Supplement:

VARIATIONS IN TROPOSPHERIC SUBMICRON PARTICLE SIZE DISTRIBUTIONS ACROSS THE EUROPEAN CONTINENT 2008-2009

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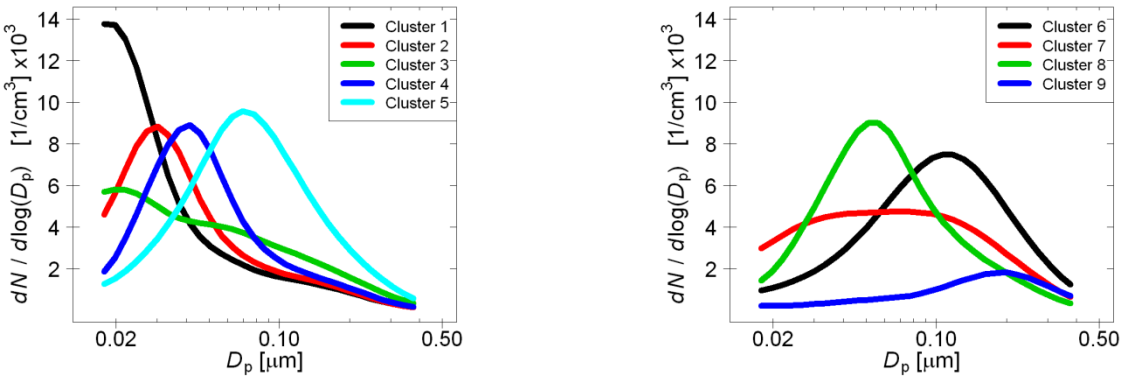
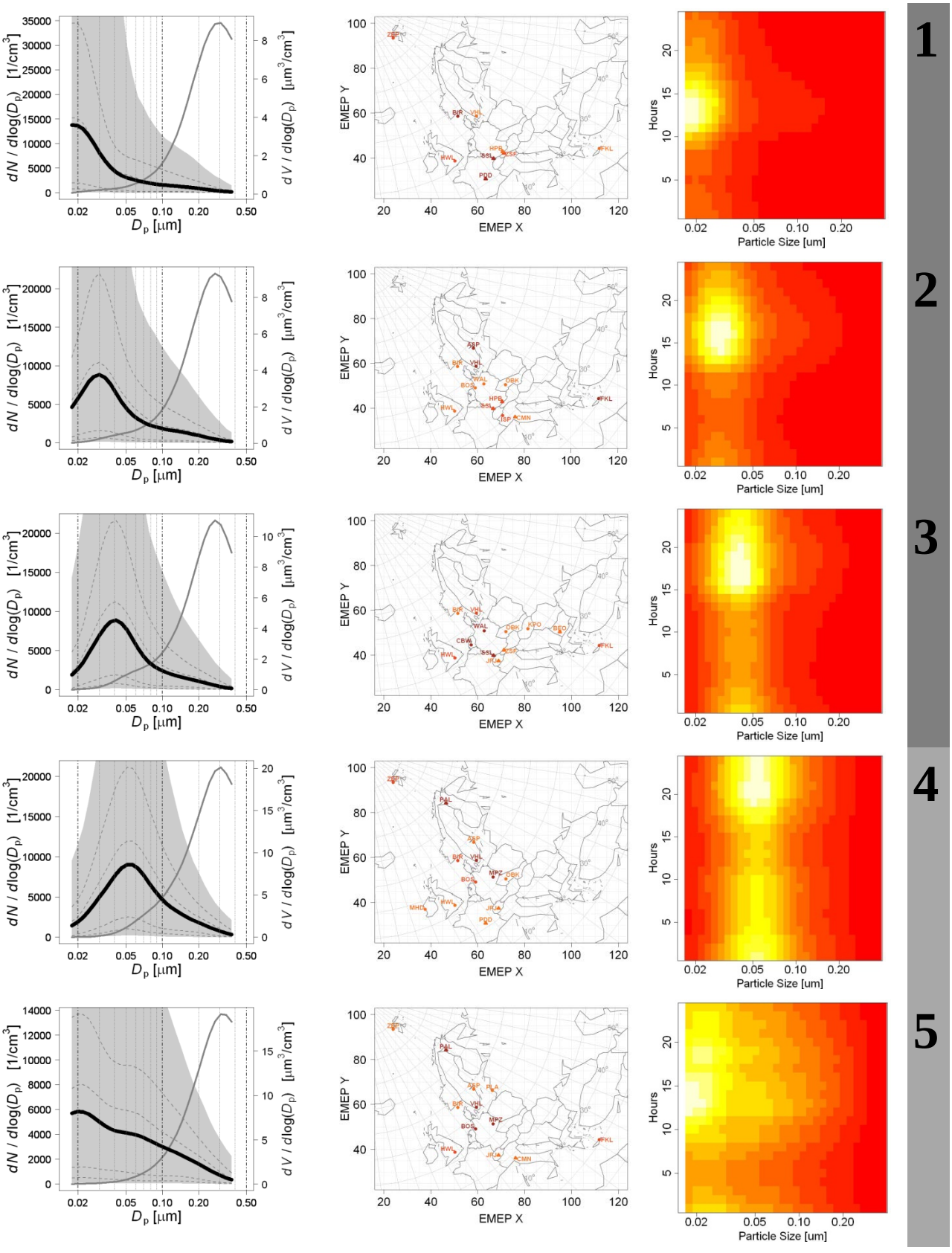


Figure S1. Cluster Centres derived from the *k*-Means analysis of the hourly averaged spectra.


1
2
3
4
5
dN / dlog(Dp) [1/cm3]
dV / dlog(Dp) [µm3/cm3]
Dp [µm]
EMEP Y
EMEP X
Hours
Particle Size [um]

