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Boundary-layer height and surface stability at Hyytiälä, Finland, in ERA5 and observations

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References

CLU. Cloud profiling product classification; 2018-10-01, 2018a. URL `https://hdl.handle.net/21.12132/1.4515948370b94375`. Generated by the cloud profiling unit of the ACTRIS Data Centre.

CLU. Cloud profiling product classification; 2018-10-28, 2018b. URL `https://hdl.handle.net/21.12132/1.e87b5b355e634f6e`. Generated by the cloud profiling unit of the ACTRIS Data Centre.

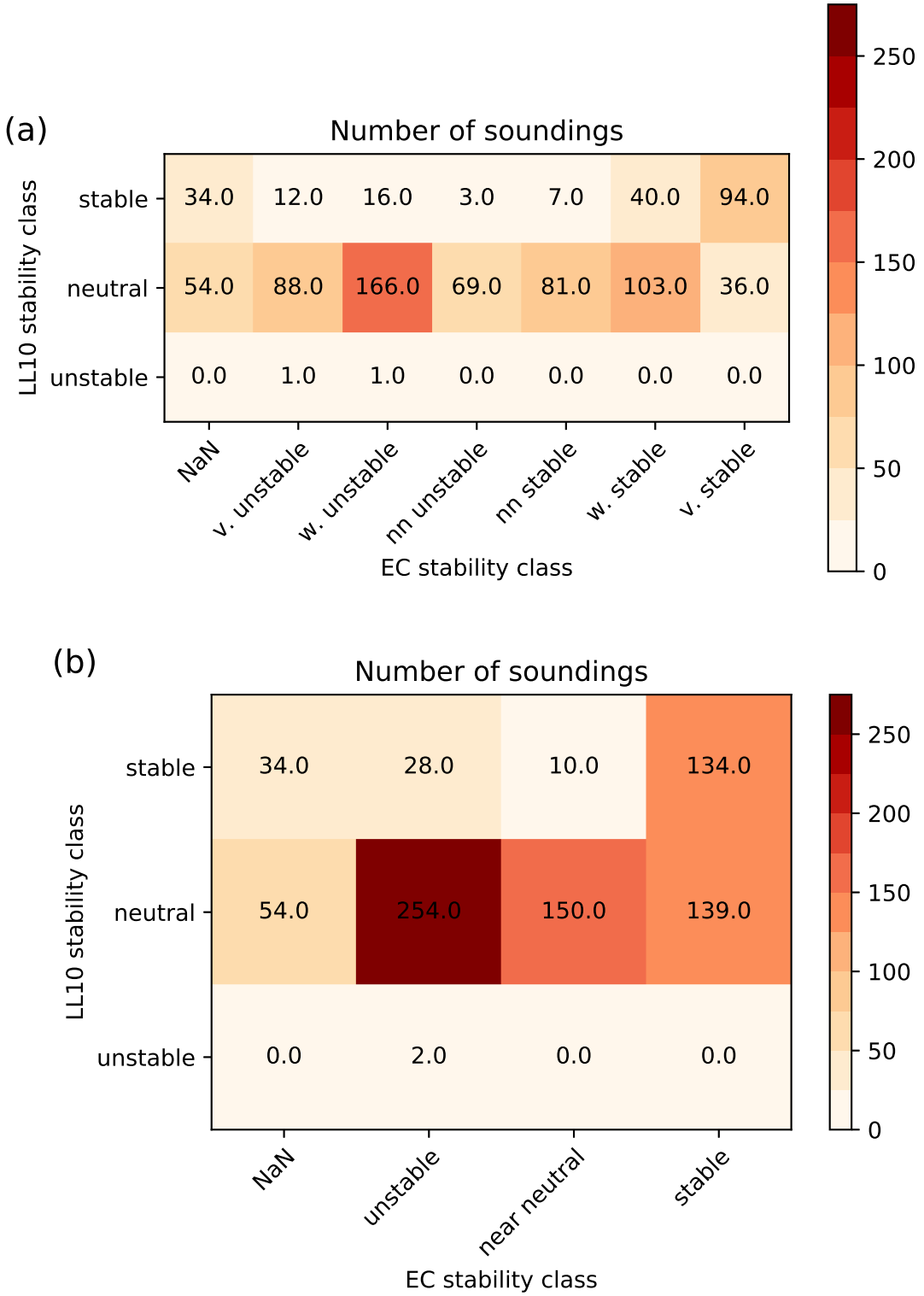


Figure S1: Comparison of the stability classes derived from the LL10 method (y-axis) and from the eddy covariance data (x-axis). Shading and numbers show the number of soundings in each bin. In (b), the EC stability classes have been group so that unstable includes very and weakly unstable, neutral includes near neutral unstable and near neutral stable, and stable includes weakly and very stable classes. NaNs are almost all caused by missing EC data.

