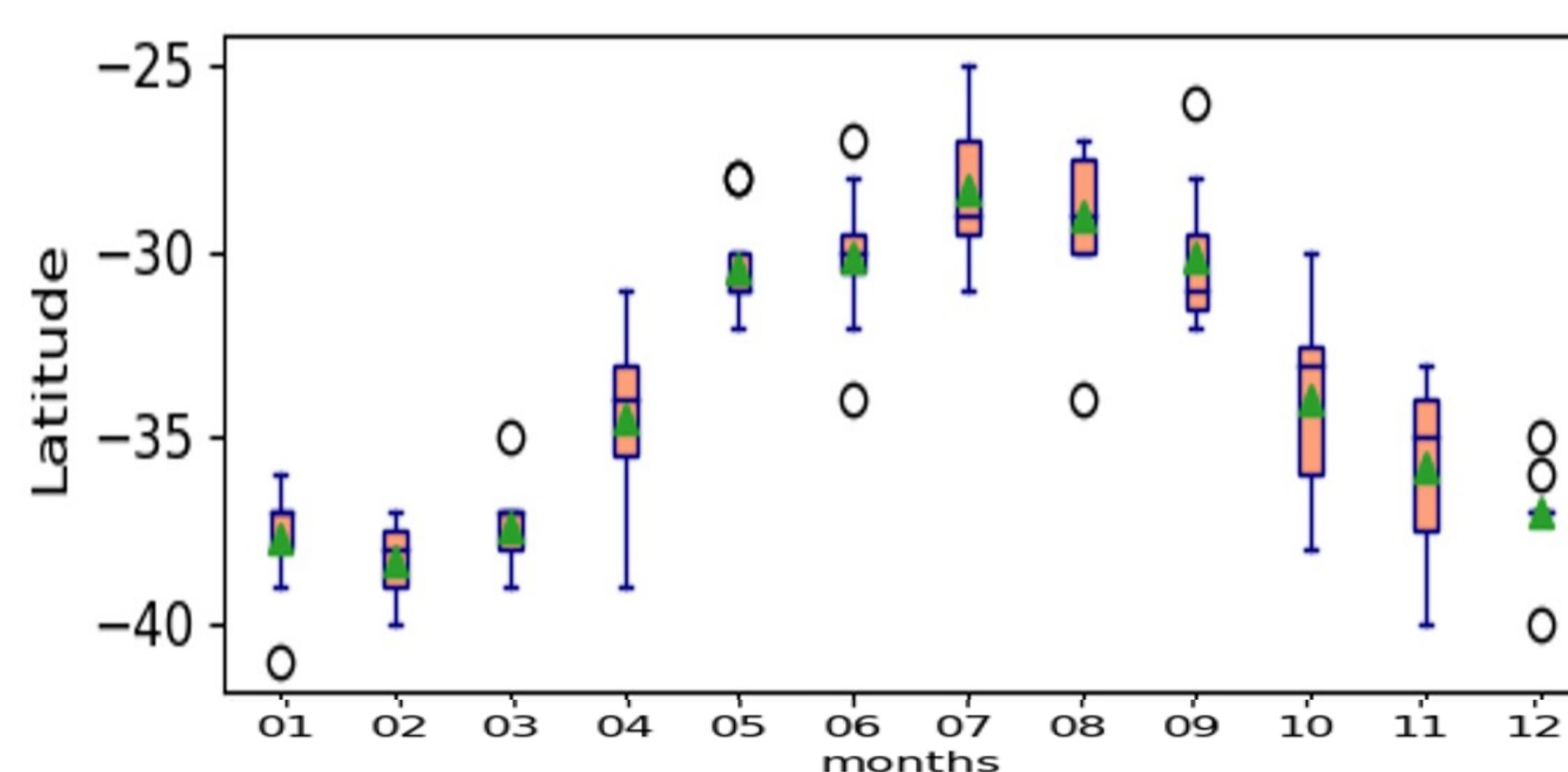