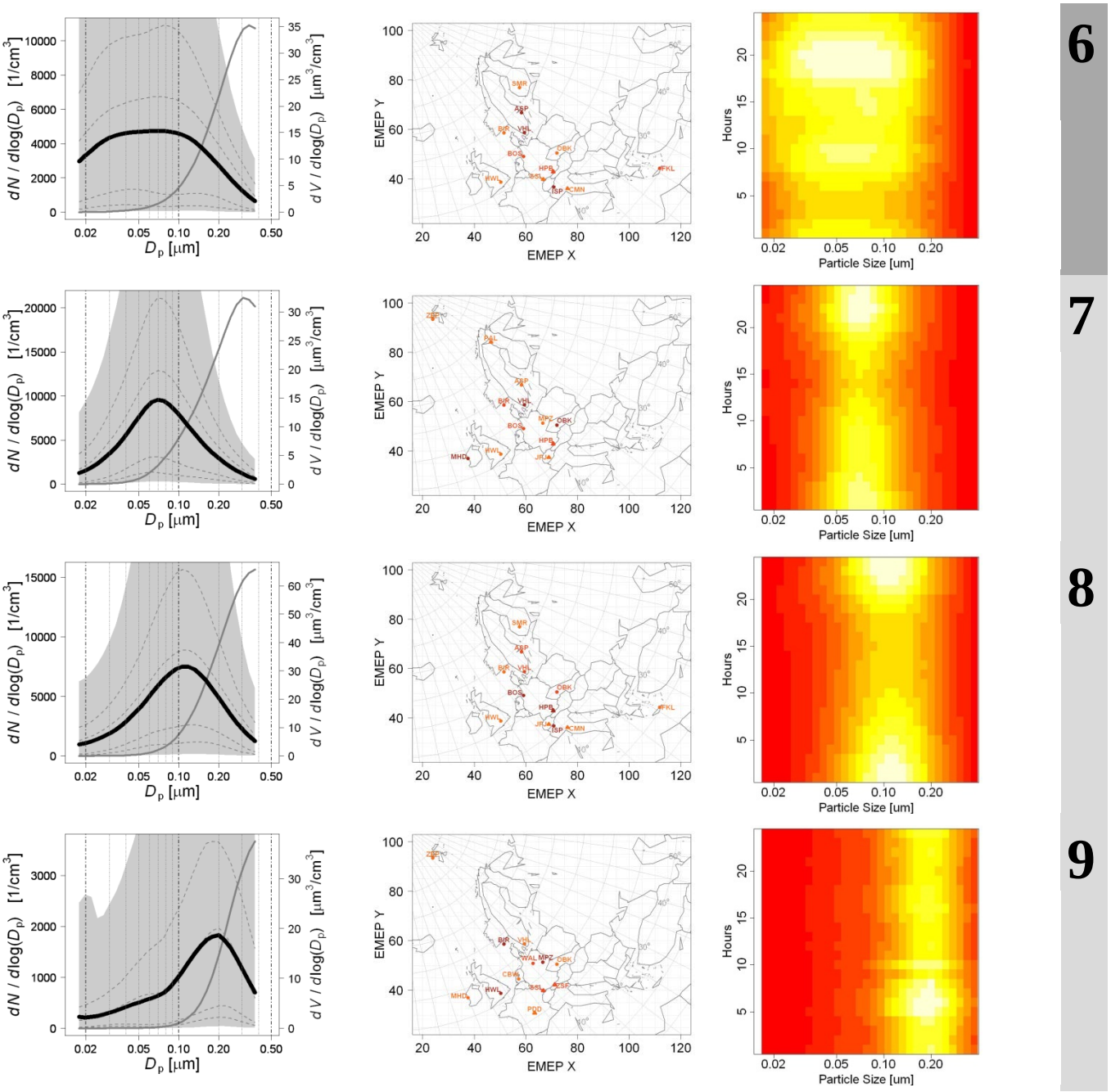


Figure S2. Average clustered hourly particle size distributions (*cluster 1-9 left hand panels*) and the spatial distribution of each cluster (*right hand panels*). The solid black line shows the average spectrum and the dashed lines show the 10th, 25th, 75th and 90th percentile spectrum. The maximum and minimum spectra are traced out by the extremities of the shaded areas. When counting the spectrum types within the whole data set, the sites which collected above the 90th, 75th and 50th