



*Supplement of*

## **Impacts of the Icelandic Holuhraun volcanic eruption on cloud properties using regional model cloud-aerosol simulations**

**Masaru Yoshioka et al.**

*Correspondence to:* Masaru Yoshioka (m.yoshioka@leeds.ac.uk)

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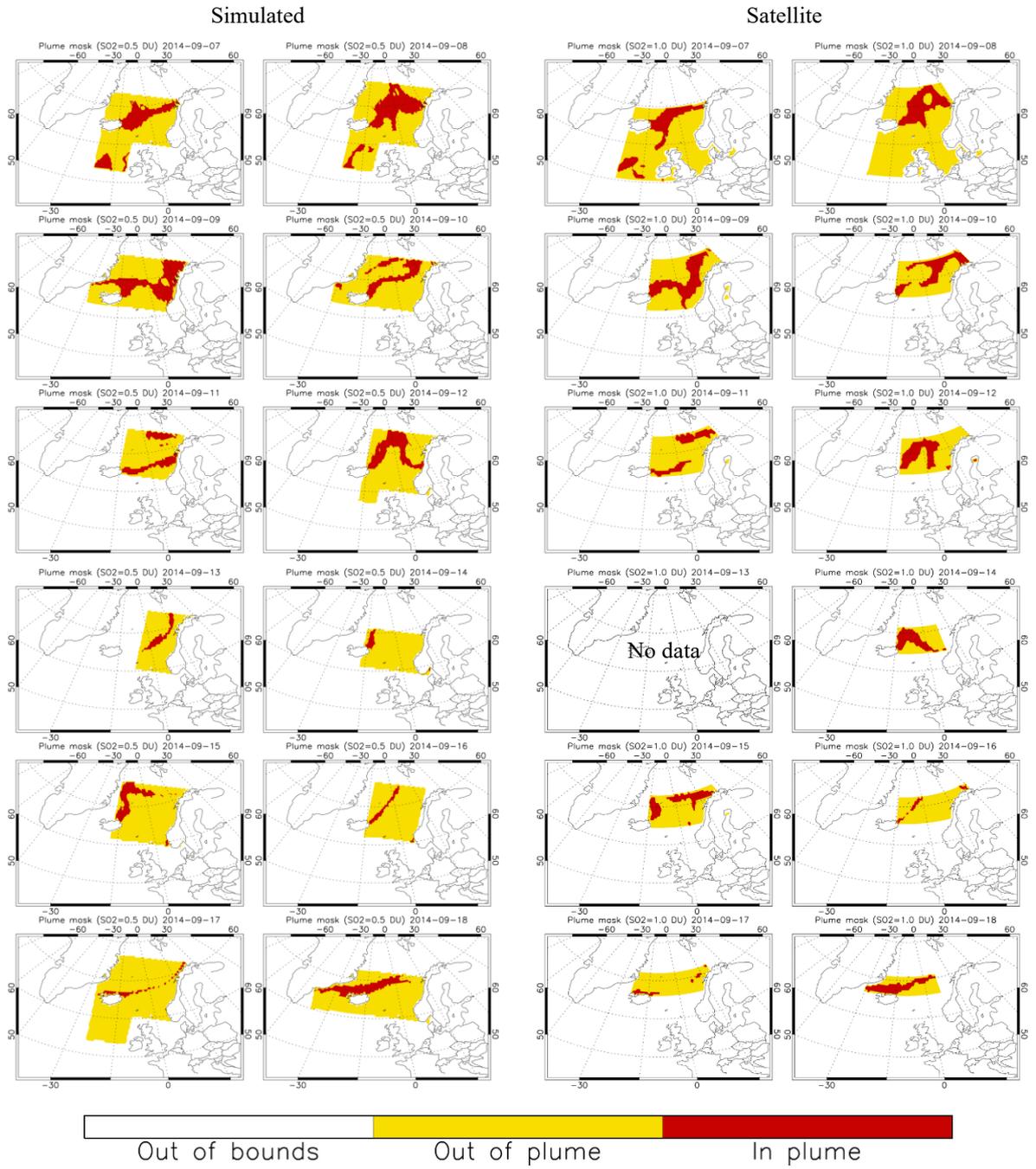
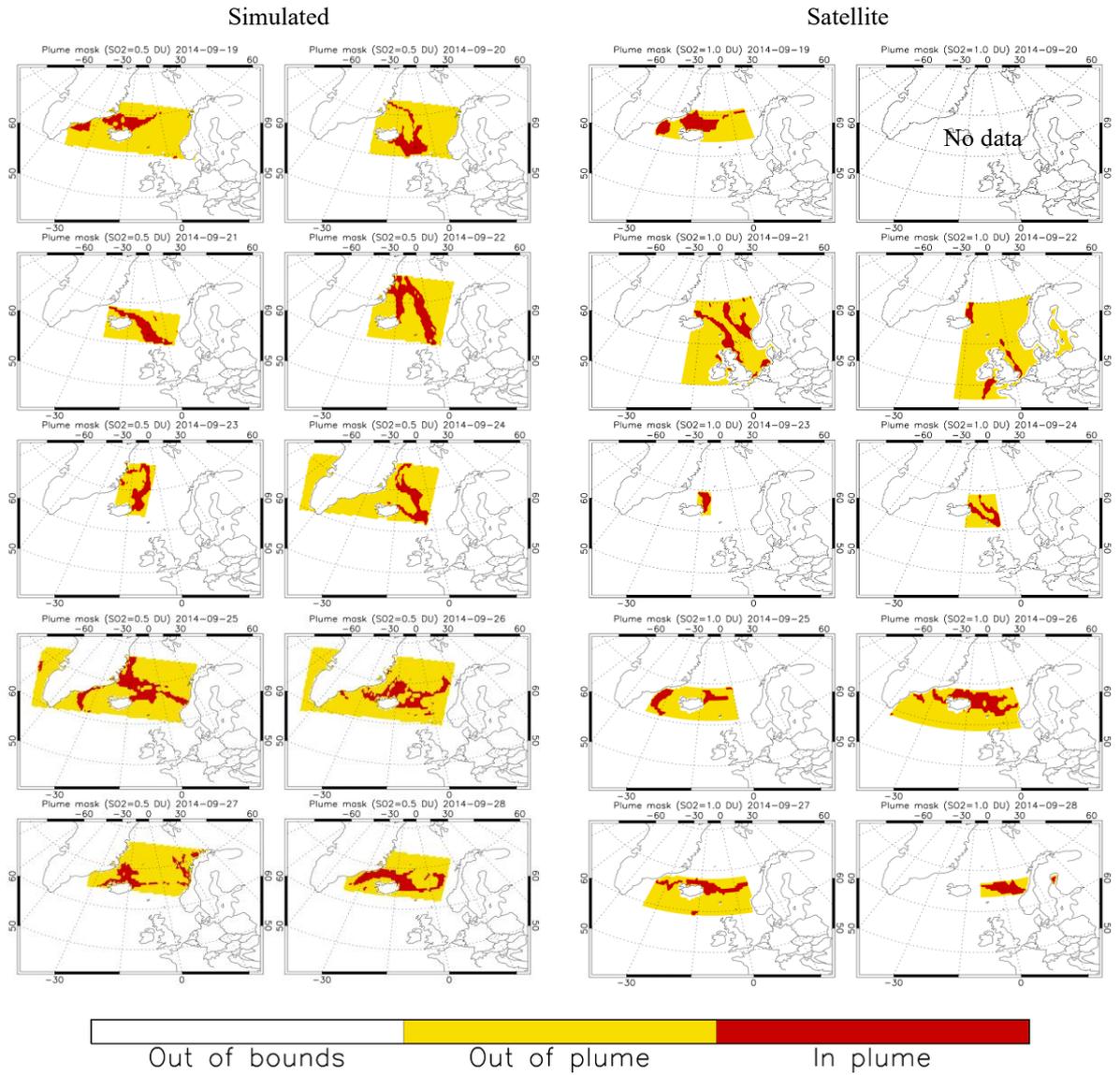


