

Supplementary material to Manuscript No. ACP-2012-590
Dynamical characteristics of ice supersaturated regions
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Analysis of additional months

In the original version of this paper we analysed only one month, March 2012. One reason for not looking at more months was the update of the Integrated Forecast System to a new cycle in November 2011 with a change in the treatment of supersaturation. However, according to information given to us by Dr. Richard Forbes from the ECMWF, this update did only touch supersaturation in mixed-phase clouds and did not change relative humidity in the upper tropospheric ice-only levels. Thus earlier data from the previous model version can safely be used. Furthermore, both reviewers recommended to look at more months in order to enhance the credibility of the results. We follow the reviewer's recommendation and show here the results for three additional months so that together with our March 2012 all seasons are covered, each with one month. The additional months are June, September, and December 2011.

As the seasonal variation is not expected to be large in the tropics and as it turns out that the results already obtained from the March 2012 study are confirmed by the additional analysis we only show data for Europe and only for one month per season.

A comparison of the numbers in the table here and in the main text as well as a comparison of the histograms with those in the main paper shows that the seasonal variation of the statistical quantities is generally weak. Most values that differ insignificantly from zero in March 2012 do so as well in the other months. Three exceptions are (1) the skewness of the vorticity distribution in the unconditioned data ("all") for September 2011, and (2 and 3) the mean vertical velocity in the ISSRs for June and December. The vertical velocity is not statistically different from zero in March 2012, and in September the $3\text{-}\sigma$ significance criterion is just missed. Values that differ significantly from zero in March 2012 do so in all months considered. The significant values themselves change little between the four months, much less than their respective standard deviations.

Table 1: Statistical parameters mean, standard deviation, skewness and kurtosis, of dynamical fields within ISSRs and generally over Europe on the 250 hPa level for three months in 2011. Mean values and standard deviations of divergence and vorticity (units $\text{m}^2 \text{s}^{-2}$) have been scaled by 10^6 , while skewness and kurtosis are dimensionless. For the meaning of the parameters and their standard deviations see the main text. Values that are at least three times larger than their standard deviation are printed in boldface.

	June 2011		September 2011		December 2011	
	all	ISSR	all	ISSR	all	ISSR
divergence						
mean	-0.12 ± 0.43	19.2 ± 5.0	0.11 ± 0.52	15 ± 4.0	0.30 ± 0.51	14 ± 4.6
std. dev.	27 ± 3	36 ± 5	27 ± 3	32 ± 5	31 ± 3	30 ± 4
skewness	0.45 ± 0.29	1.3 ± 0.5	0.3 ± 0.3	1.3 ± 0.8	-0.1 ± 0.3	1.1 ± 0.8
kurtosis	6.7 ± 2.7	4.3 ± 3.2	6.4 ± 4.1	6.5 ± 9.8	6.9 ± 3.8	5.7 ± 7.7
rel. vorticity						
mean	5.3 ± 4.2	-58 ± 10	3.7 ± 4.7	-53 ± 11	6.7 ± 3.6	-44 ± 15
std. dev.	69 ± 5	47 ± 5	75 ± 8	48 ± 6	64 ± 7	42 ± 8
skewness	0.44 ± 0.18	0.71 ± 0.30	0.69 ± 0.20	0.89 ± 0.46	0.21 ± 0.22	0.61 ± 0.41
kurtosis	0.39 ± 0.62	1.6 ± 1.1	0.69 ± 0.72	2.2 ± 2.3	-0.2 ± 0.5	1.1 ± 1.4
vertical velocity						
mean	0.006 ± 0.003	-0.063 ± 0.017	-0.002 ± 0.005	-0.063 ± 0.022	-0.003 ± 0.007	-0.064 ± 0.021
std. dev.	0.09 ± 0.01	0.13 ± 0.03	0.10 ± 0.02	0.12 ± 0.03	0.15 ± 0.03	0.14 ± 0.04
skewness	-1.0 ± 0.9	-2.0 ± 0.9	-0.9 ± 0.9	-2.0 ± 1.4	-0.3 ± 0.8	-1.5 ± 1.1
kurtosis	17 ± 13	11 ± 12	17 ± 18	15 ± 23	21 ± 17	15 ± 15