percentile were marked with a progressively lighter orange colour. Circles denote boundary layer sites and triangles sites of relatively high altitude. The right hand panel shows the colour maps plotted using the average day of hourly spectra for each of the clusters.

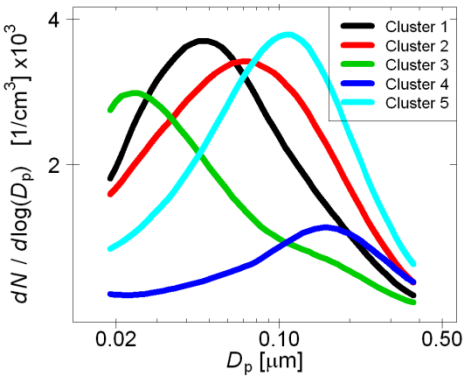


Figure S3. Cluster Centres derived from the *k*-Means analysis of the weekly averaged spectra.

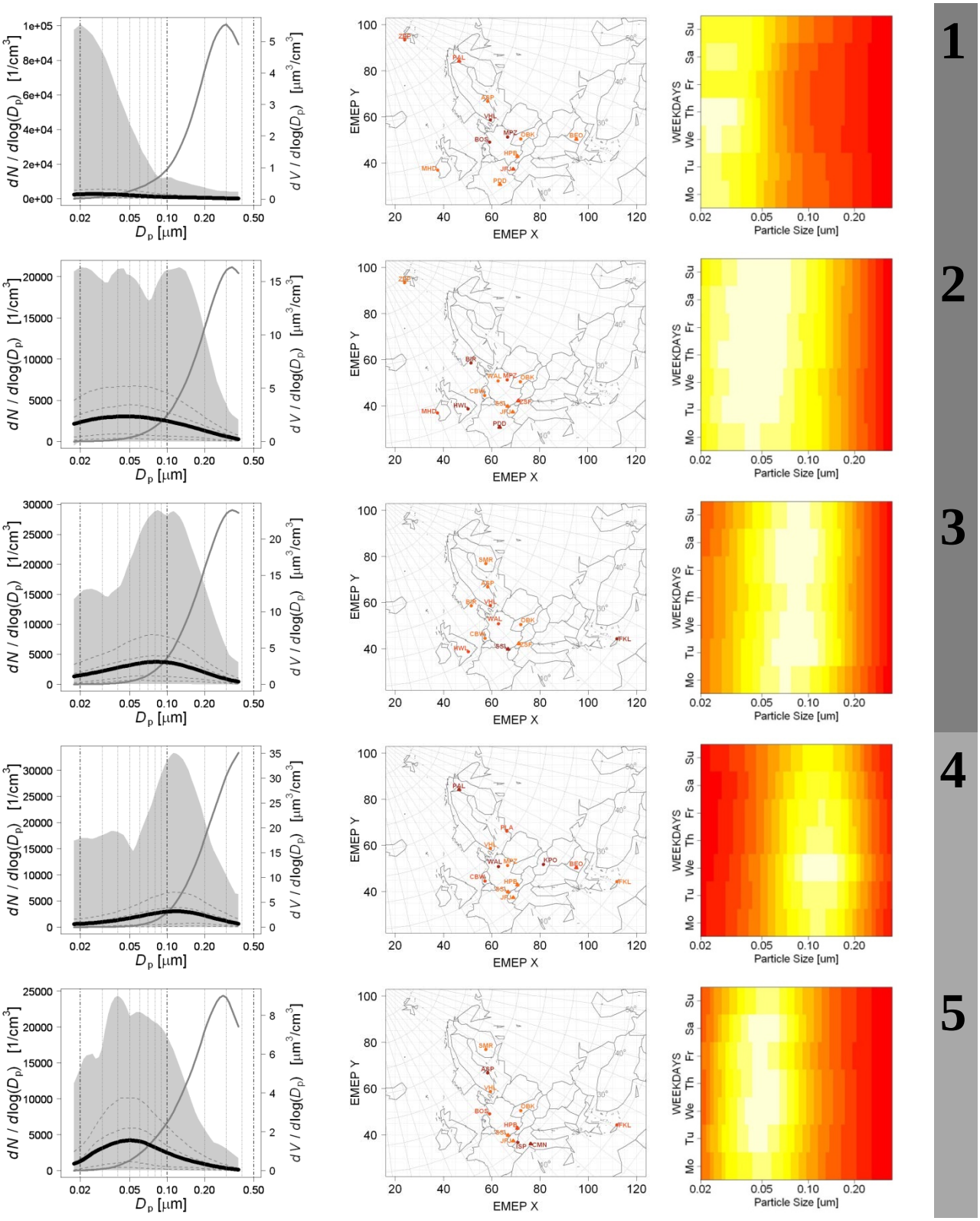
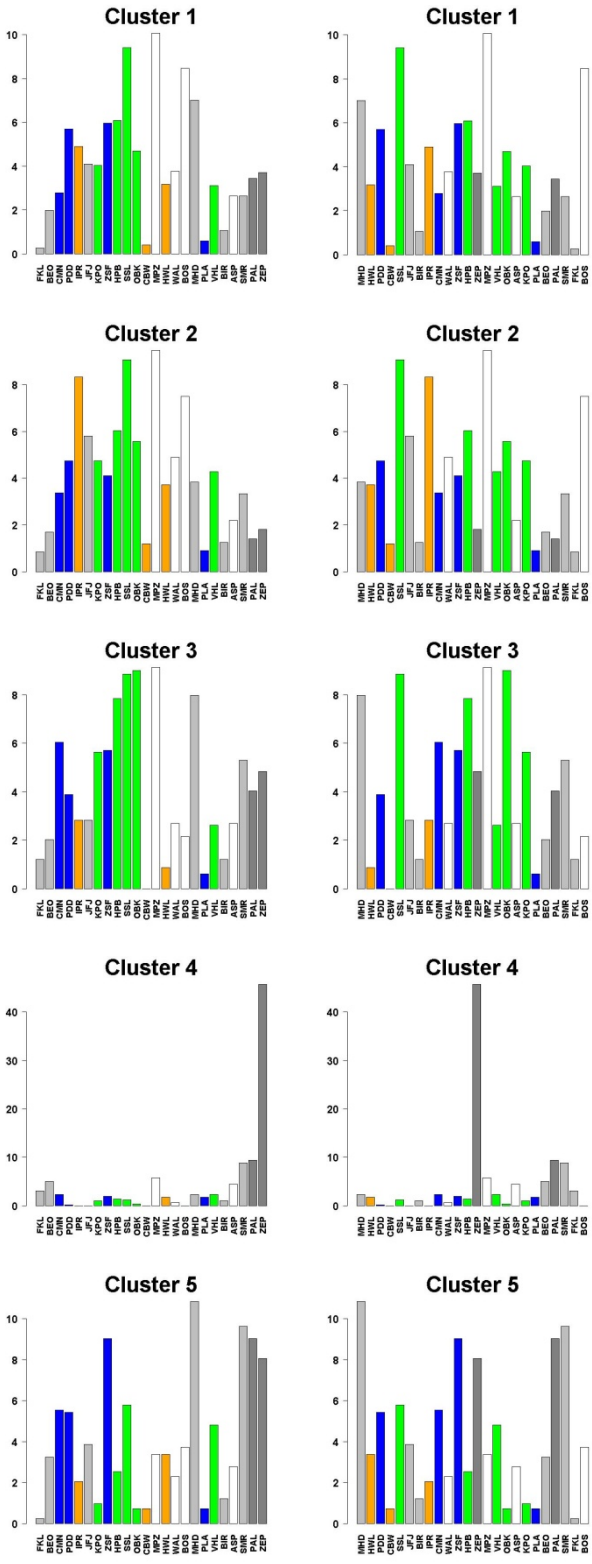
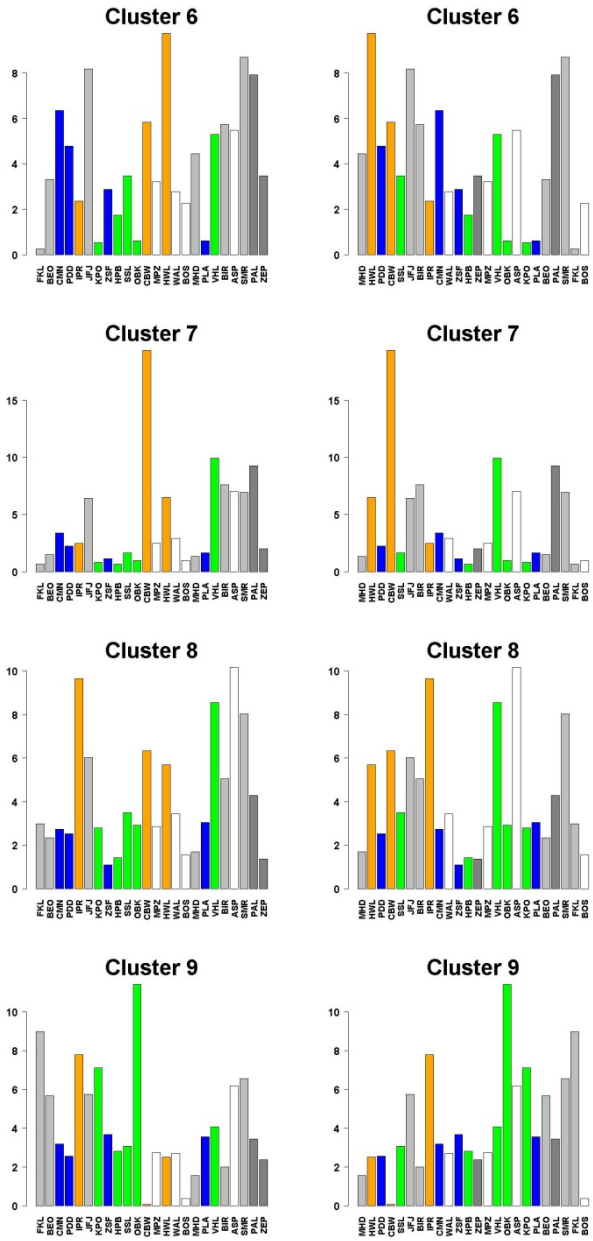