Figure S1 (a). Plume masks based on simulated (two columns on the left) and satellite derived (two columns on the right) column amount of SO<sub>2</sub> for the 7th to 18th of September 2014.



**Figure S1 (b).** Plume masks based on simulated (two columns on the left) and satellite derived (two columns on the right) column amount of SO<sub>2</sub> for the 19th to 28th of September 2014.

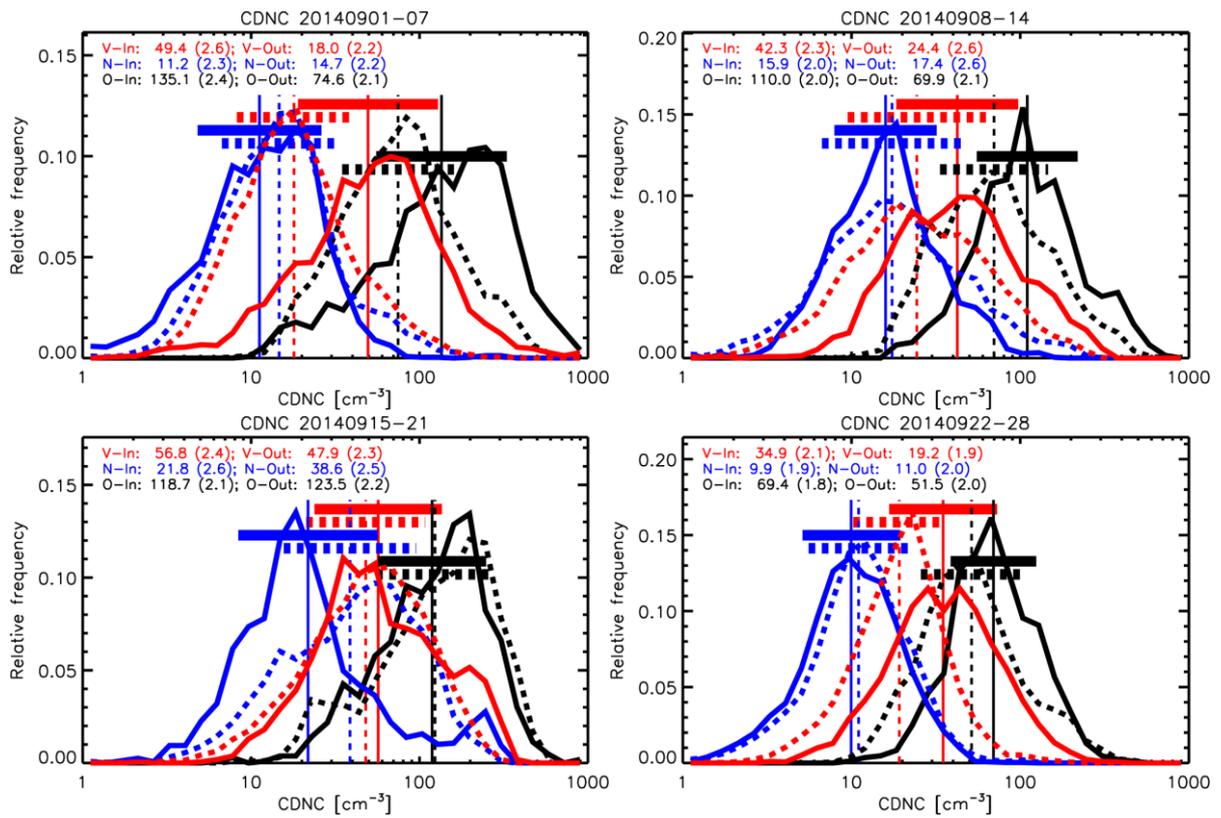


Figure S2. Relative frequency of occurrences of values of CDNC in four 7-day periods in Volc and NoVolc simulations (red and blue, respectively) and satellite observation (black) within (solid lines) and out of (dotted lines) the volcanic plume judged by column SO<sub>2</sub> loading.

Vertical lines are placed at the geometric means and horizontal lines show the range of one geometric standard deviation. Within each panel are shown the geometric means and (within parentheses) the standard deviations.

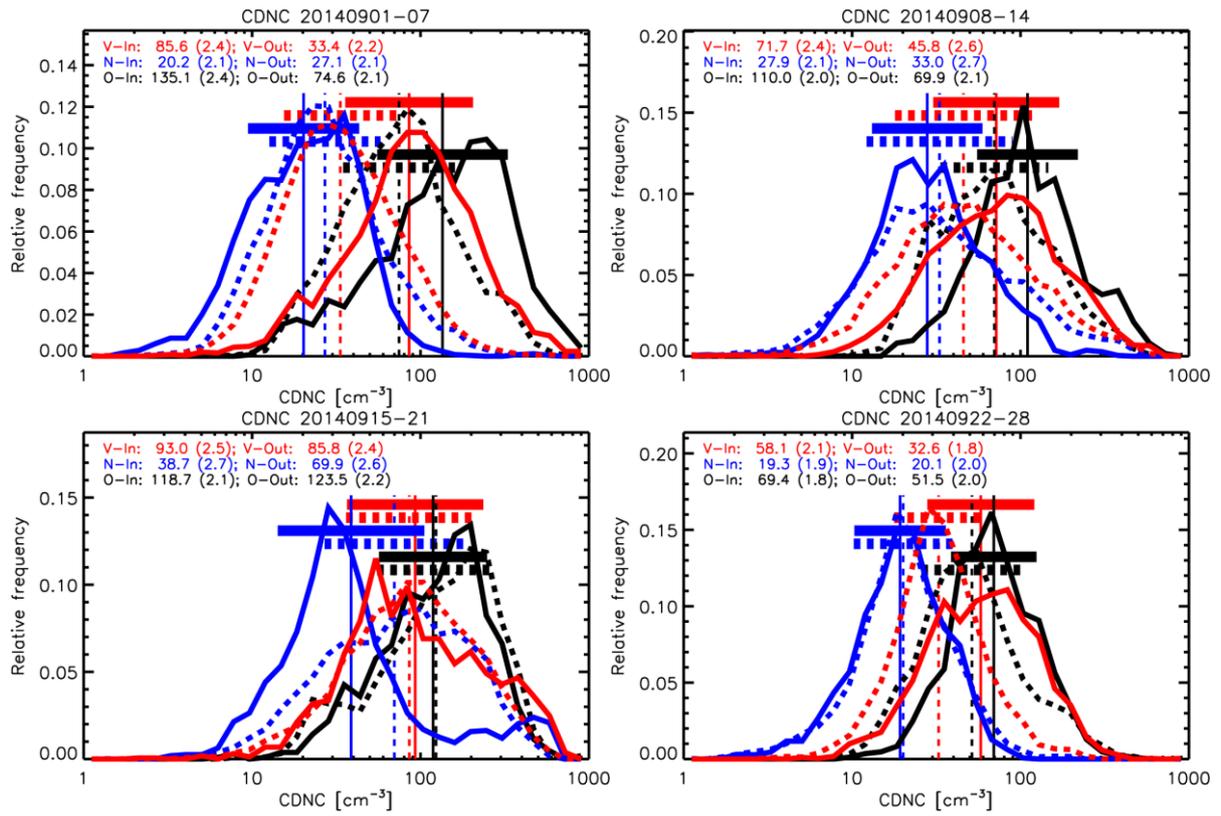


Figure S3. Same as figure S2 but for the simulations with enhanced background aerosols. Note that logarithmic horizontal axis is used, and geometric means and standard deviations are shown.