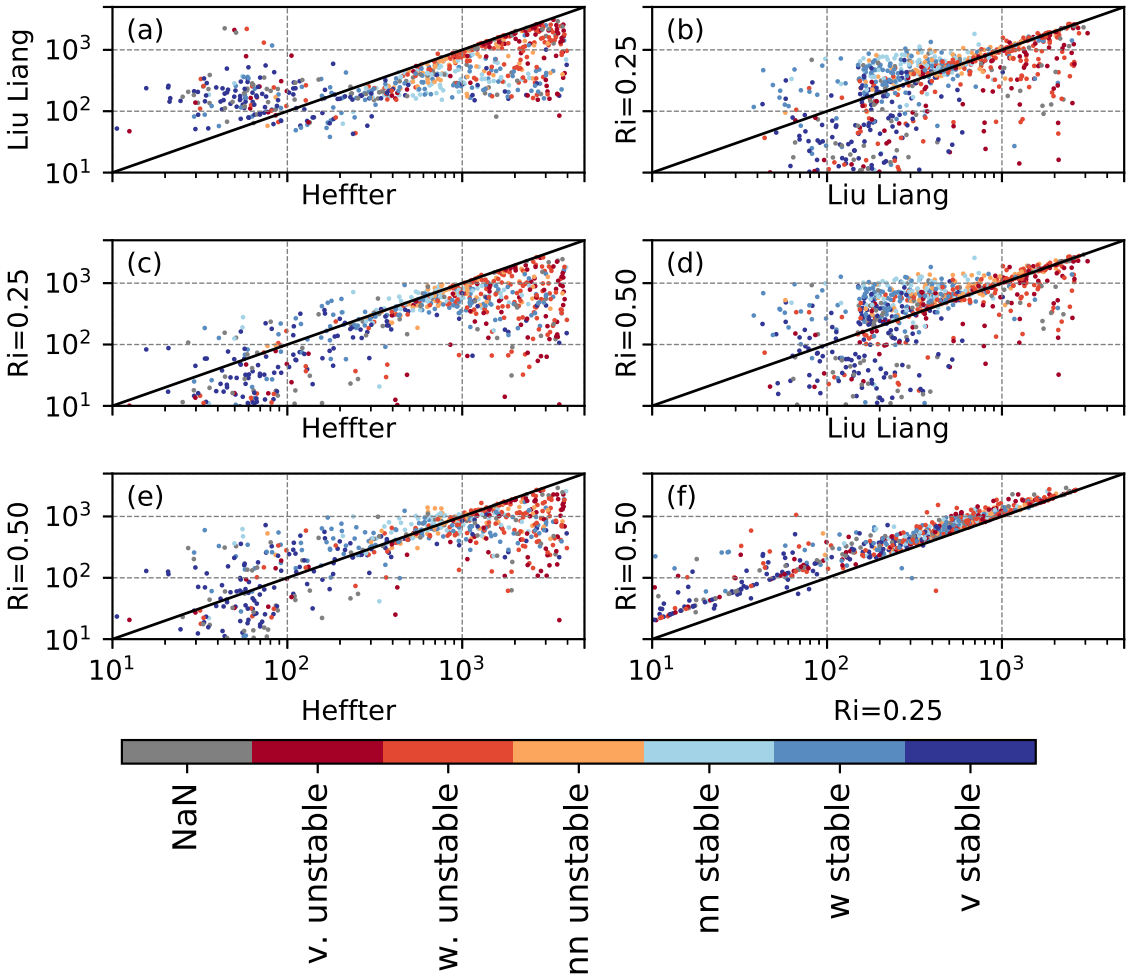


Figure S2: Scatter plots showing the relation between the BL height diagnosed from radiosondes taken during BAECC using 4 different methods. Data is from 1st February 2014 - 13th September 2014. Colours show the stability class diagnosed from the eddy covariance measurements. Black solid lines show the 1-to-1 line. Note the logarithmic scale.