Figure S4. Average clustered weekly particle size distributions (*cluster 1-5 left hand panels*) and the spatial distribution of each cluster (*right hand panels*). The solid black line shows the average spectrum and the dashed lines show the 10th, 25th, 75th and 90th percentile spectrum. The maximum and minimum spectra are traced out by the extremities of the shaded areas. When counting the spectrum types within the whole data set, the sites which collected above the 90th, 75th and 50th percentile were marked with a progressively lighter orange colour. Circles denote boundary layer sites and triangles sites of relatively high altitude. The right hand panel shows the colour maps plotted using the average day of hourly spectra for each of the clusters.





Cluster 1, 2 and 3 are Central European site dominant.

Clusters 5 & 4 are Atlantic-Arctic-Nordic site dominant.

Cluster 9 is a Central-Europe-Balkan site dominant.

Clusters 6, 7 & 8 are Nordic-Central European site dominant.

Figure S5. Frequency percentage of the clusters measured at each of the sites: (*left hand panel*) sites ordered by latitude and (*right hand panel*) sites ordered by longitude. [Bar colours correspond to the different site types in Table 1: rural – *green*; mostly remote – *grey*; weakly influenced – *blue* and agglomeration – *orange*. Sites with blank bars have no type assignment.]

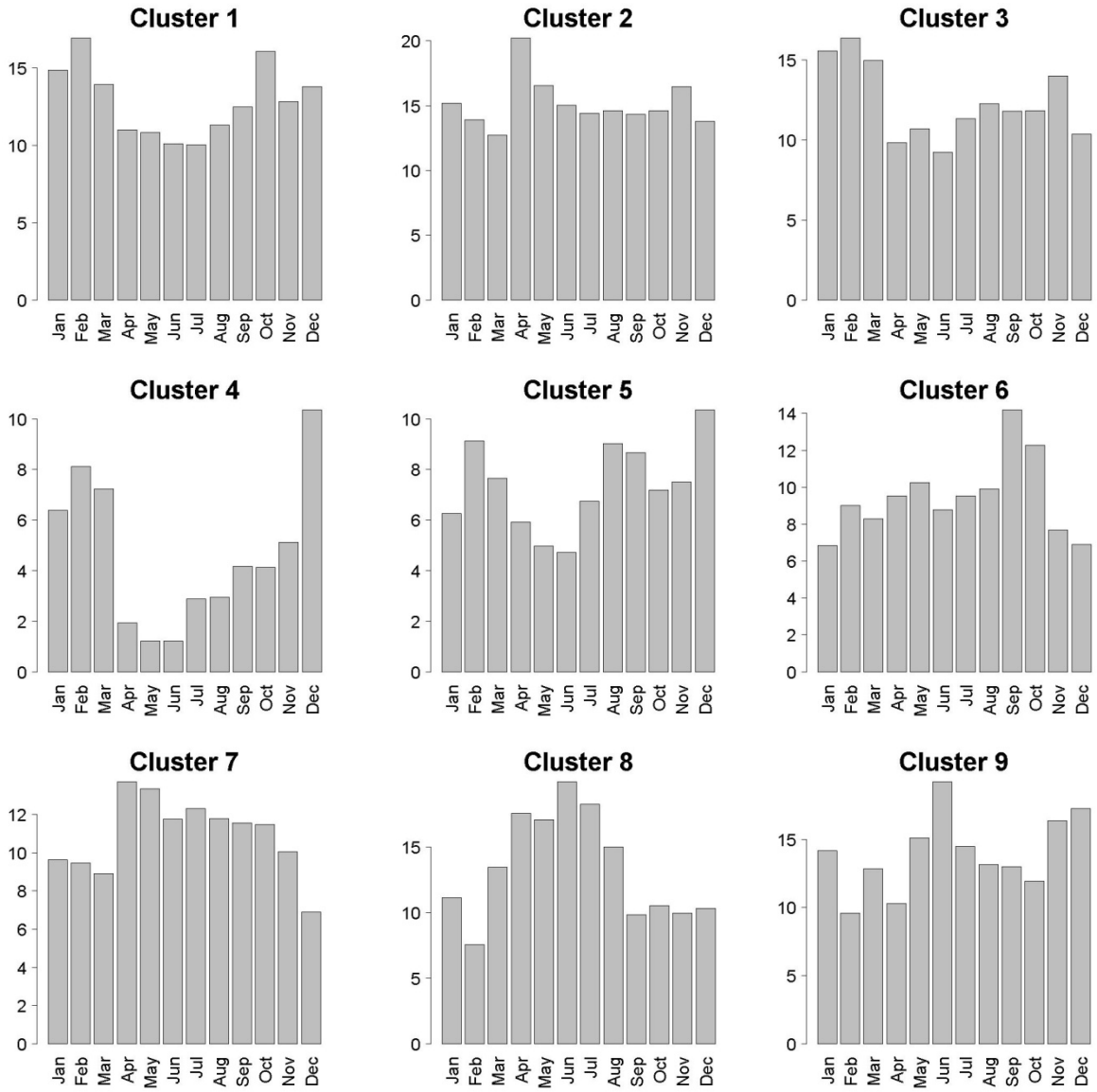


Figure S6. Seasonal percentages for the observed clusters.

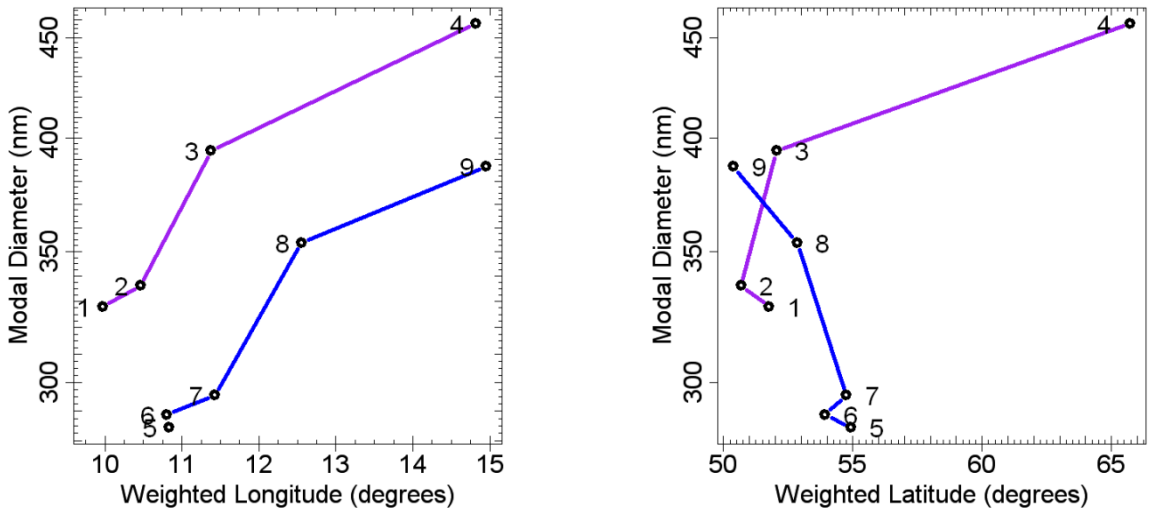
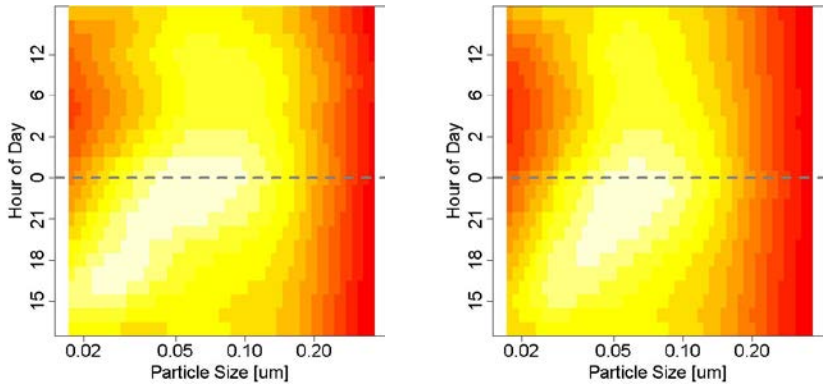


Figure S7. Using the volume distribution, the fitted modal-diameters of each cluster (1-9) is plotted against the Weighted Latitude, calculated for each cluster, using $WL = \sum_i^{24} W_i \cdot X_i / \sum_i^{24} W_i$, where X_i is the latitude/longitude of the sites where the cluster is detected and W_i corresponding population of the cluster across for the 24 sites.



(a) **(b)**

Figure S8. Colour maps derived from the averaging of (a) clusters 1-4 and (b) 5-9, showing the diurnal trends of the spectra collected inside and outside of central Europe respectively.

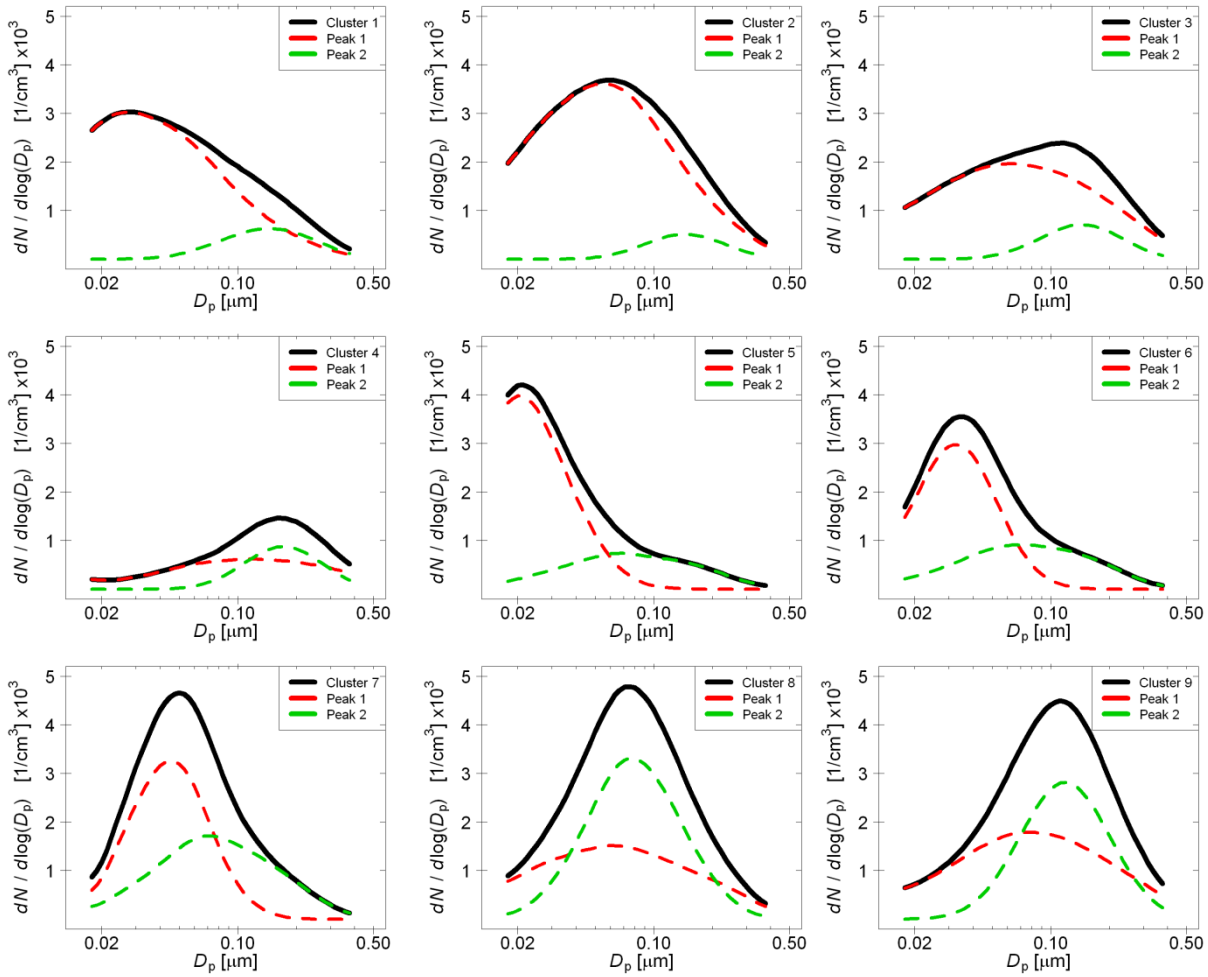


Figure S9. Peak fitted clusters.