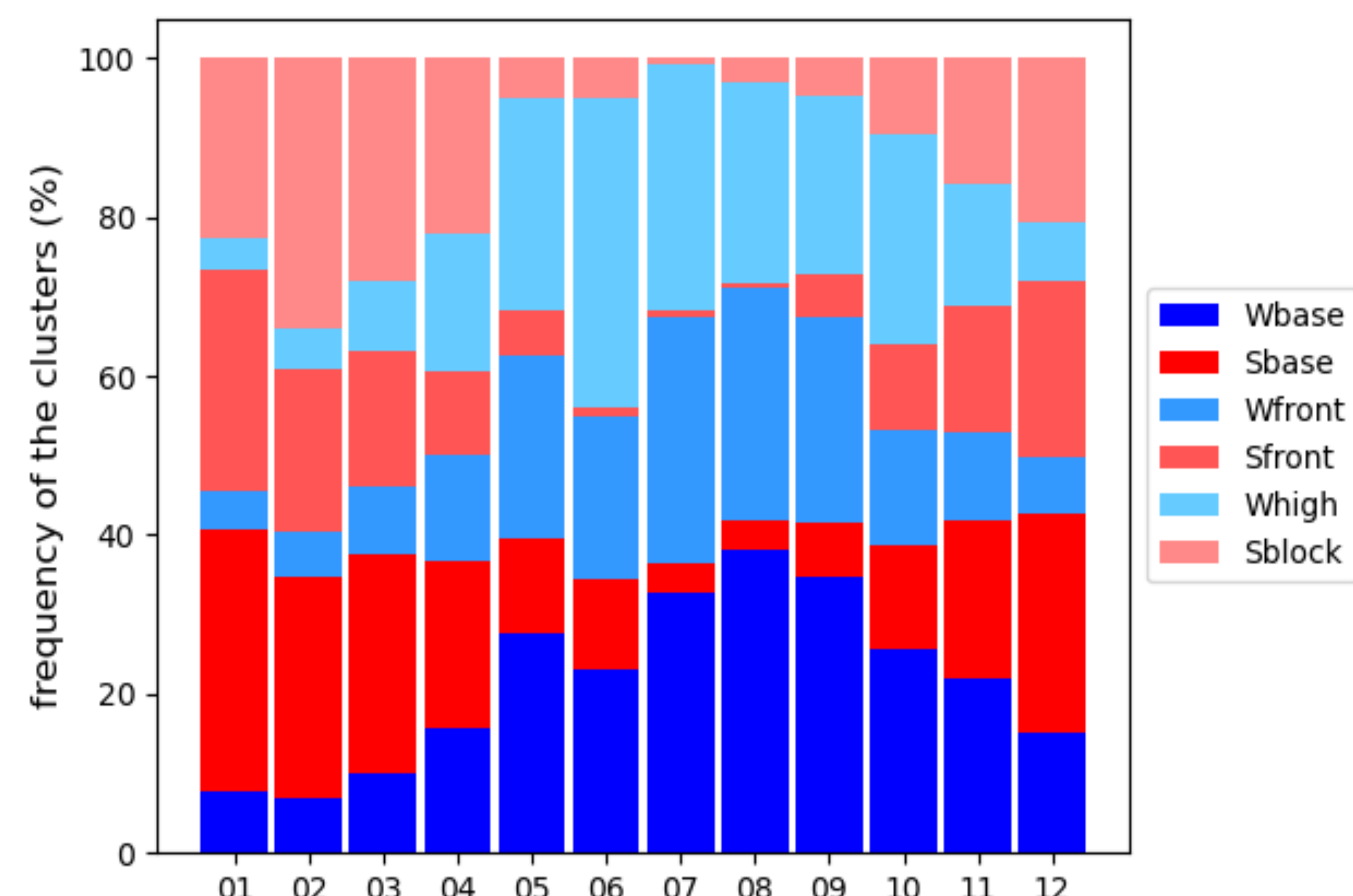