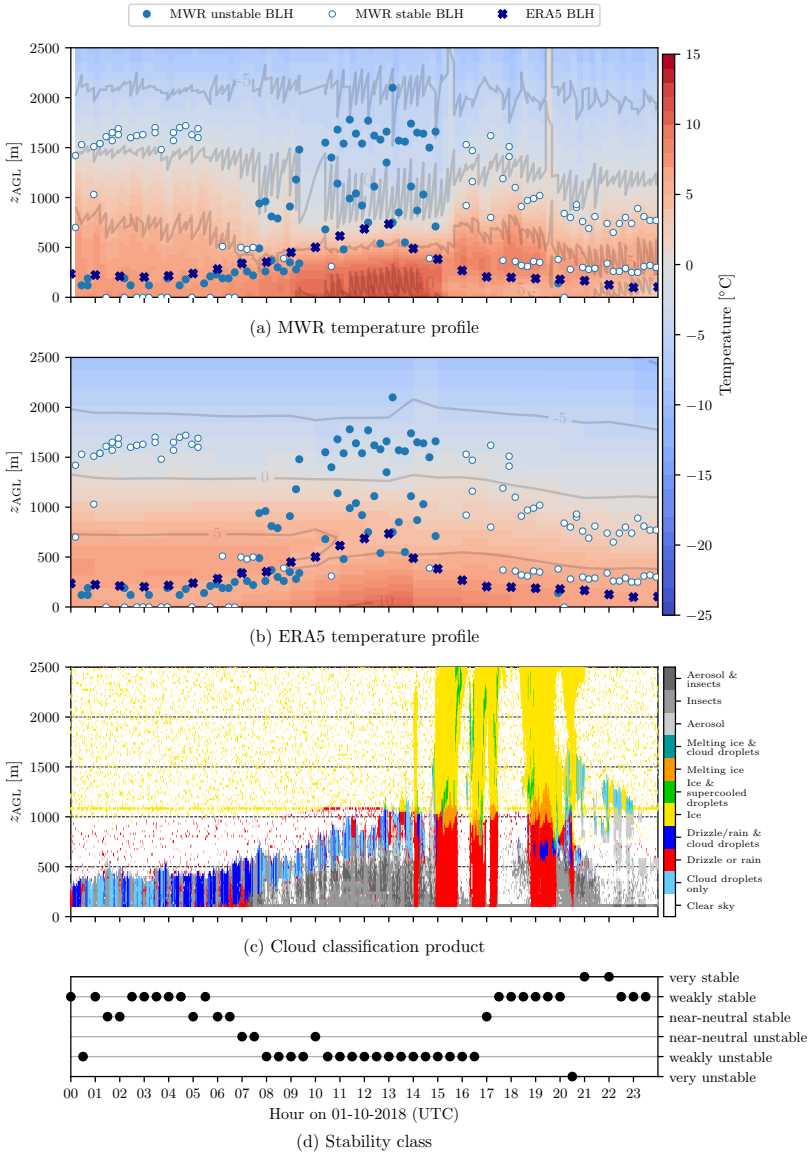
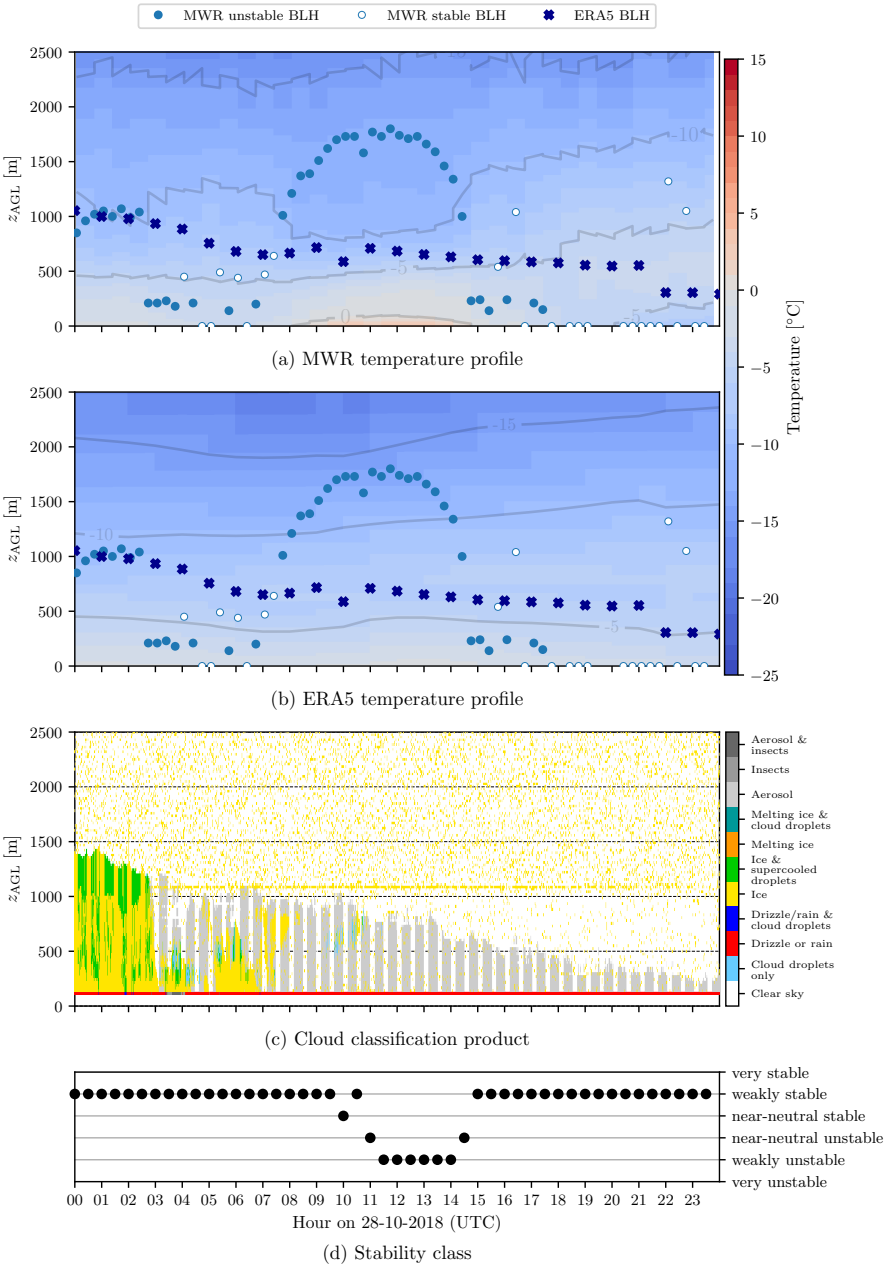