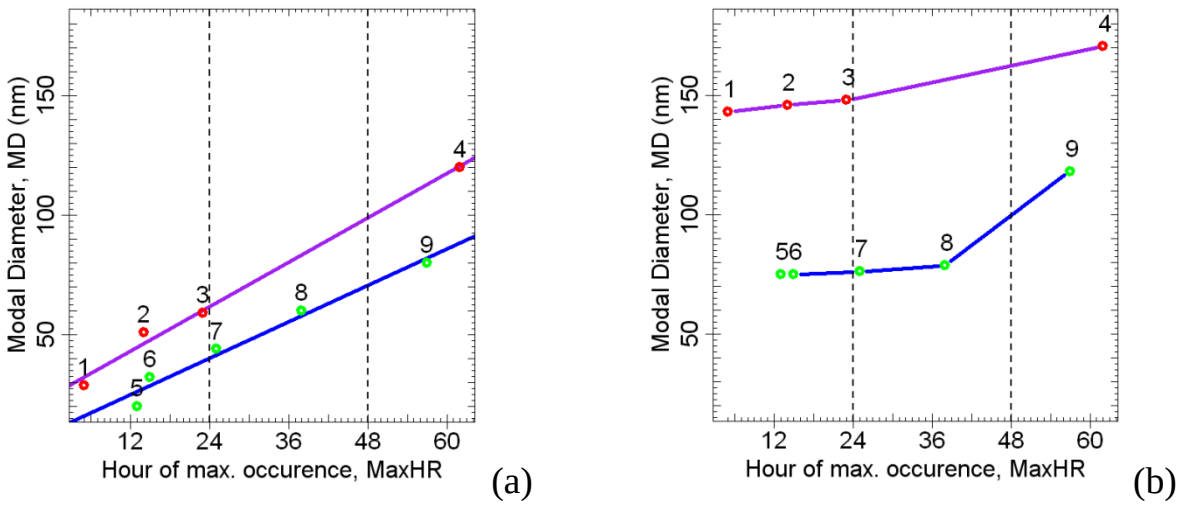
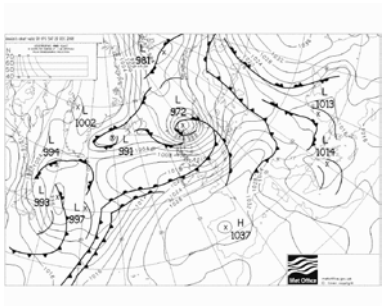
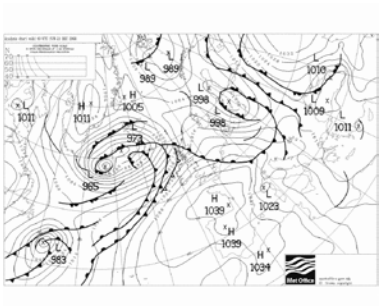


Figure S10. Plot showing how the modal diameters of the peaks (a) peak 1 and (b) peak 2, fitted to the average cluster spectra (shown in Figure S9) vary with the hour of their maximum occurrence. The red (1,2,3 and 4) and green (5,6,7,8 and 8) colours depict two aggregated trends observed in the data based on a South to North and West to East air mass movement. The fitted curves for figure (a) are $MD = 1.5 \times HR + 24$ for clusters 1- 4 and $MD = 1.3 \times HR + 9.7$ for clusters 5 - 9.



2008/12/20



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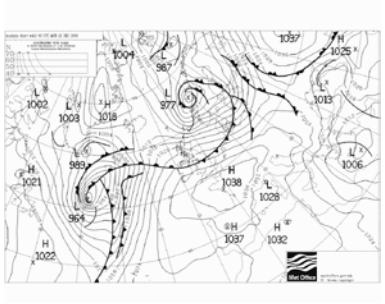

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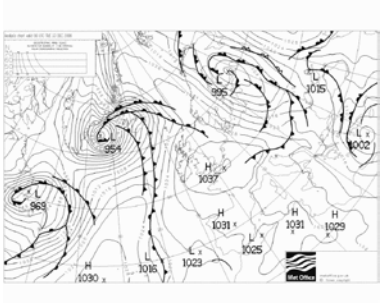

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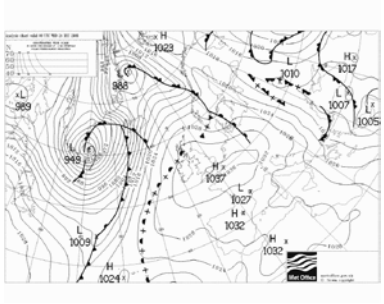

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Figure S11. Synoptic chart available at midnight of the sequential days along the trajectory arriving at FKL on the 24th of December 2008 at midnight (Figure 8).

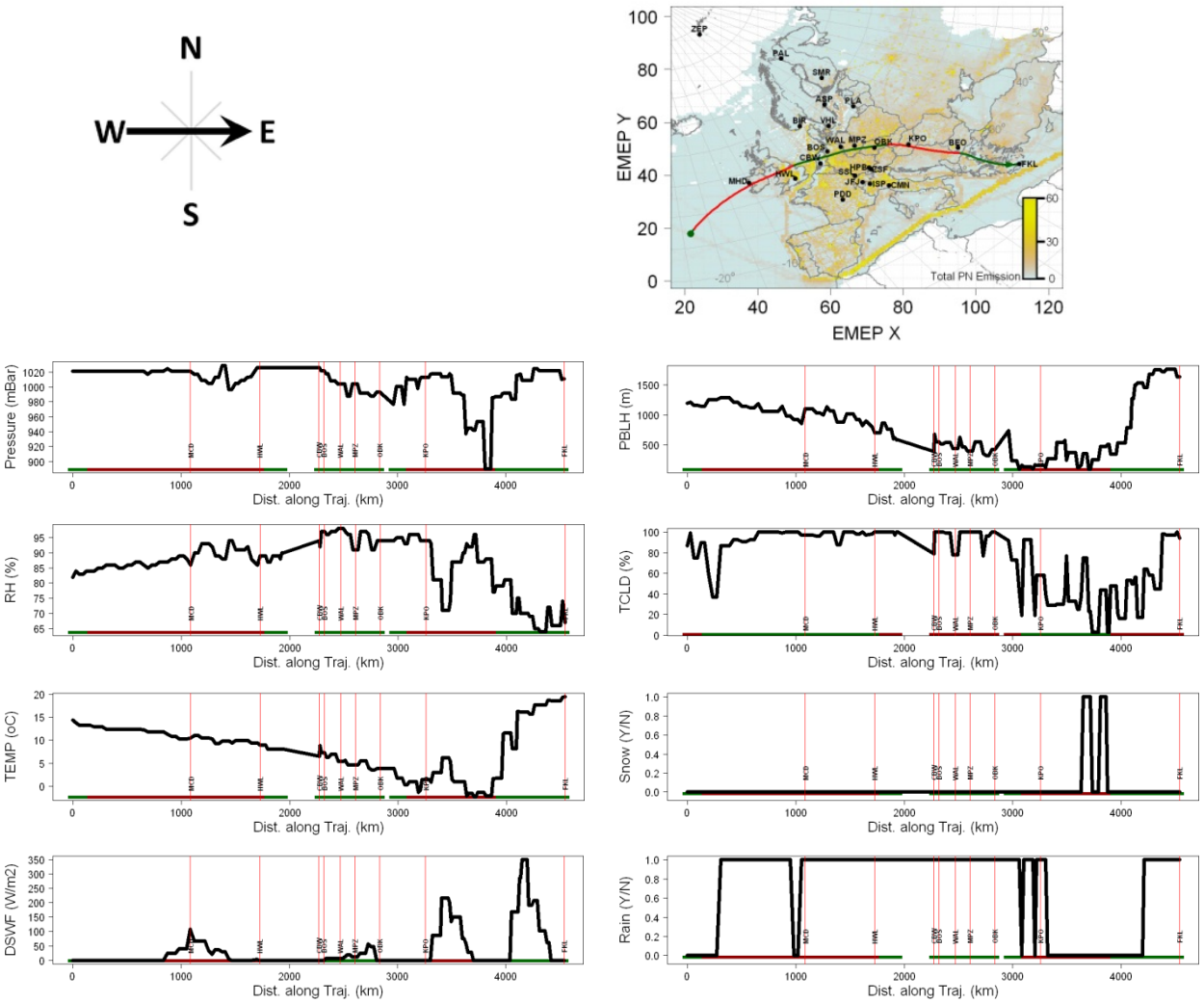
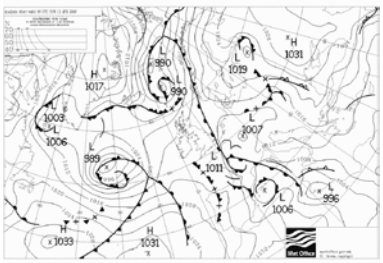


