Nonstationary drainage flows and the valley cold pool

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“Near-Calm”/light and variable winds

2-m *speed of vector ave. winds < 0.5 m/s; short term (1 min) speed often reaches 1-2 m/s.*

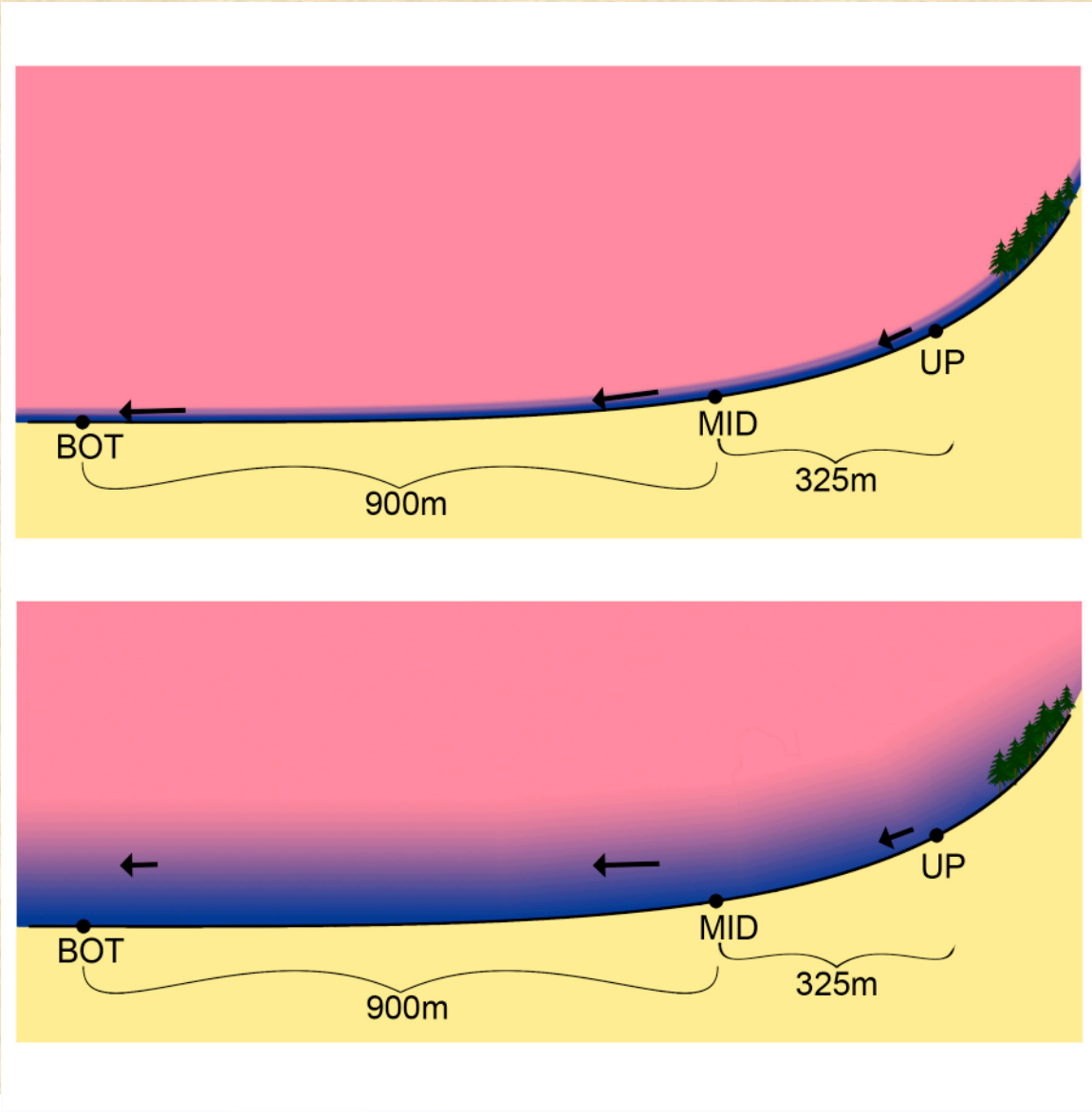
This regime is quite common in basin and valley cold pools with small downvalley slope