The Seasonality of the Synoptic Meteorology over the Kennaook/Cape Grim and Its Affect on the CCN Concentration

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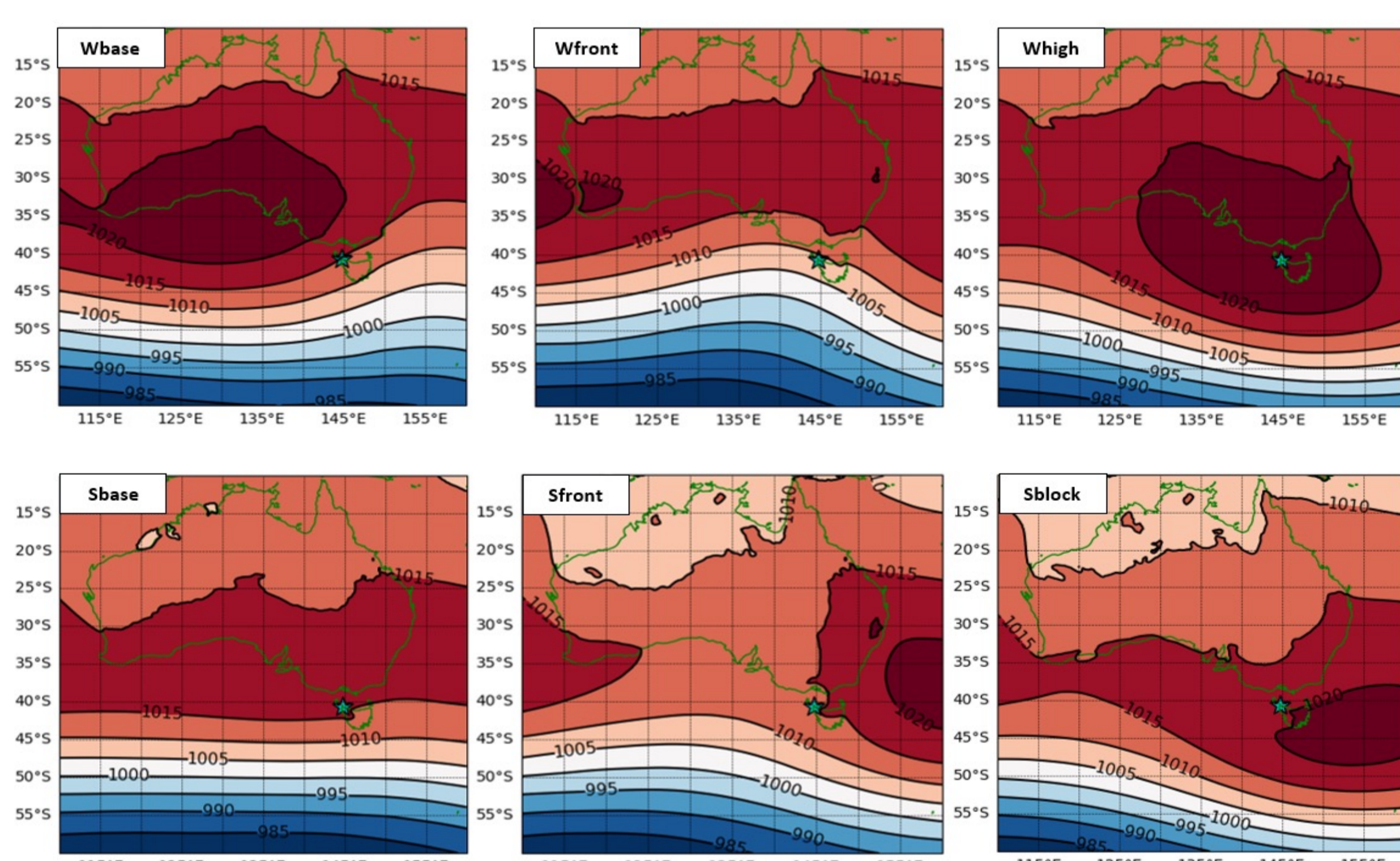
- Seasonal changes in the synoptic meteorology over Kennaook/Cape Grim are related to the seasonal migration of the subtropical ridge¹.
- A simple k-means cluster analysis suggests that 6 clusters can be used to define the synoptic meteorology; 3 in winter and 3 in summer.
- This seasonality contributes to the seasonal cycle in CCN as observed at the Kennaook /Cape Grim station² (CGO) under baseline conditions (Sbase and Wbase).

Clusters (2011-2021)	Number of cases from a total of 8036	CCN (cm ⁻³)	Radon (mBeq.m ⁻³)	Precipitation (mm/hour)
Baseline_Winter (Wbase)	1742 (21.7%)	93.2	111	0.1
Baseline_Summer (Sbase)	1388 (17.3%)	213.8	248	0.03
Frontal_Winter (Wfront)	1307 (16.3%)	429.3	1329	0.33
Frontal_summer (Sfront)	925 (11.5%)	929.1	1229	0.03
Winter_high pressure (Whigh)	1535 (19.1%)	287.3	501	0.02
Summer Blocking (Sblock)	1139 (14.2%)	466.2	704	0.08