Figure S12. Meteorology along the trajectory arriving at FKL on the 24th of December 2008 at midnight (Figure 8).



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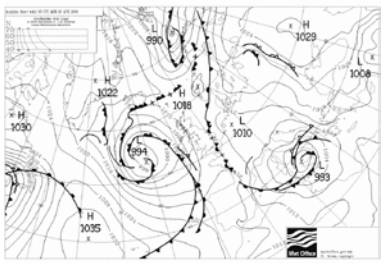

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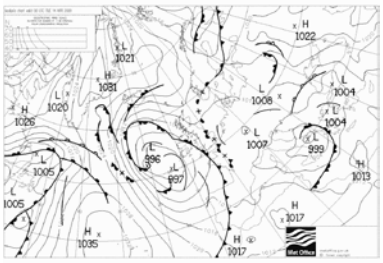

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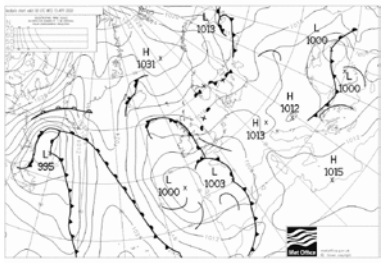

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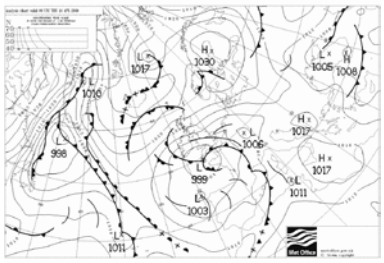

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Figure S13. Synoptic chart available at midnight of the sequential days along the trajectory arriving at MHD on the 16th of April 2009 at 18:00 (Figure 9).

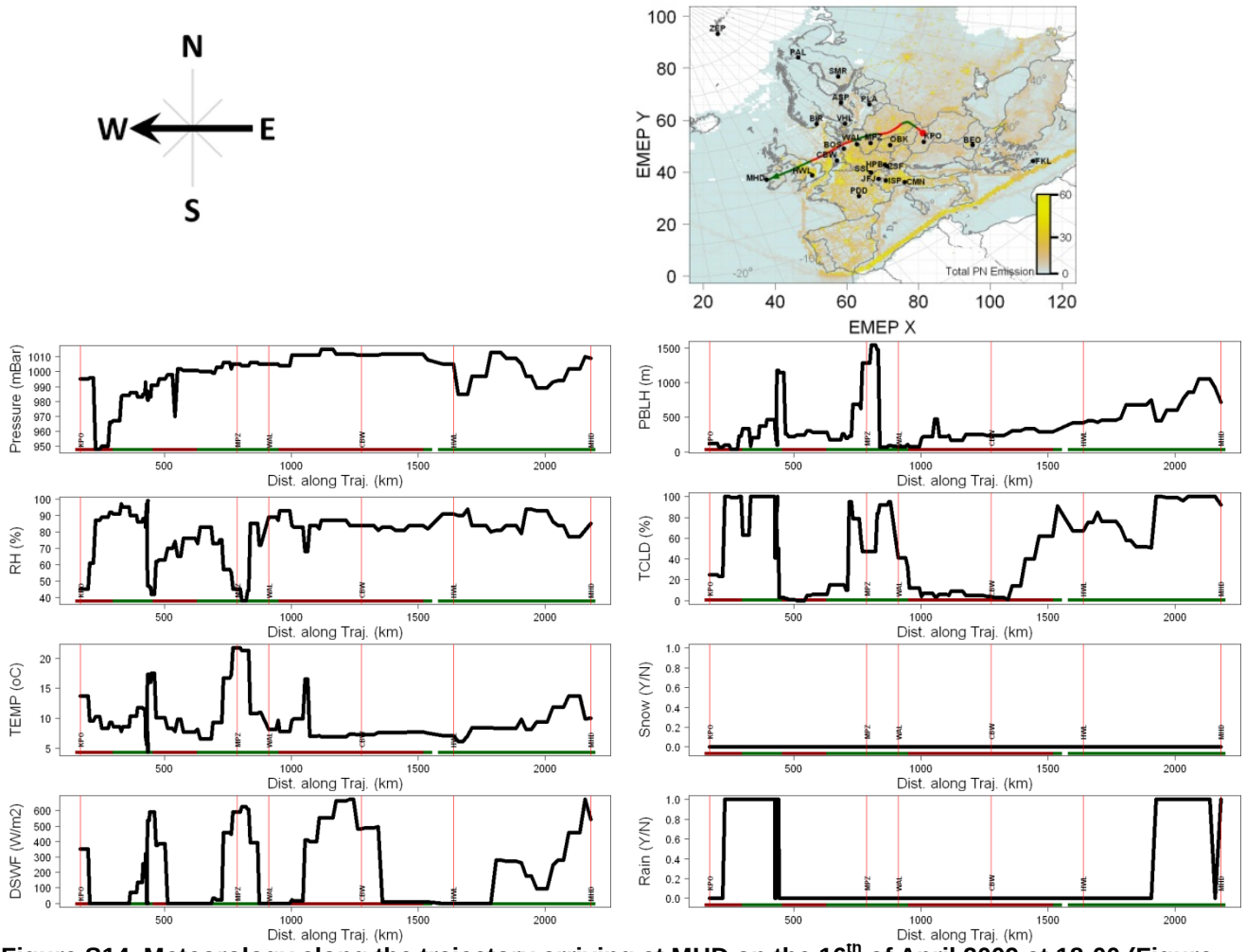
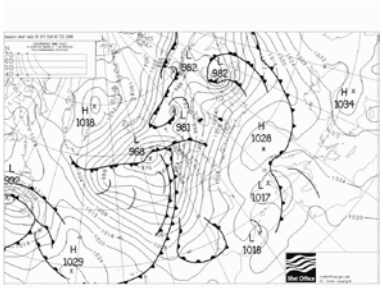


Figure S14. Meteorology along the trajectory arriving at MHD on the 16tn of April 2009 at 18:00 (Figure 9).