Figure S3: (a) Temperature profiles from MWR measurements and (b) ERA5, (c) a cloud profiling product and (d) the stability regimes for 1 October 2018. Panels (a-b) have the MWR unstable BL height (filled circle), MWR stable BL height (empty circle), and ERA5 BL height (cross) plotted. The grey lines in panels (a-b) denote isotherms in 5°C intervals. z_{AGL} stands for height above ground level. The cloud classification product is taken from CLU [2018a].



(a) MWR temperature profile

(b) ERA5 temperature profile

(c) Cloud classification product

(d) Stability class

Figure S4: Same as Fig. S3, but for 28 October 2018. The cloud classification product is taken from CLU [2018b].

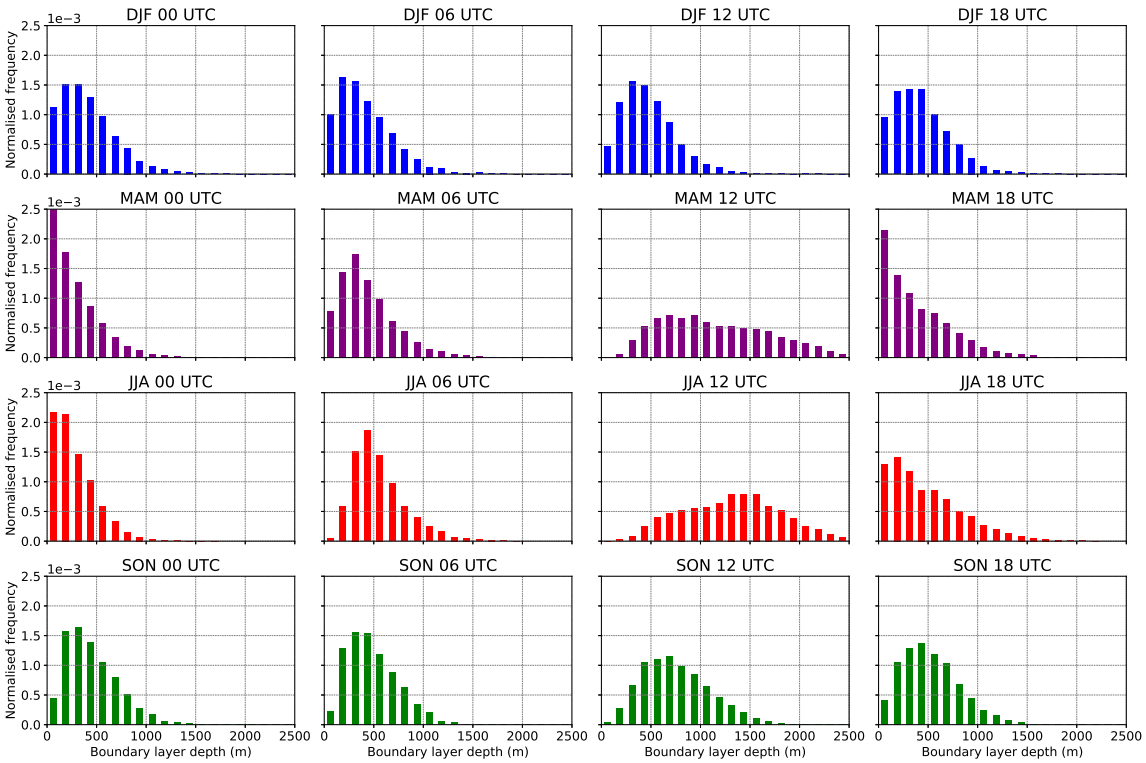


