Preliminary analysis of transitions from Sc to Sc-Cu cloud conditions during MAGIC

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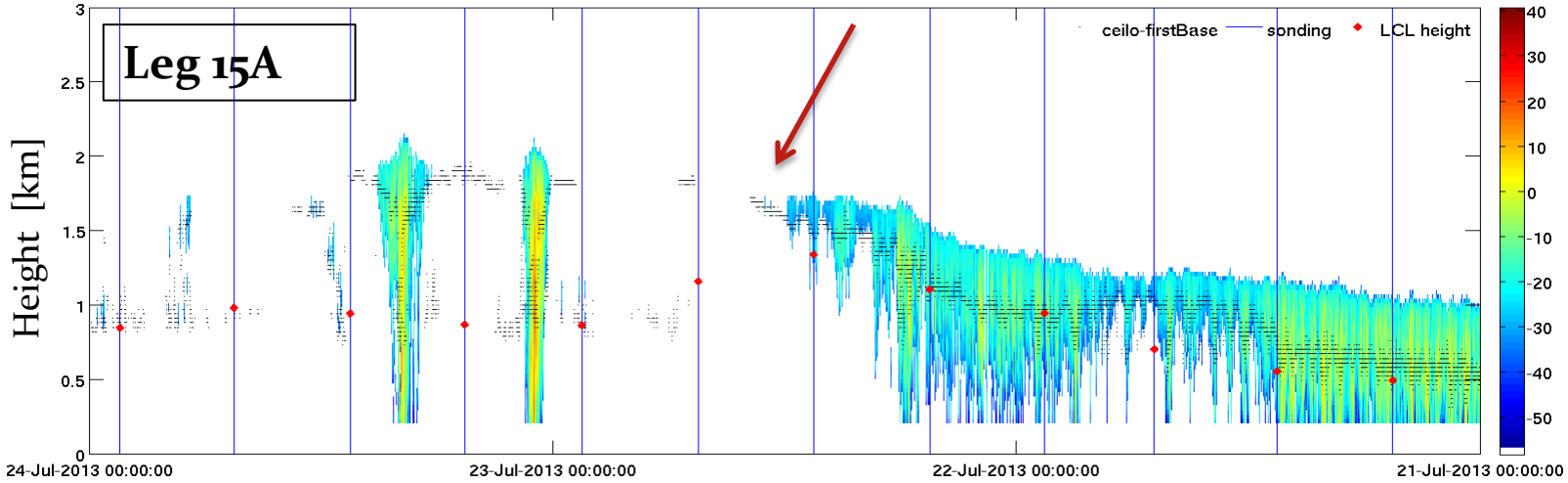
ASR
Atmospheric
System Research

Case from Leg 15A & Leg 5A

Honolulu, Hawaii

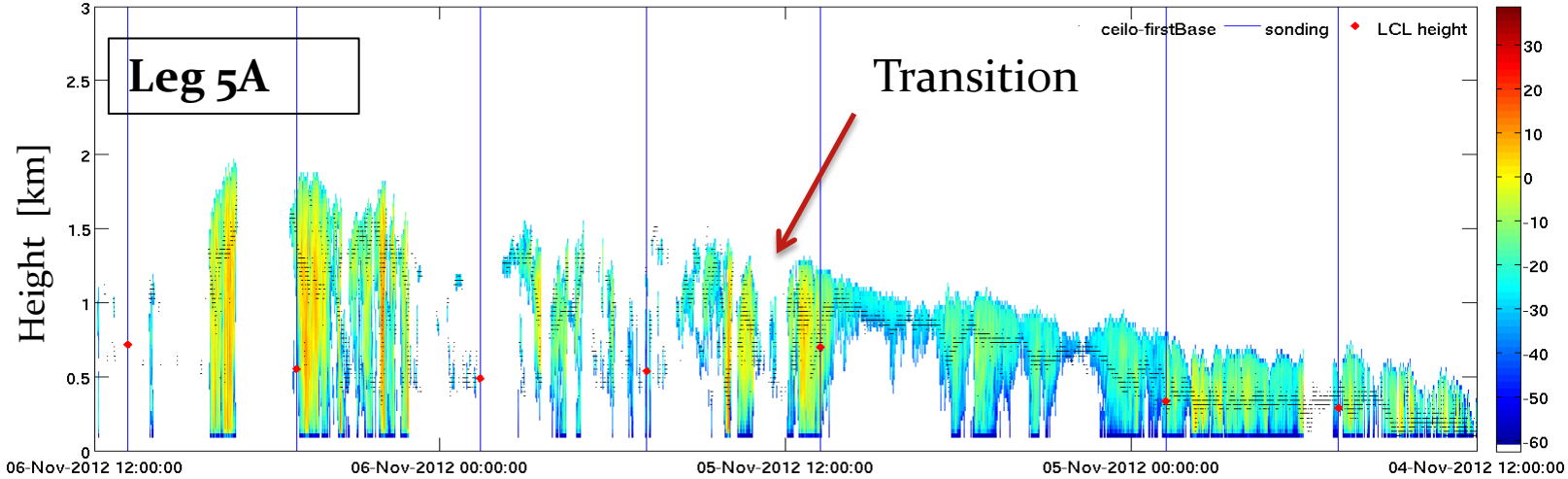
California Coast

Transition



Time [DD MM YYYY hh:mm:ss]