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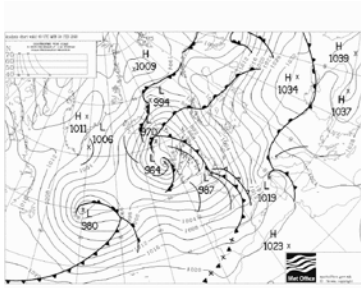

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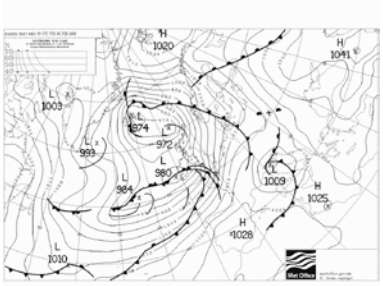

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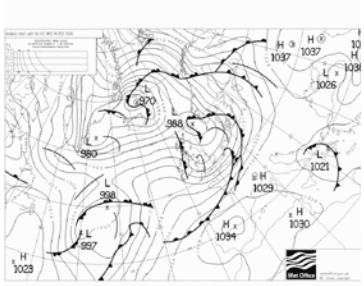

2008/02/06

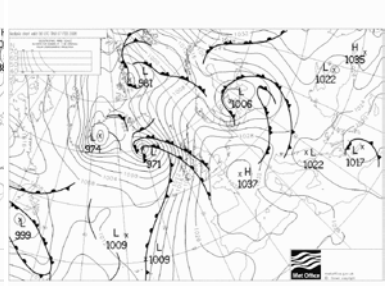

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Figure S15. Synoptic chart available at midnight of the sequential days along the trajectory arriving at ZEP on the 7th of February 2008 at 06:00 (Figure 10).

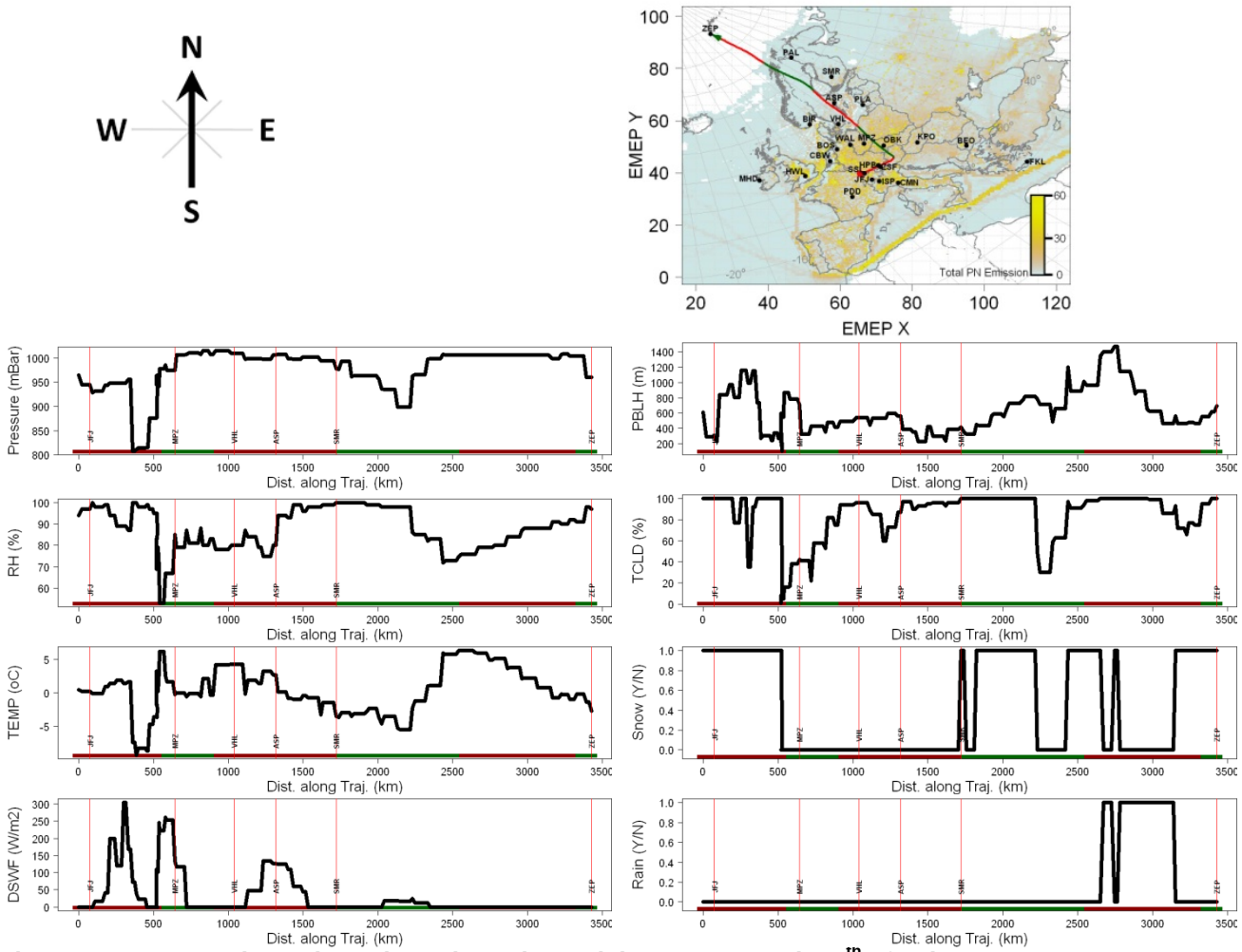

Figure S16. Meteorology along the trajectories arriving at ZEP on the 7th of February 2008 at 06:00 (Figure 10).

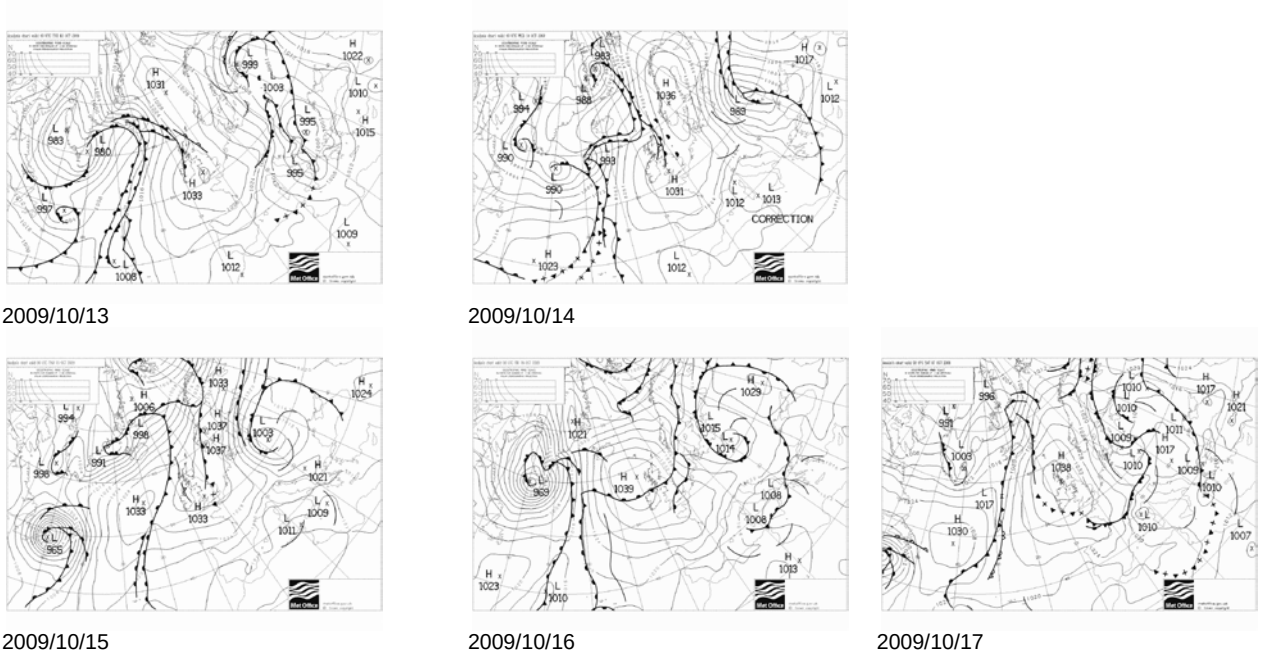

Figure S17. Synoptic chart available at midnight of the sequential days along the trajectory arriving at CMN on the 17th of October 2009 at 18:00 (Figure 11).