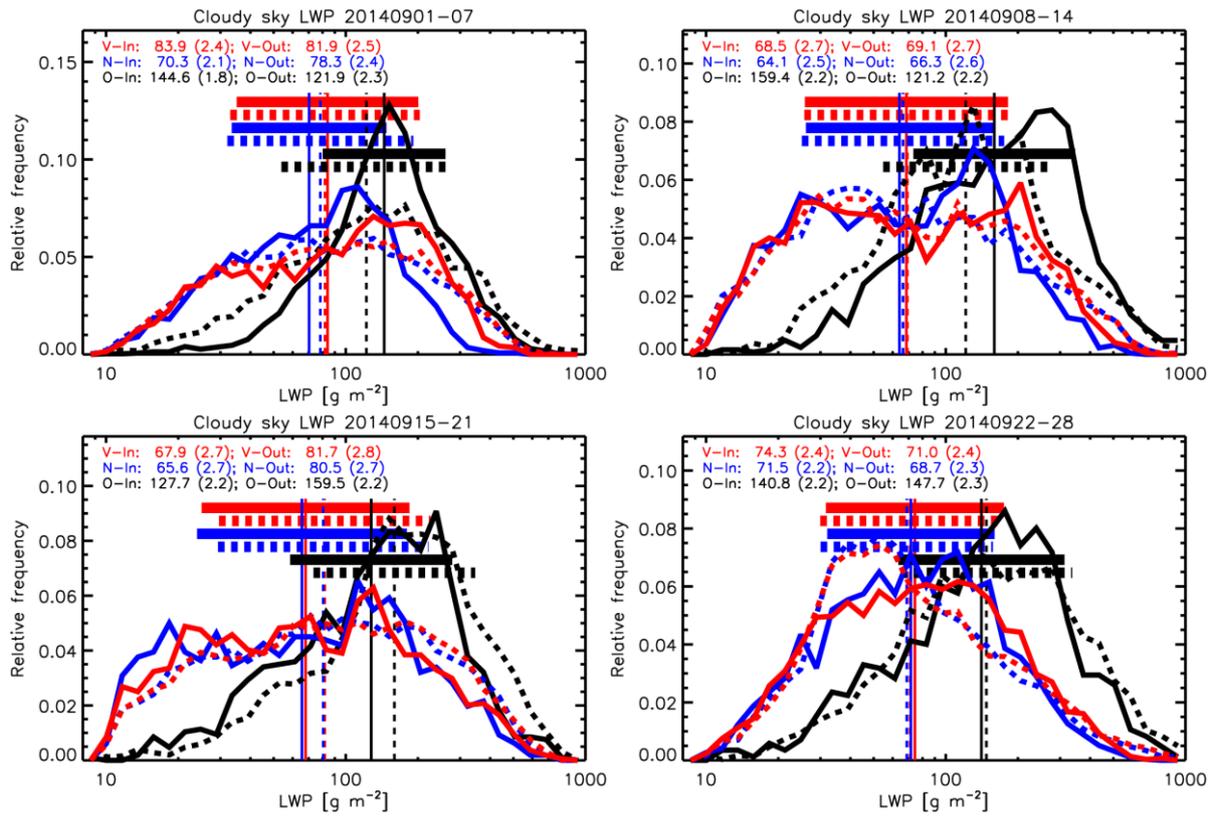


Figure S4. Same as figure S2 but for cloudy sky liquid water path. Note that logarithmic horizontal axis is used, and geometric means and standard deviations are shown.