Figure S5: Normalised histograms of the diagnosed boundary layer depth in ERA5 at the grid point closest to Hyytiälä in December-January-February (blue, N=3700), March-April-May (purple, N=3772), June-July-August (red, N=3772) and September-October-November (green, N=3731) at 00, 06, 12 and 18 UTC. Data from January 1979 to December 2019 is included.

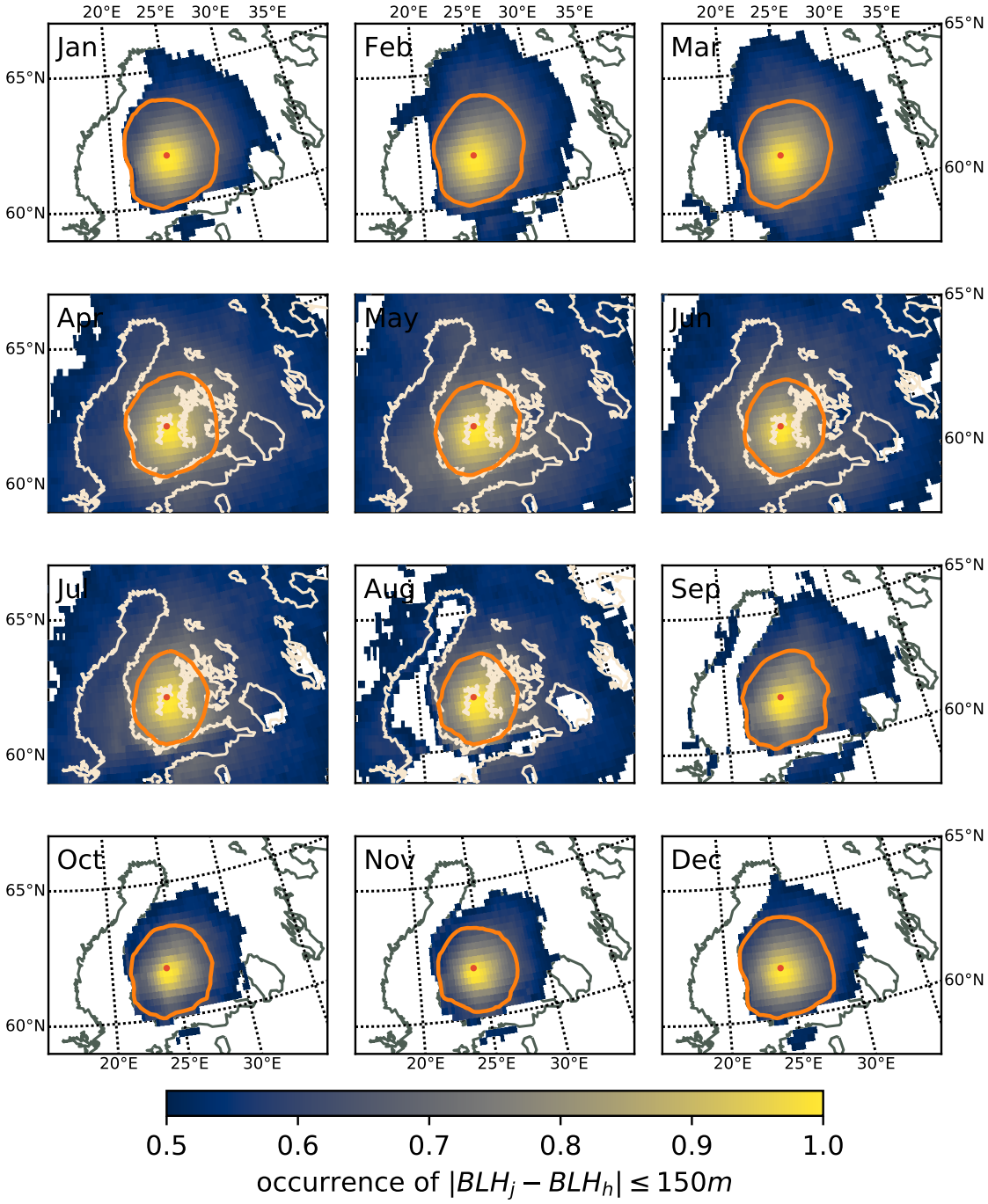


Figure S6: Spatial variability of the BL height in ERA5 at 00 UTC. Shading shows the fraction of all 00 UTC times between January 1979 and December 2019 that the BL height at each grid point is within 150 m of the BL height at the grid cell closest to Hyytiälä. Orange contours shows the 0.75 contour of the monthly correlations between ERA5 BL height series from the grid cell closest to Hyytiälä and the neighbouring ERA5 grid cells computed using only data at 00 UTC over the time period from January 1979 to December 2019. The position of the Hyytiälä station is marked with a red dot.