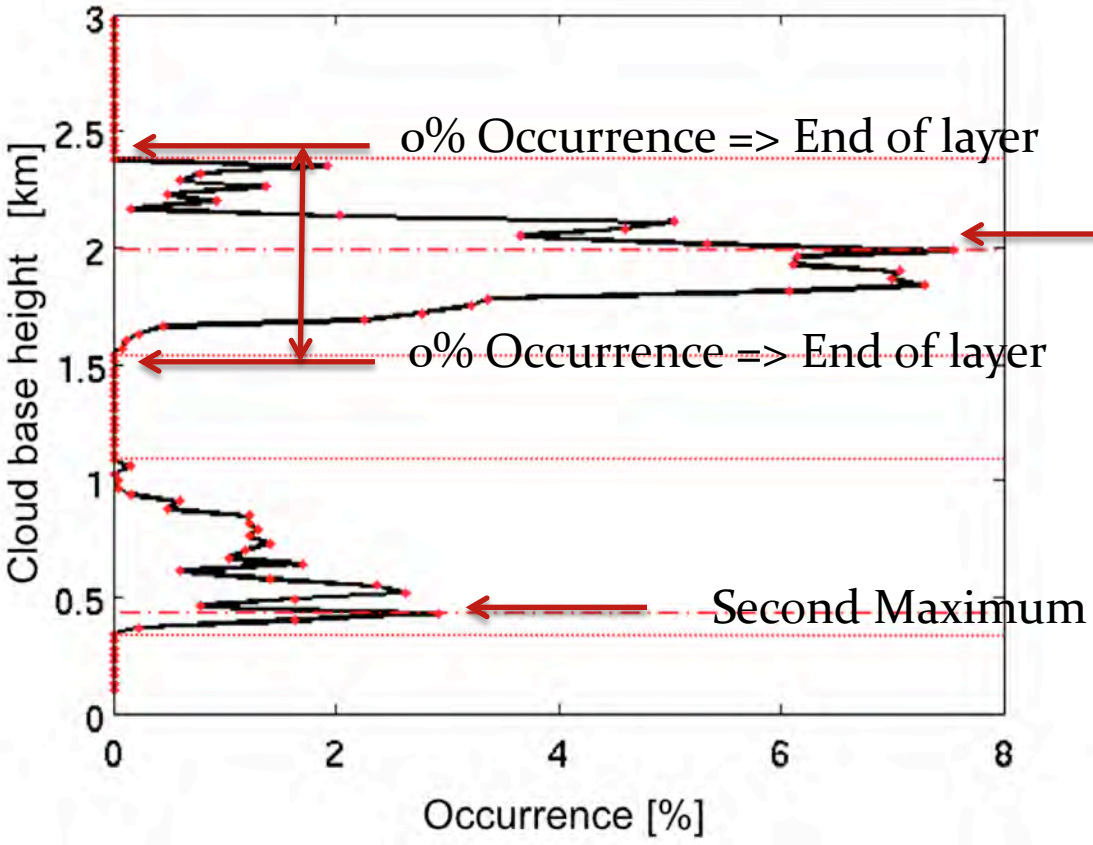
California Local Time



Time [DD MM YYYY hh:mm:ss]