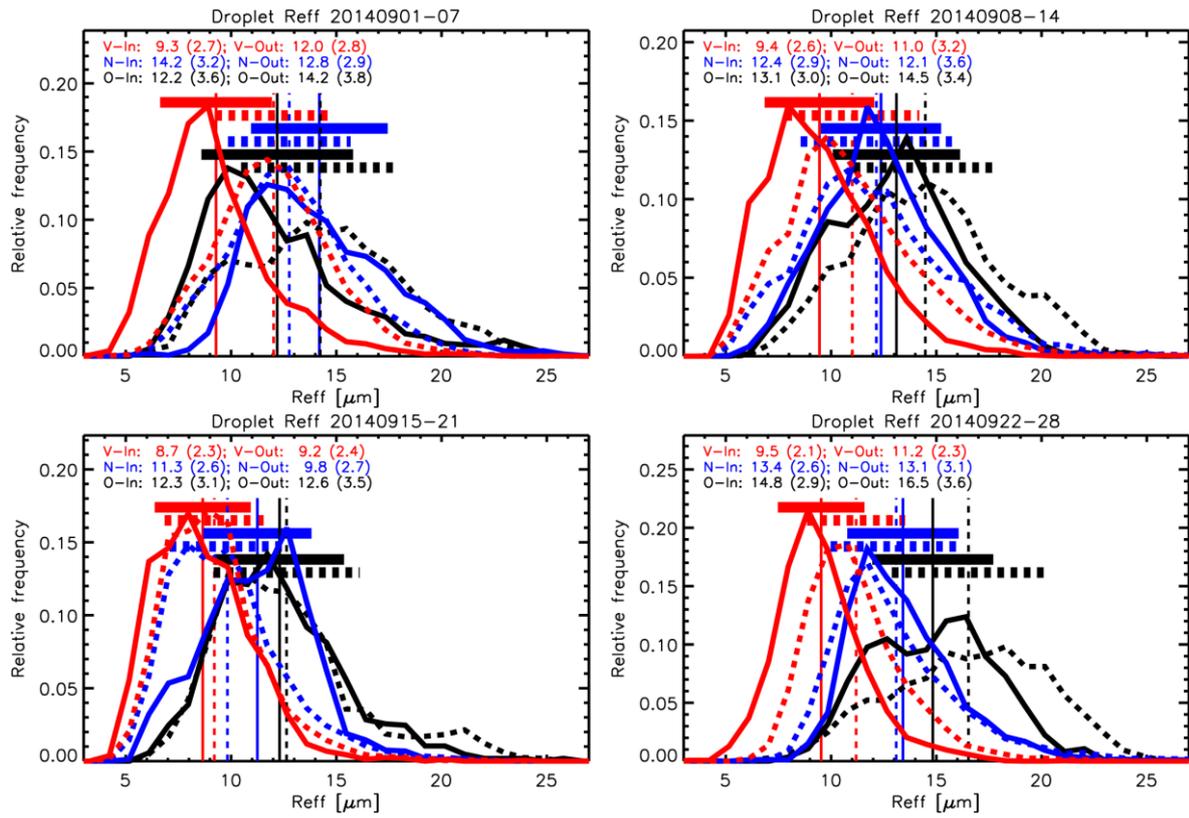


Figure S5. Same as figure S2 but for droplet effective radius. Note that linear horizontal axis is used, and arithmetic means and standard deviations are shown.

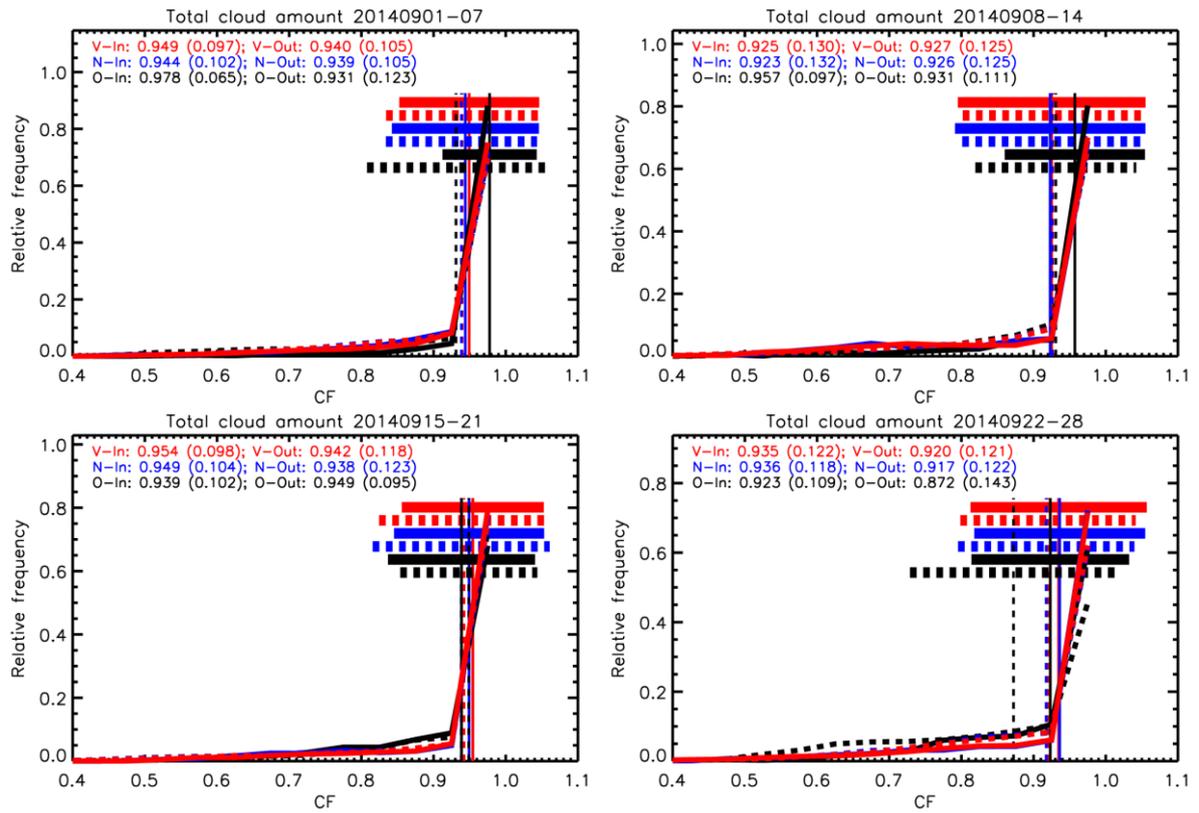


Figure S6. Same as figure S2 but for total cloud fraction. Note that linear horizontal axis is used, and arithmetic means and standard deviations are shown.