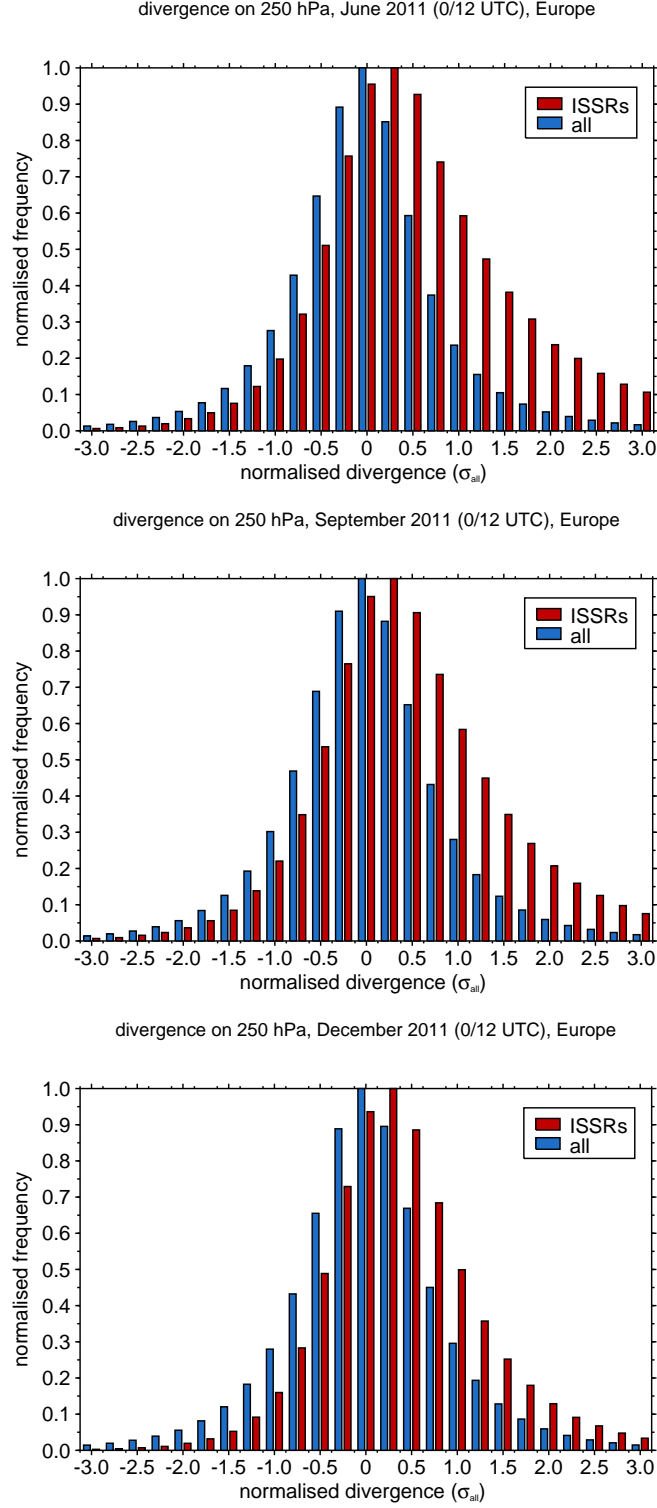


Figure 1: Histograms of divergence for Europe on the 250 hPa level for three months in 2011. The blue bars refer to all grid boxes in Europe while the red ones refer to ISSRs only. The data are normalised with the standard deviation of the complete set of all forecast times and all grid boxes (σ_{all}). The relative frequencies of occurrence are normalised such that the maximum value is unity. The bin width is $\sigma_{\text{all}}/4$ and the bins are marked with the small ticks on the x-axes.