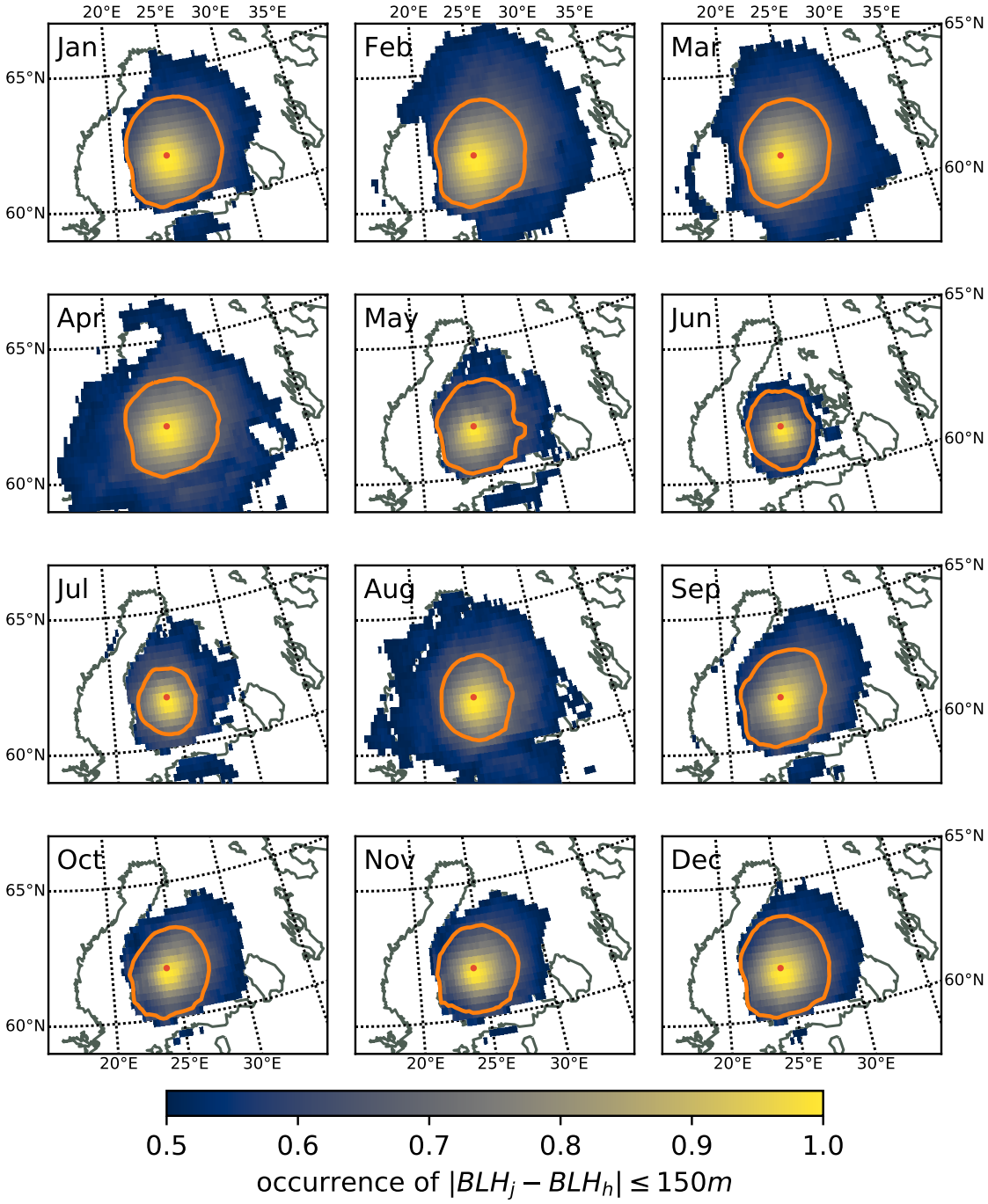


Figure S7: Spatial variability of the BL height in ERA5 at 06 UTC. Shading shows the fraction of all 06 UTC times between January 1979 and December 2019 that the BL height at each grid point is within 150 m of the BL height at the grid cell closest to Hyytiälä. Orange contours shows the 0.75 contour of the monthly correlations between ERA5 BL height series from the grid cell closest to Hyytiälä and the neighbouring ERA5 grid cells computed using only data at 06 UTC over the time period from January 1979 to December 2019. The position of the Hyytiälä station is marked with a red dot.