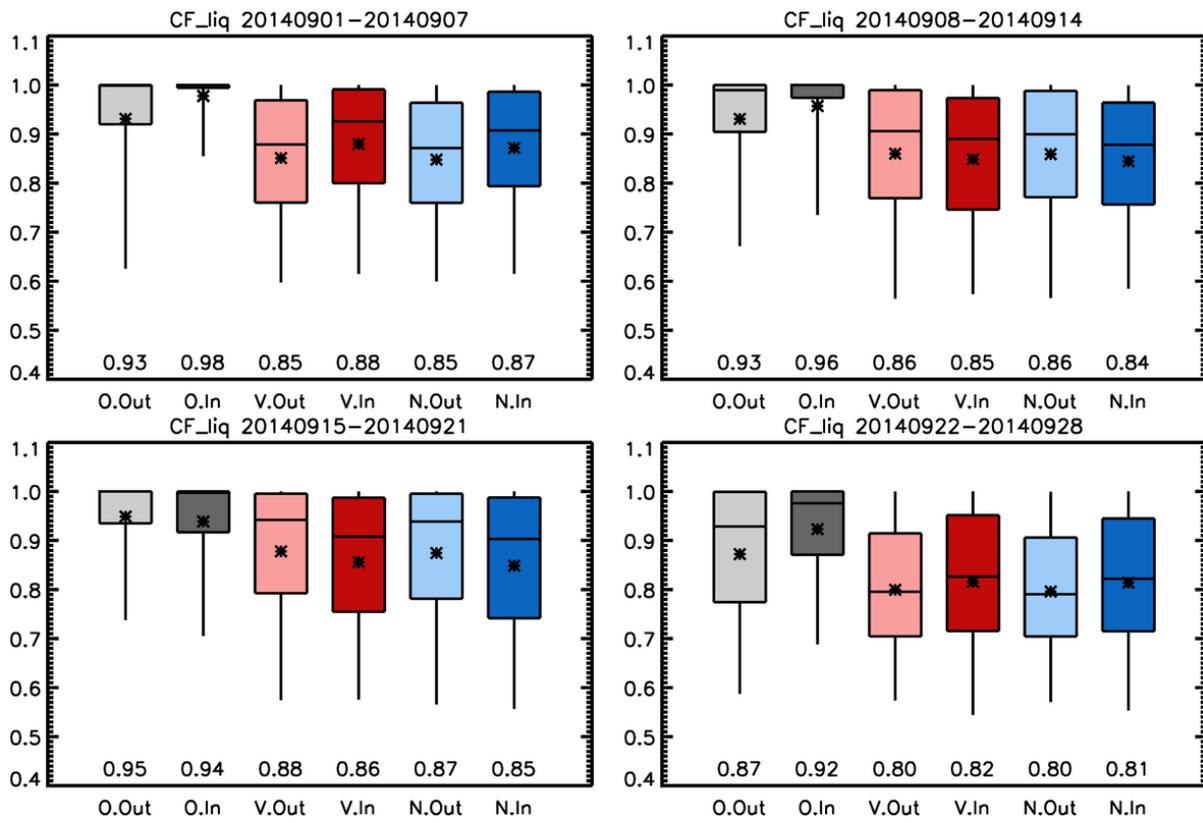


Figure S7. Same as figure 7 but for liquid cloud fraction from the model only. Liquid cloud fraction is not available for MODIS and only the total cloud fraction is shown. Note that the vertical axis has a linear scale and the values at the bottom and shown in stars are arithmetic means. Corresponding probability distribution functions are shown in figure S8.