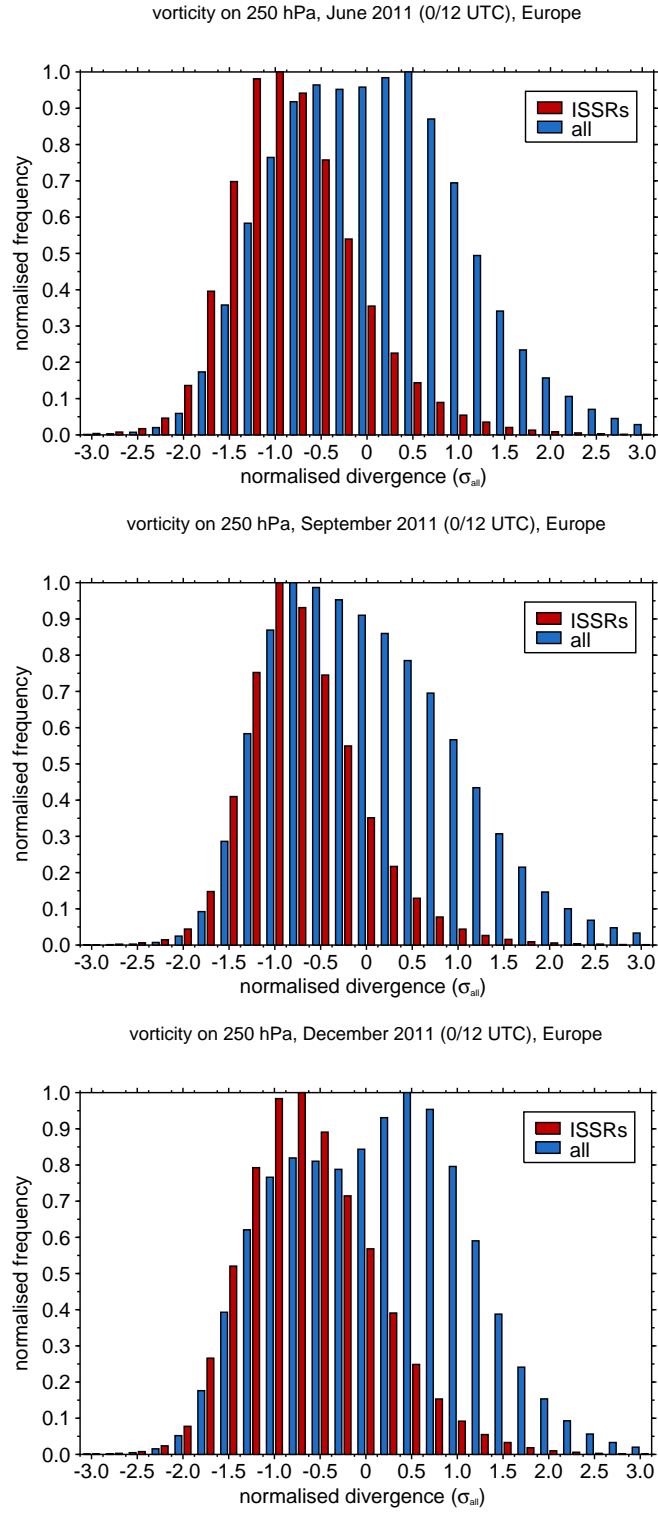


Figure 2: As figure 1, but for realtive vorticity.

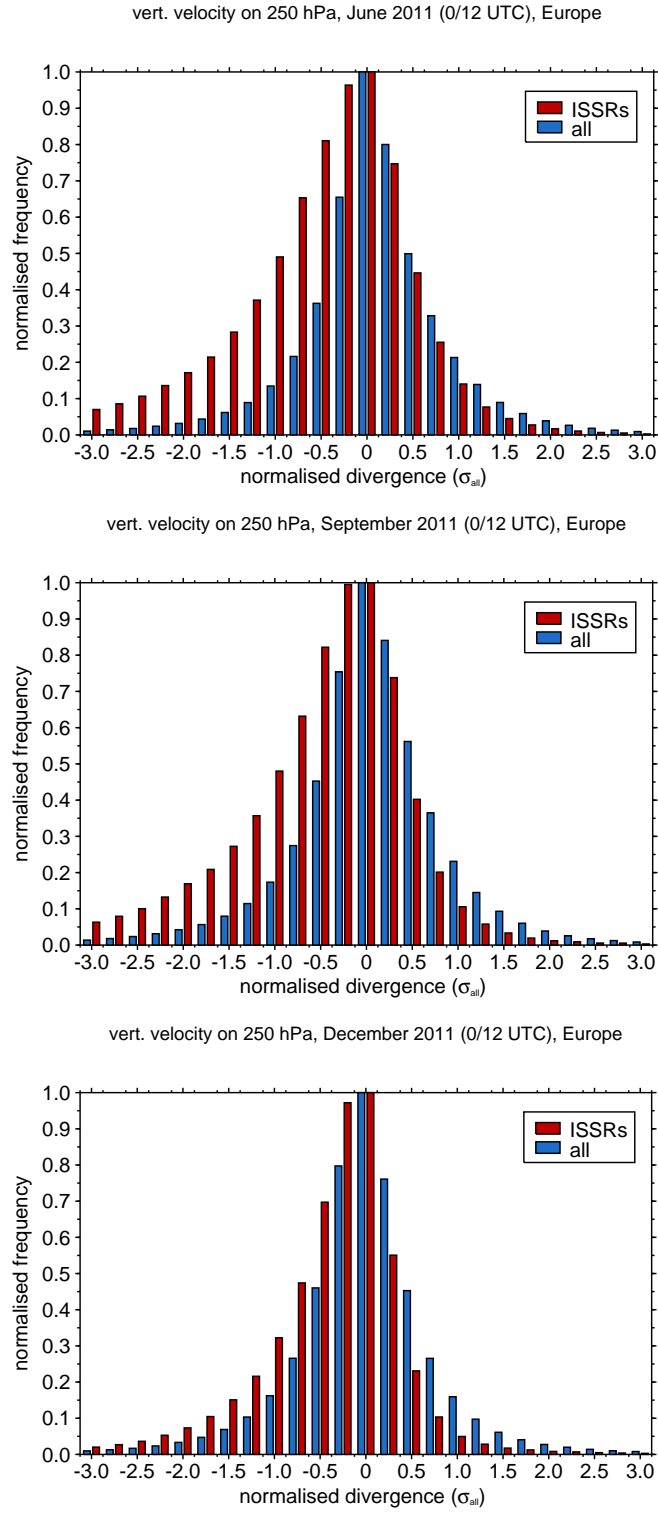


Figure 3: As figure 1, but for vertical velocity in pressure coordinates.