Can lead to :

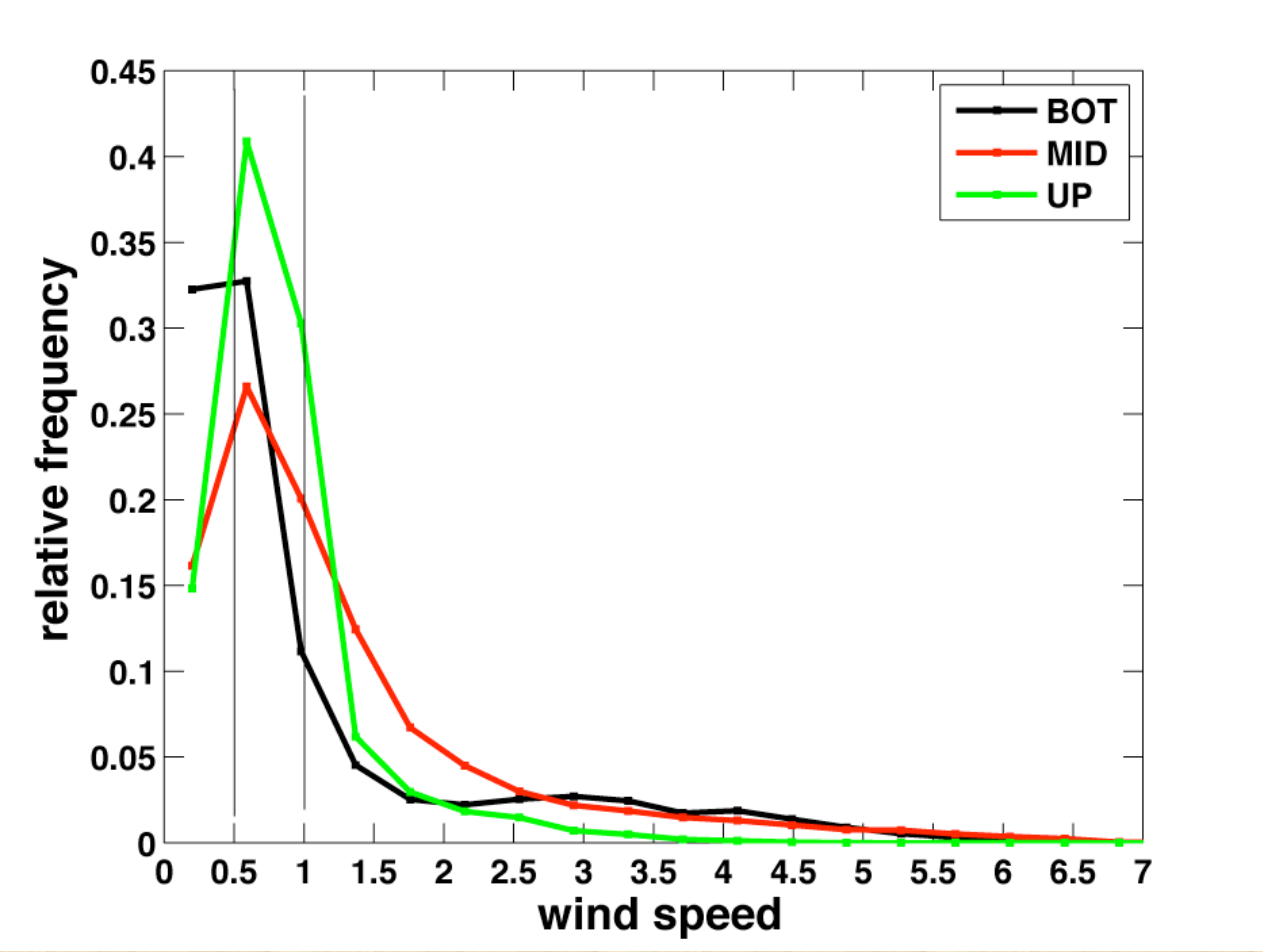
- Cold nocturnal temperatures
- Poor diffusion of pollutants
- Dense fog