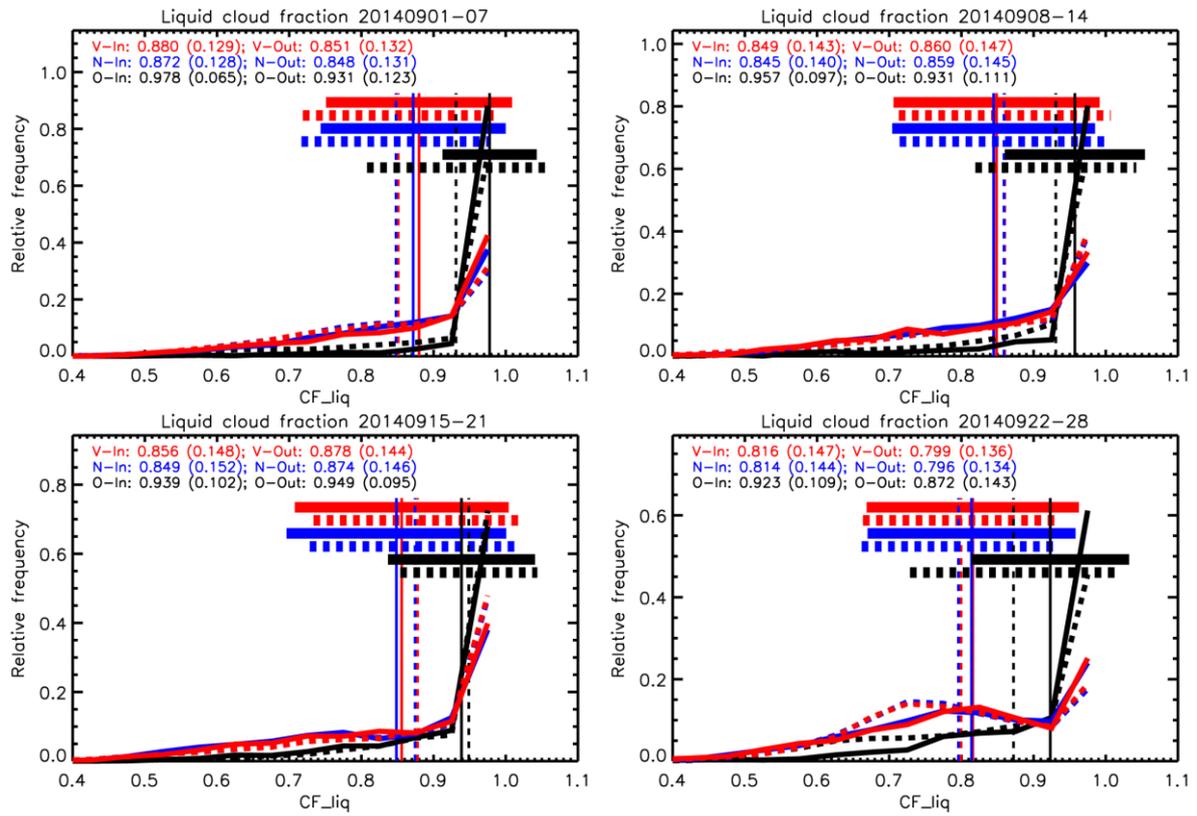


Figure S8. Same as figure S8 but for liquid cloud fraction. Note that linear horizontal axis is used, and arithmetic means and standard deviations are shown.

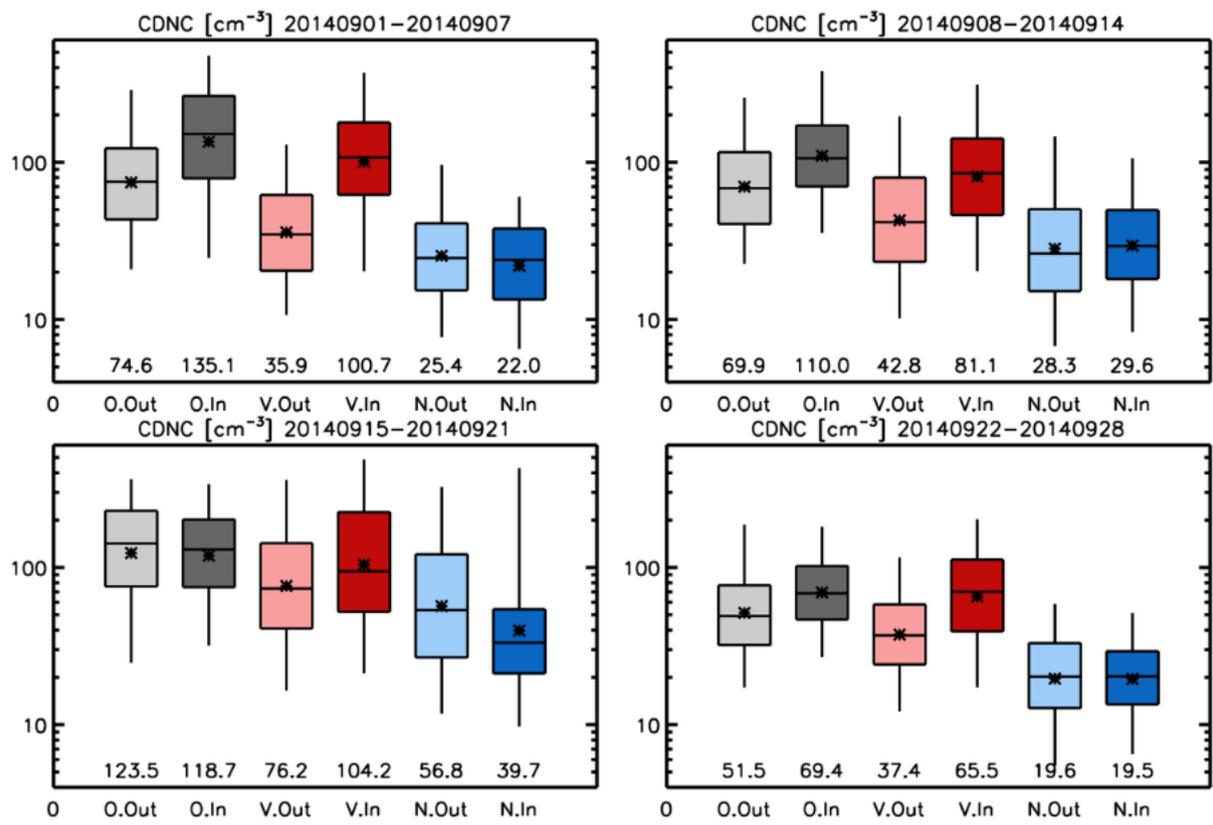


Figure S9. The same as figure 4 but created using 1 DU masks instead of 0.5DU.