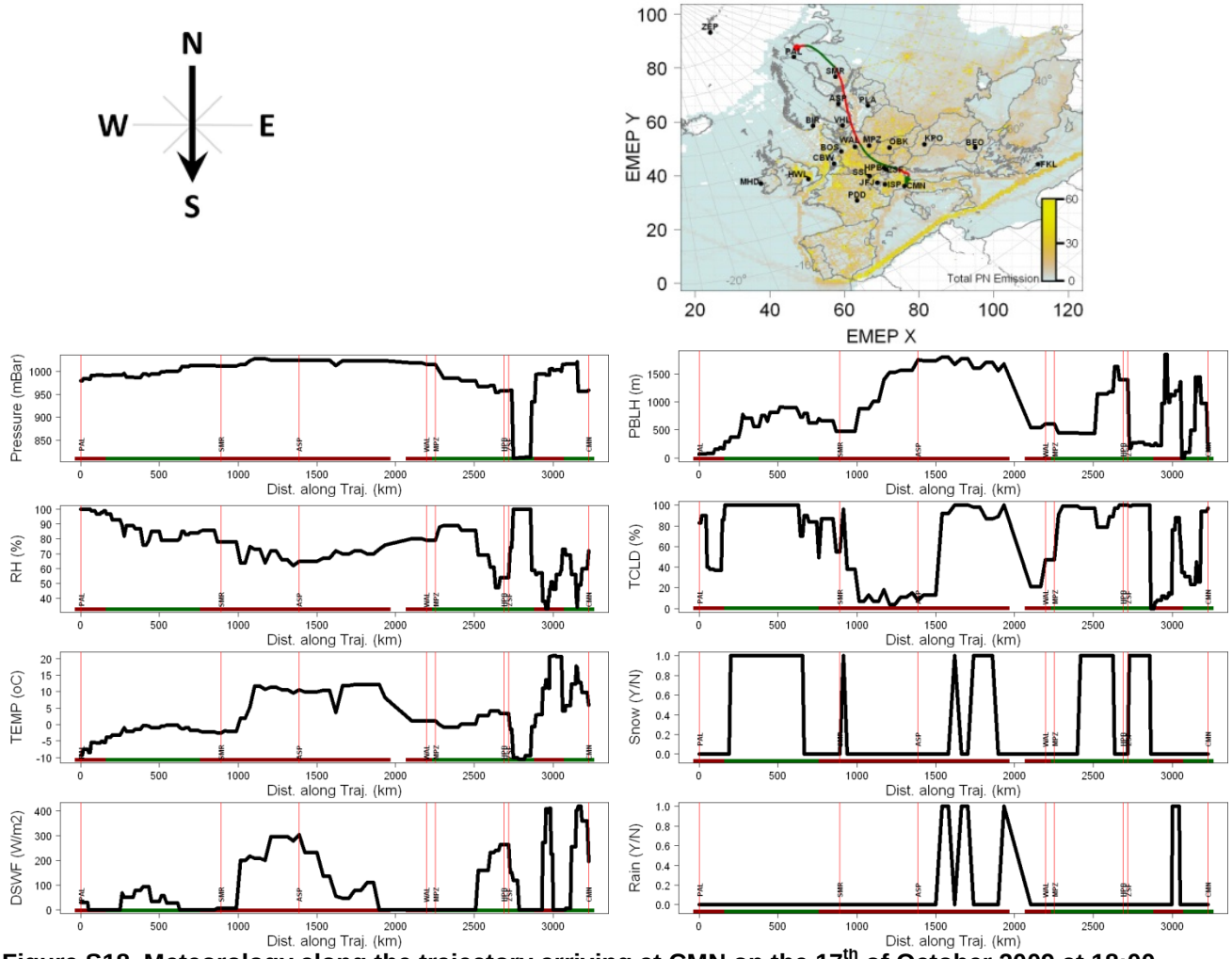

Figure S18. Meteorology along the trajectory arriving at CMN on the 17th of October 2009 at 18:00 (Figure 11).

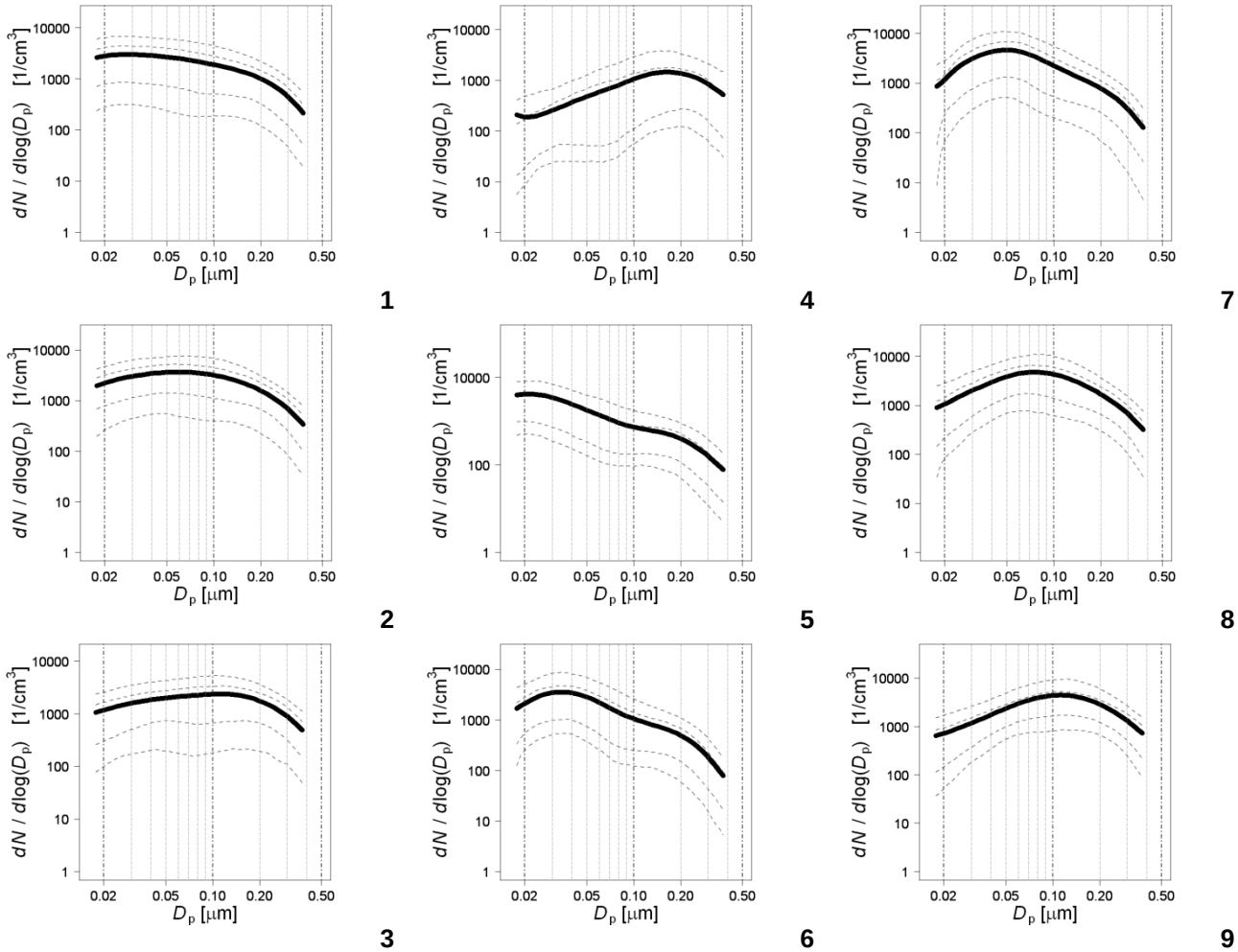

Figure S19. Average clustered particle size distributions (*cluster 1-9 shown in left hand panels in Figure 3 but plotted on log scales*). The solid black line shows the average spectrum and the dashed lines show the 10th, 25th, 75th and 90th percentile spectrum.