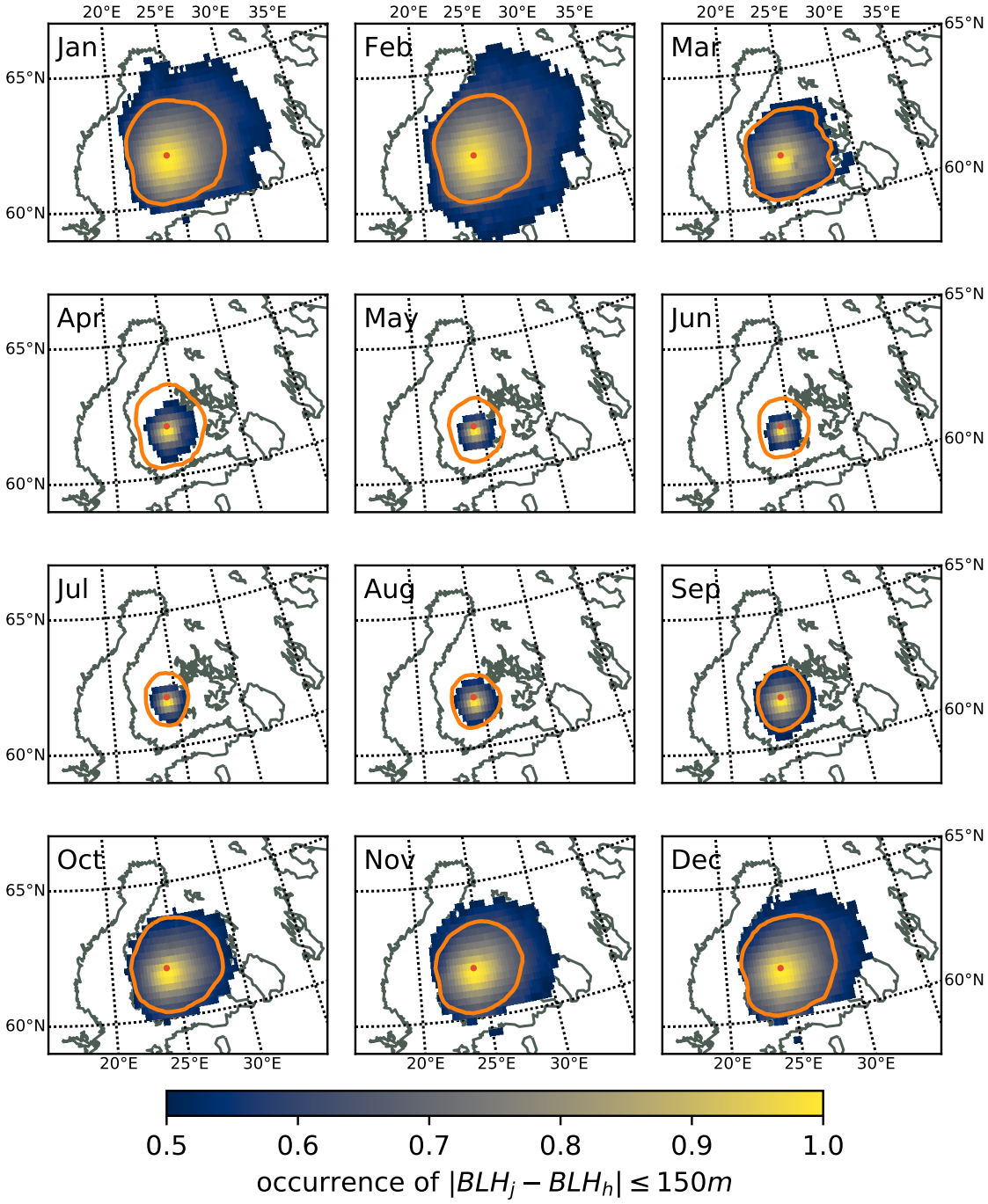


Figure S8: Spatial variability of the BL height in ERA5 at 12 UTC. Shading shows the fraction of all 12 UTC times between January 1979 and December 2019 that the BL height at each grid point is within 150 m of the BL height at the grid cell closest to Hyytiälä. Orange contours shows the 0.75 contour of the monthly correlations between ERA5 BL height series from the grid cell closest to Hyytiälä and the neighbouring ERA5 grid cells computed using only data at 12 UTC over the time period from January 1979 to December 2019. The position of the Hyytiälä station is marked with a red dot.