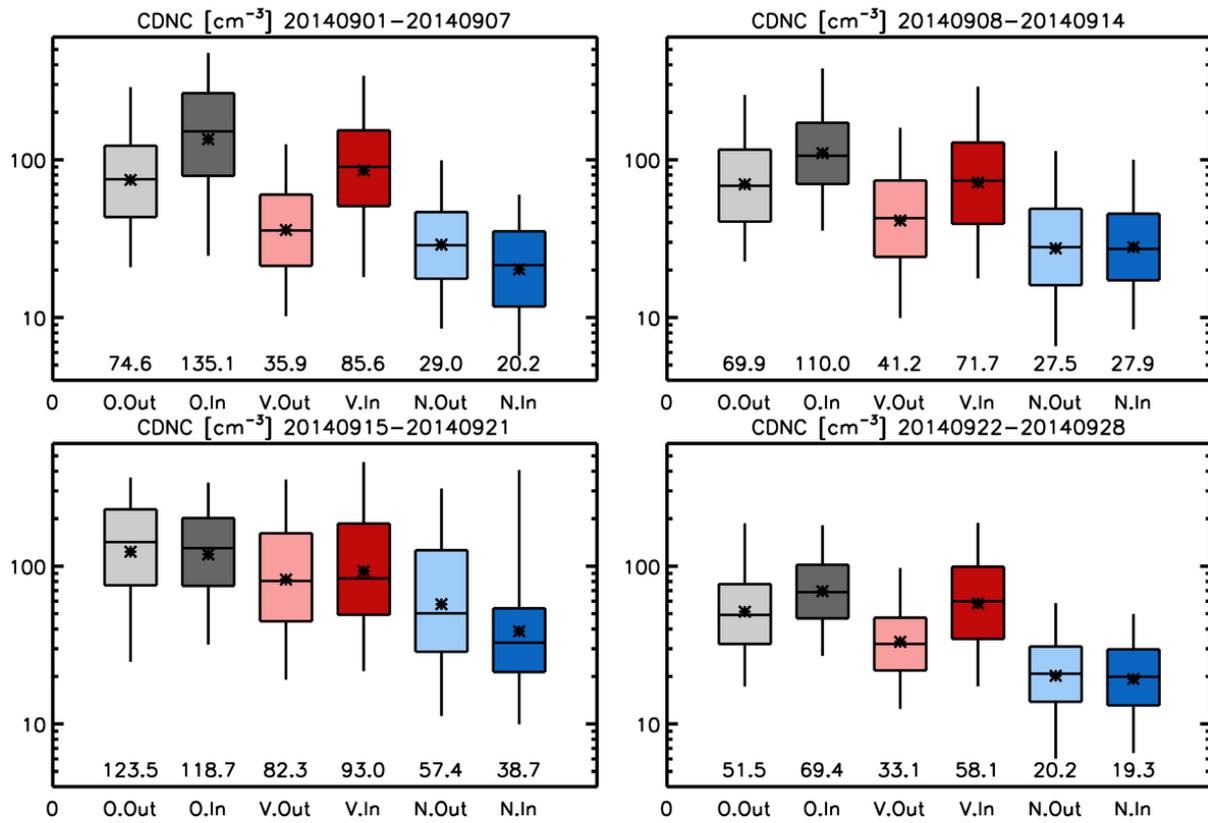


Figure S10. The same as figure 4 but created using hybrid masks where within and out-of-bounds regions follow satellite derived masks whereas in-plume region follows model derived mask.

**Table S1. Effect of using hybrid masks on CDNC analyses**

Original 0.5 DU masks (Figure 4)				
Week	1	2	3	4
v.out	33.4	45.8	85.8	32.6
v.in	85.6	71.7	93.0	58.1
total	2.56	1.57	1.08	1.78
n.out	27.1	33.0	69.9	20.1
n.in	20.2	27.9	38.7	19.3
location	0.75	0.85	0.55	0.96
eruption	4.24	2.57	2.40	3.01
aerosol	3.44	1.85	1.96	1.86

Hybrid masks (Figure S10)				
Week	1	2	3	4
v.out	35.9	41.2	82.3	33.1
v.in	85.6	71.7	93.0	58.1
total	2.38	1.74	1.13	1.76
n.out	29.0	27.5	57.4	20.2
n.in	20.2	27.9	38.7	19.3
location	0.70	1.01	0.67	0.96
eruption	4.24	2.57	2.40	3.01
aerosol	3.42	1.72	1.68	1.84

Relative change (hybrid/original)				
Week	1	2	3	4
v.out	1.07	0.90	0.96	1.02
v.in	1.00	1.00	1.00	1.00
total	0.93	1.11	1.04	0.98
n.out	1.07	0.83	0.82	1.00
n.in	1.00	1.00	1.00	1.00
location	0.93	1.20	1.22	1.00
eruption	1.00	1.00	1.00	1.00
aerosol	1.00	0.93	0.86	0.99