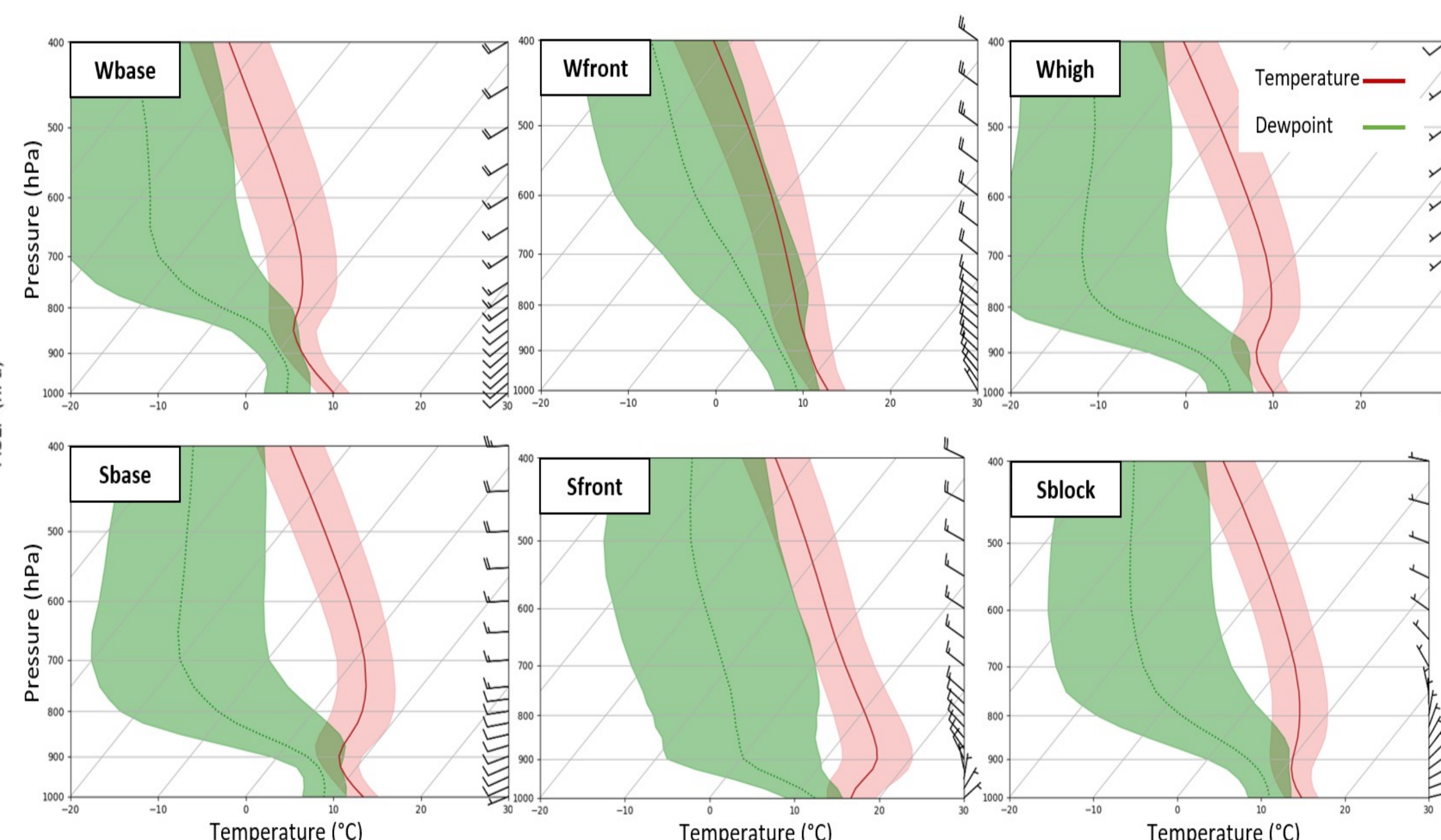


Annual cycle of monthly frequency of the clusters (top) and Box-whisker plots showing annual cycle of monthly mean latitude of the subtropical ridge over Australia (bottom)