- The turbulent mixing is generally VERY weak except for occasional mixing events that can dominate time-ave flux

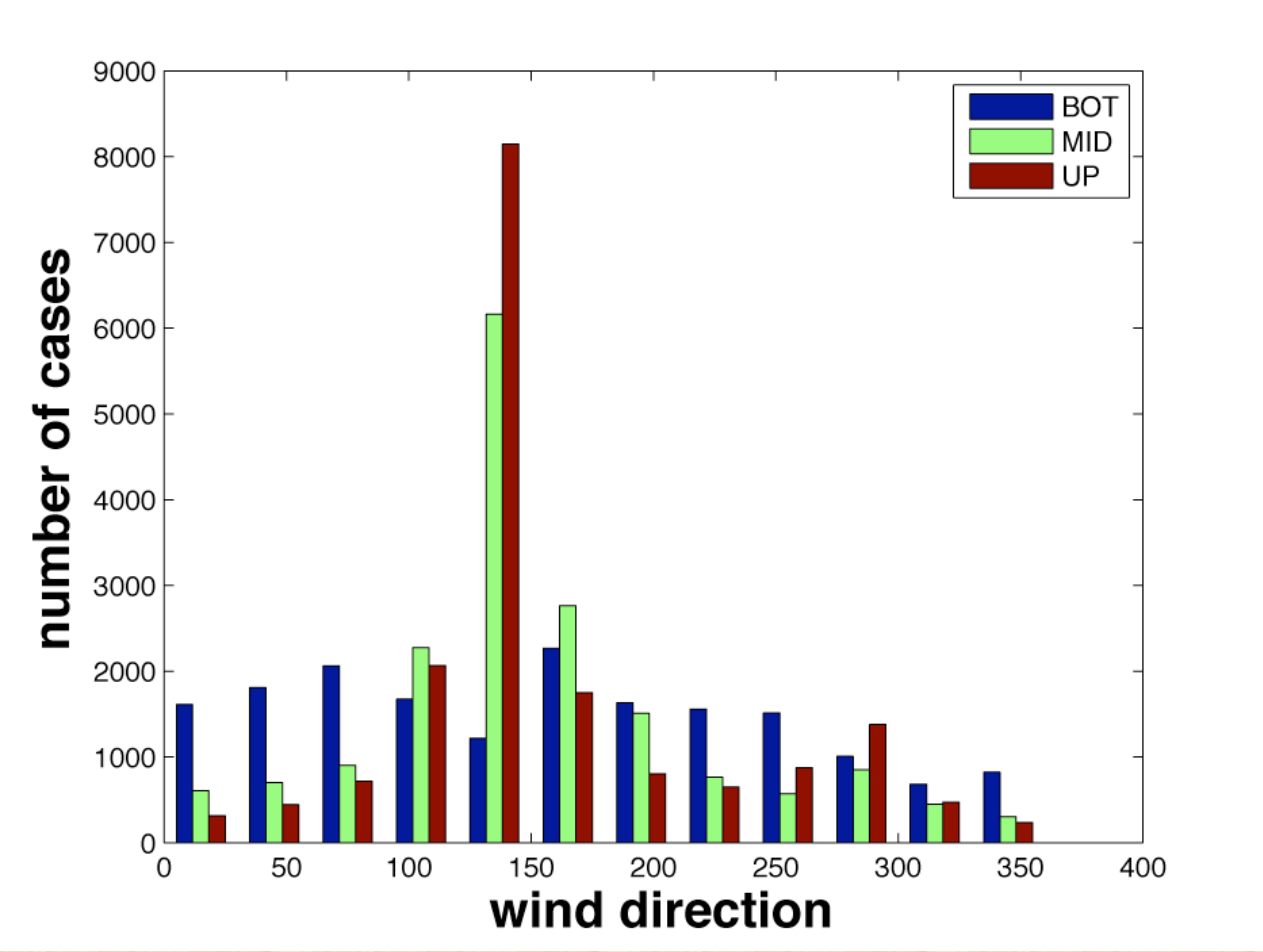
Flow of cold air drainage over the cold pool; early evening and late evening



