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

boundary layer

cold pool

downvalley flow?
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?