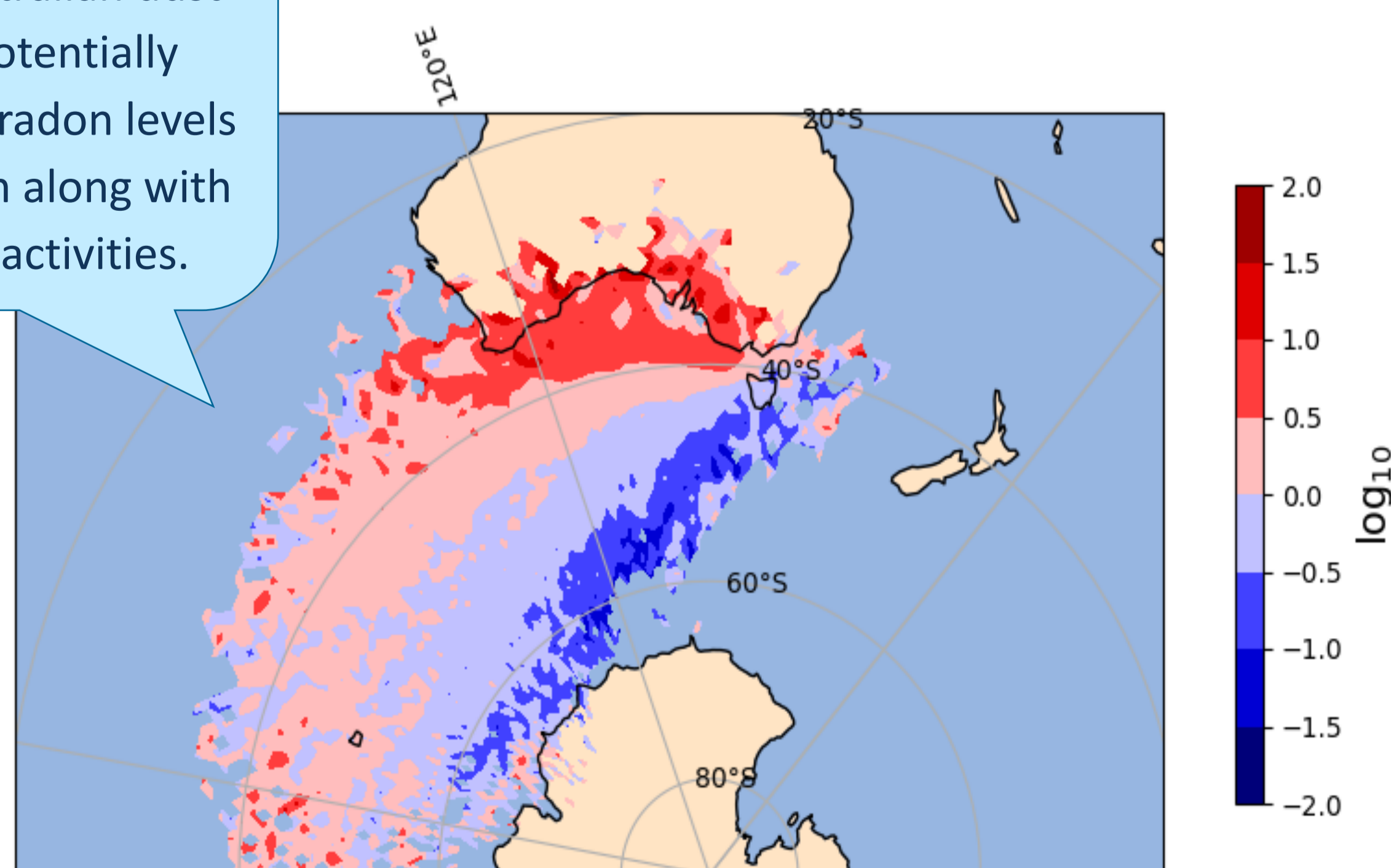
❖ MSLP composites for all the 6 clusters show that the subtropical ridge or high pressure belt tends to be located further south during the summer (bottom rows) and shifts northward towards the continent during the winter (top rows) clusters.



❖ Composite soundings for all the 6 clusters give us an idea of the atmospheric conditions that are typical for each cluster. Note that during frontal conditions, free troposphere aerosols from the mid-latitudes can be transported over the Southern Ocean, These will become entrained into the boundary layer airmass and affect baseline CCN.



Summer continental airflow suggested Australian dust transport, potentially elevating CCN, radon levels over Cape Grim along with the biogenic activities.



Ratio map of the difference between the summer baseline and the winter baseline back trajectories (72hours) at the free troposphere level

Summary:

- The seasonal cycle of each of the six clusters is strongly correlated with the latitude of the subtropical ridge.
- Continental aerosol concentrations may contribute to the observed seasonality in CCN concentration over the Cape Grim through entrainment from the free troposphere.
- More forward trajectories for the winter clusters penetrating the 60° south than the summer ones, which is consistent with the role of free troposphere entrainment on the transport of aerosols and the observed seasonality in the radon concentration³ over the S.O.

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