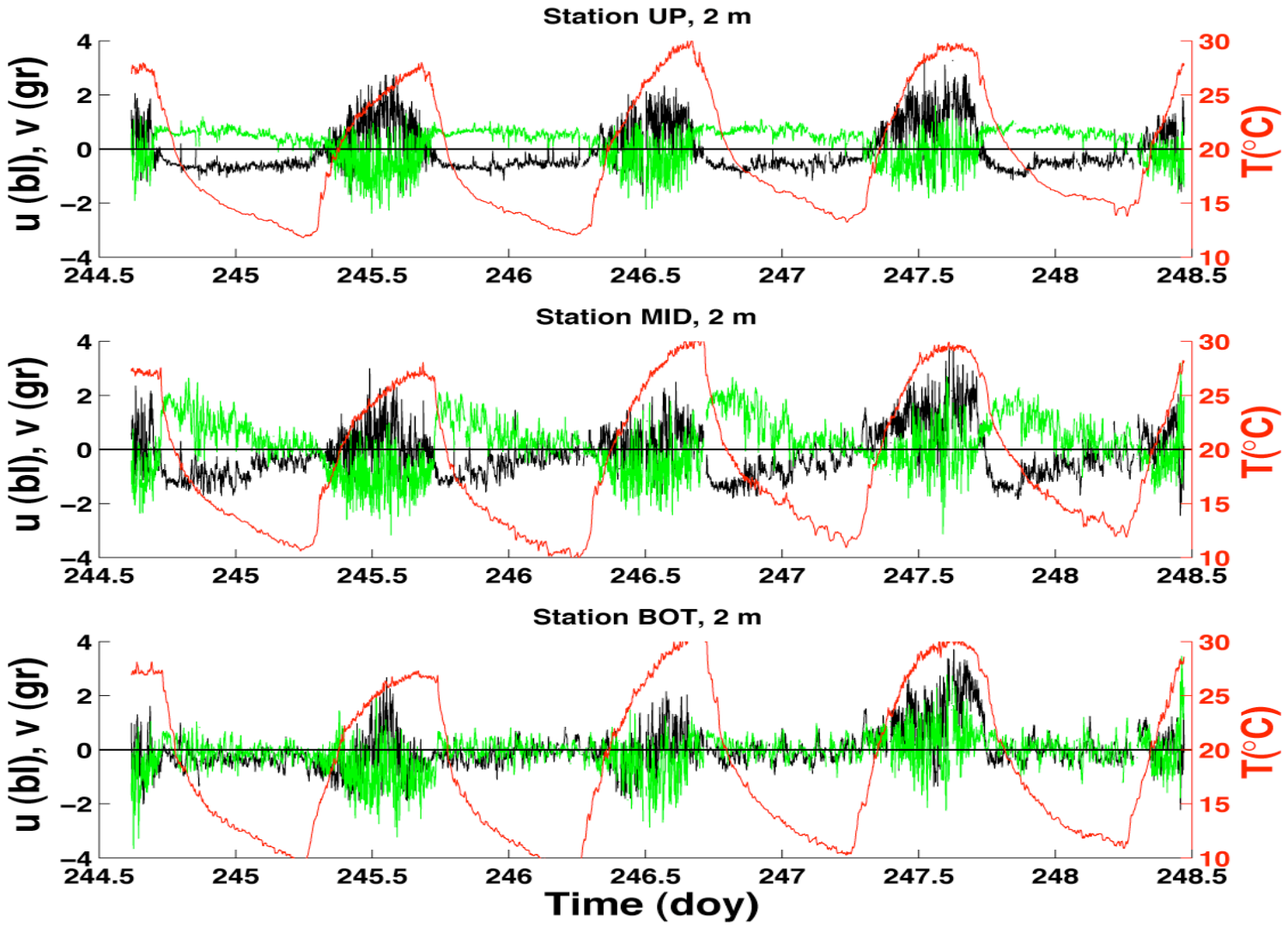
Nocturnal frequency distribution of wind speed (2 m)



