predicted (SS_{QSS}) supersaturation distribution from CAIPEEX field campaign (all flight dates). Using filtering criteria outlined in section 2, but not including rain drops or ventilation corrections due to lack of data.