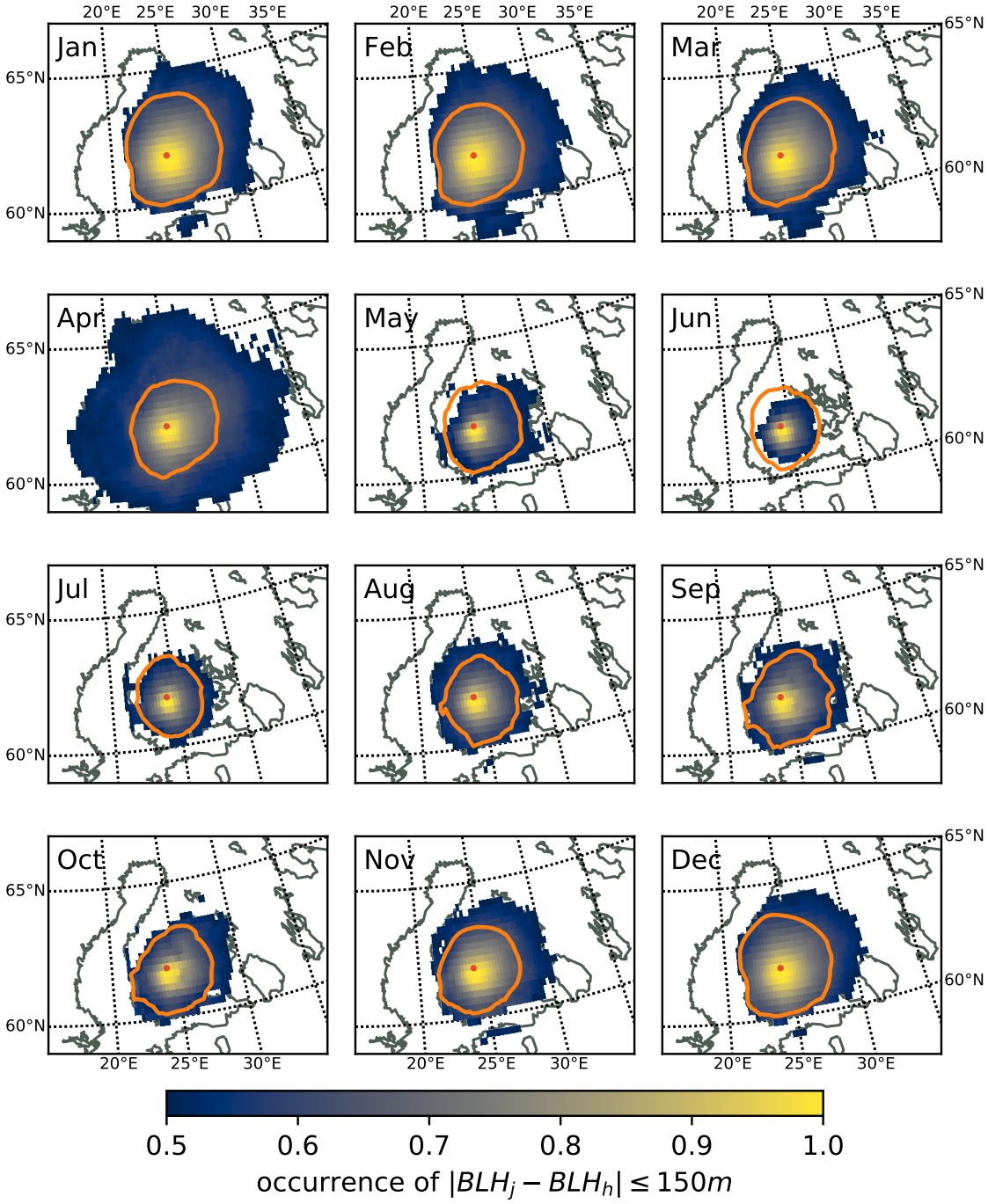


Figure S9: Spatial variability of the BL height in ERA5 at 18 UTC. Shading shows the fraction of all 18 UTC times between January 1979 and December 2019 that the BL height at each grid point is within 150 m of the BL height at the grid cell closest to Hyytiälä. Orange contours shows the 0.75 contour of the monthly correlations between ERA5 BL height series from the grid cell closest to Hyytiälä and the neighbouring ERA5 grid cells computed using only data at 18 UTC over the time period from January 1979 to December 2019. The position of the Hyytiälä station is marked with a red dot.