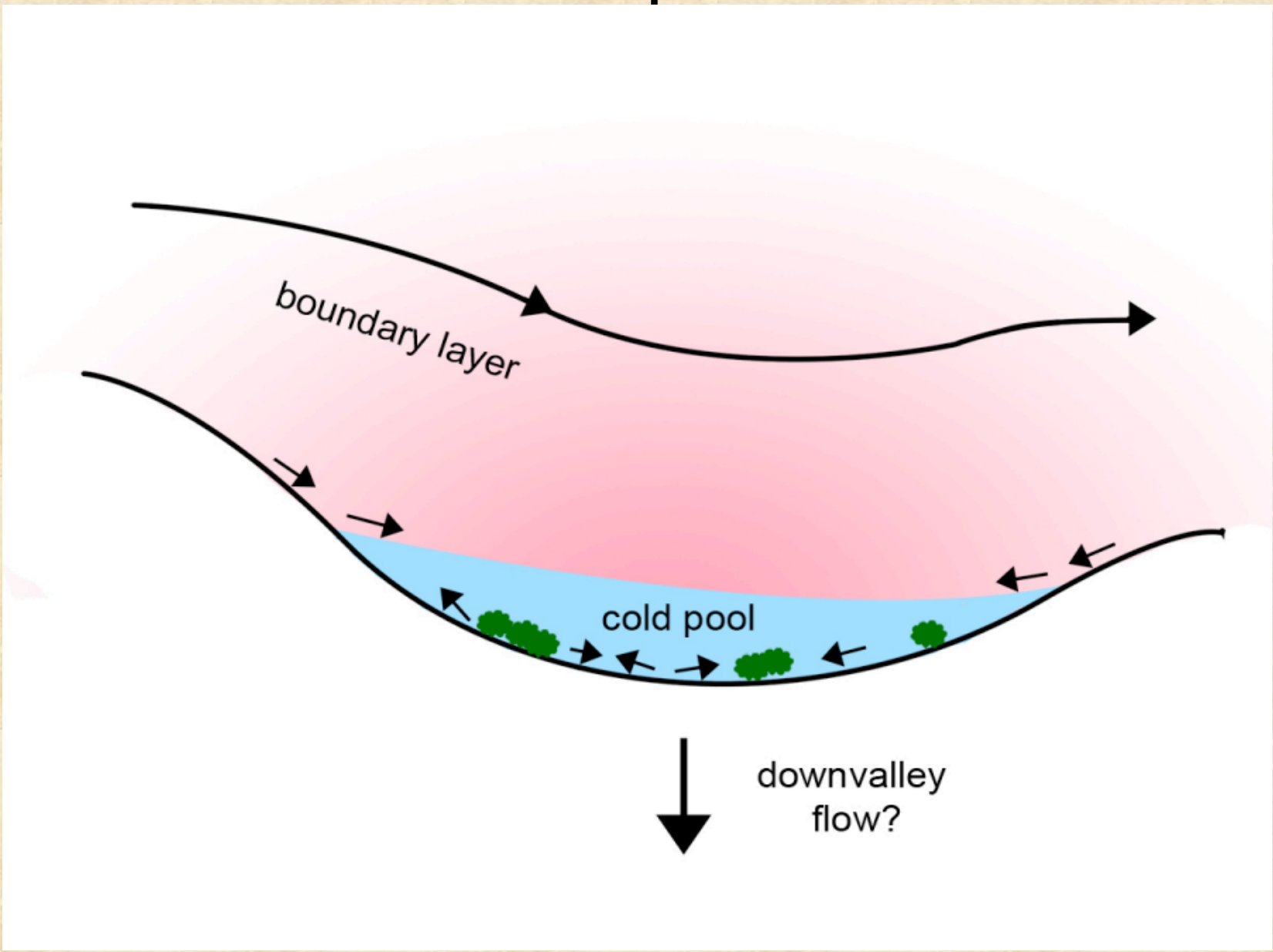
Distribution of wind speed (nocturnal 2 m)



4-day fair weather case study

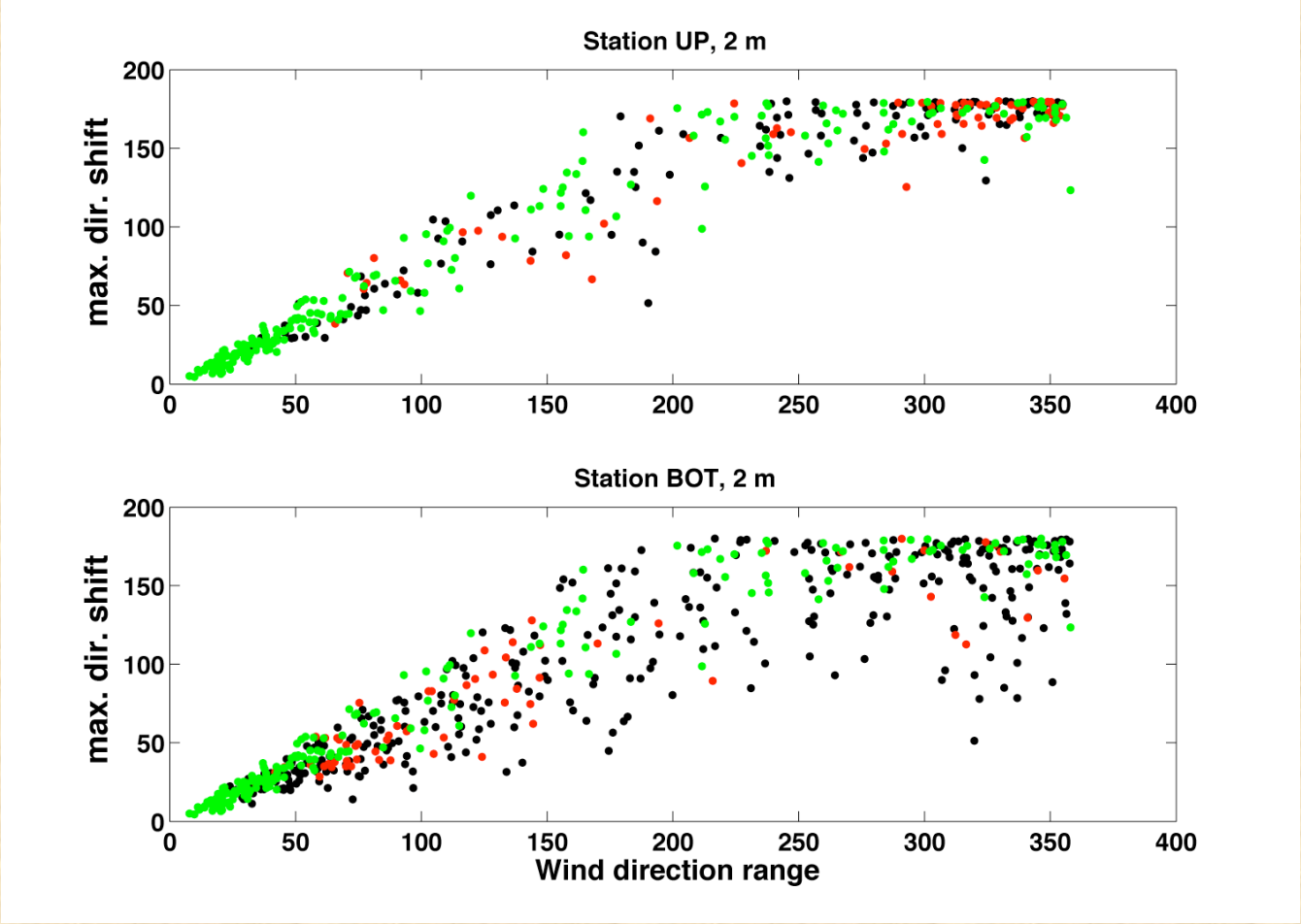


Cold pools

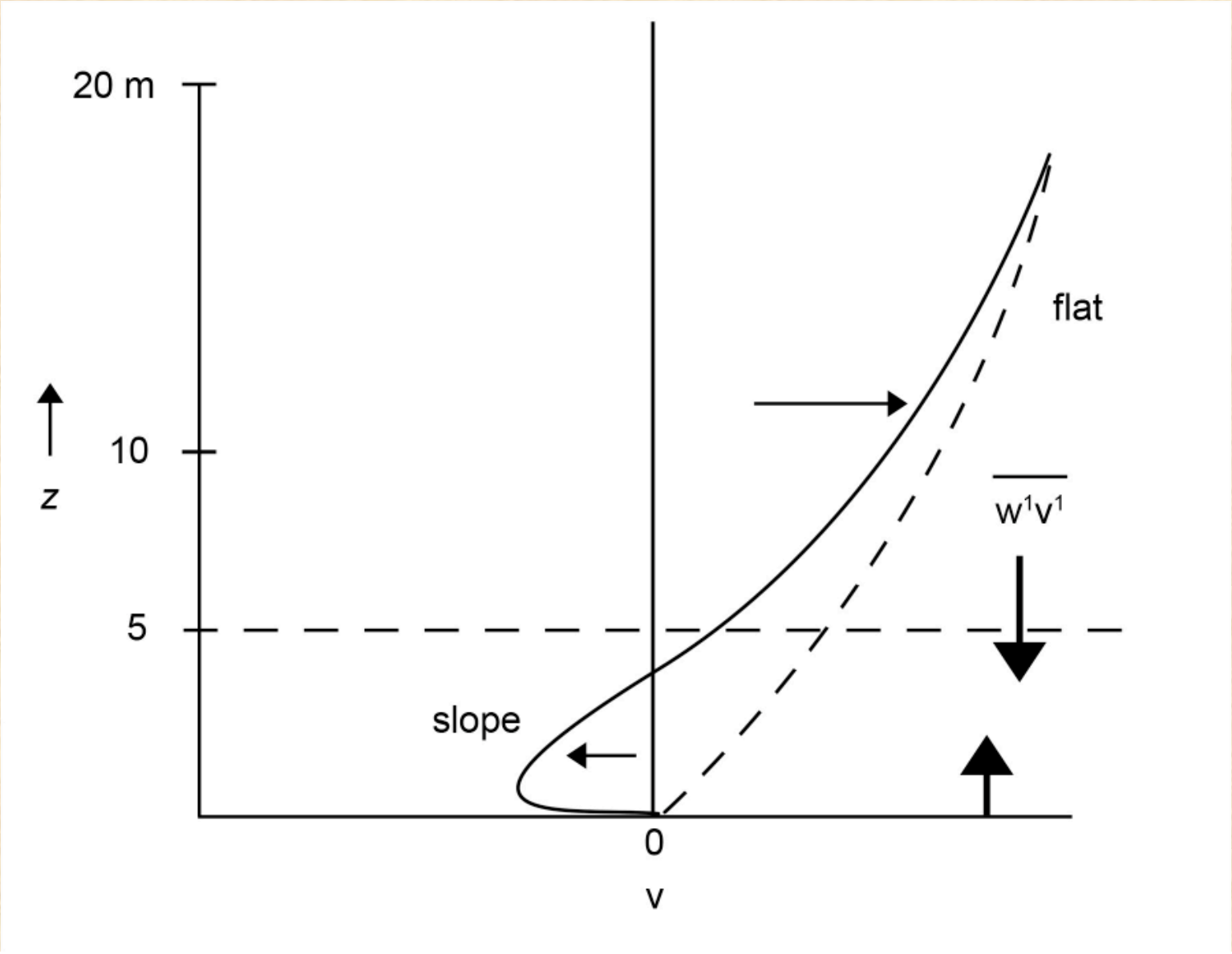


Wind direction variability

green (drainage at upper station), red (early evening transition)



Vertical profile with drainage flow



Conclusions

- **The cold pool deepens during the night** such that lower slope winds transition from drainage to very weak cold-pool winds

- With weak downvalley slopes, the cold pool **wind direction constantly changes** in response to submeso motions.

- Do sub-grid cold pools require definition of an **effective surface** with partial decoupling from the real surface?