California Local Time

Layer Detection Algorithm

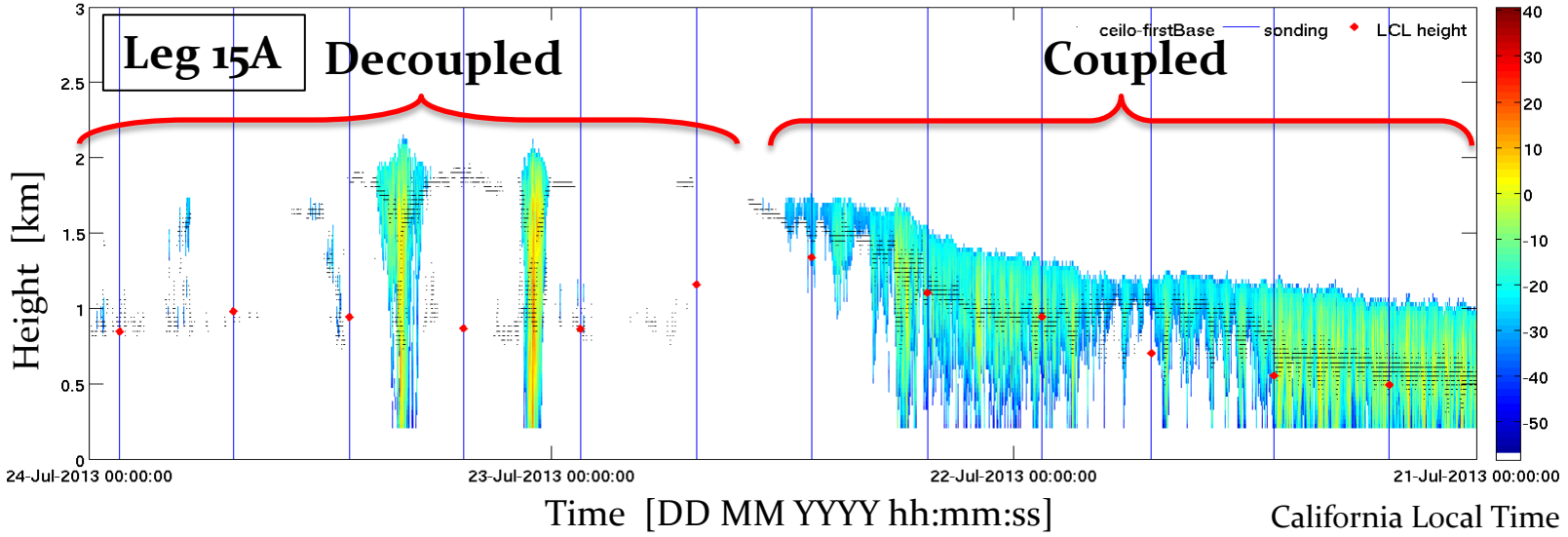


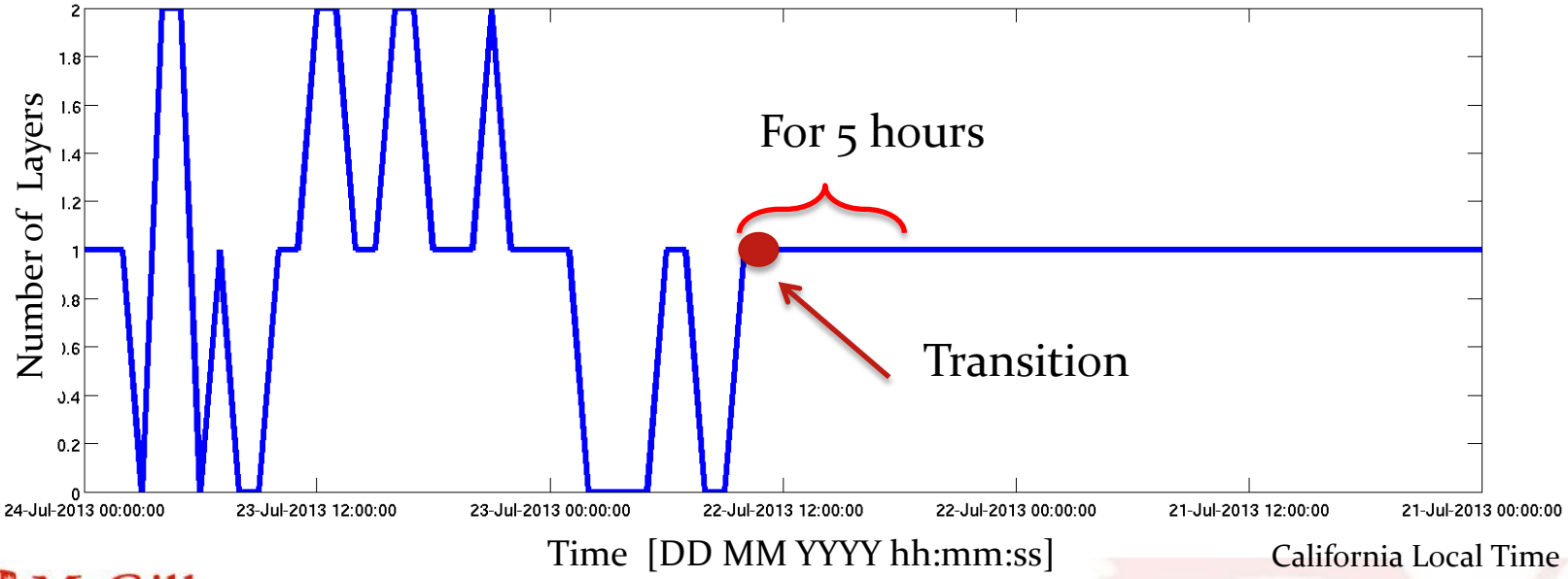
- Hourly
- Cloud base information from ceilometer (first two bases) + KAZR mask
- Create PDF of cloud base height vs. occurrence
- Locate the level with first maximum occurrence
- Moving away from the maximum, separate the layers when occurrence drops to 0%
- Estimate the total occurrence of the layer (needs to be > 10%)
- Continue locating levels, until the total occurrence is always < 10%

Layer Detection Algorithm

Honolulu, Hawaii

California Coast

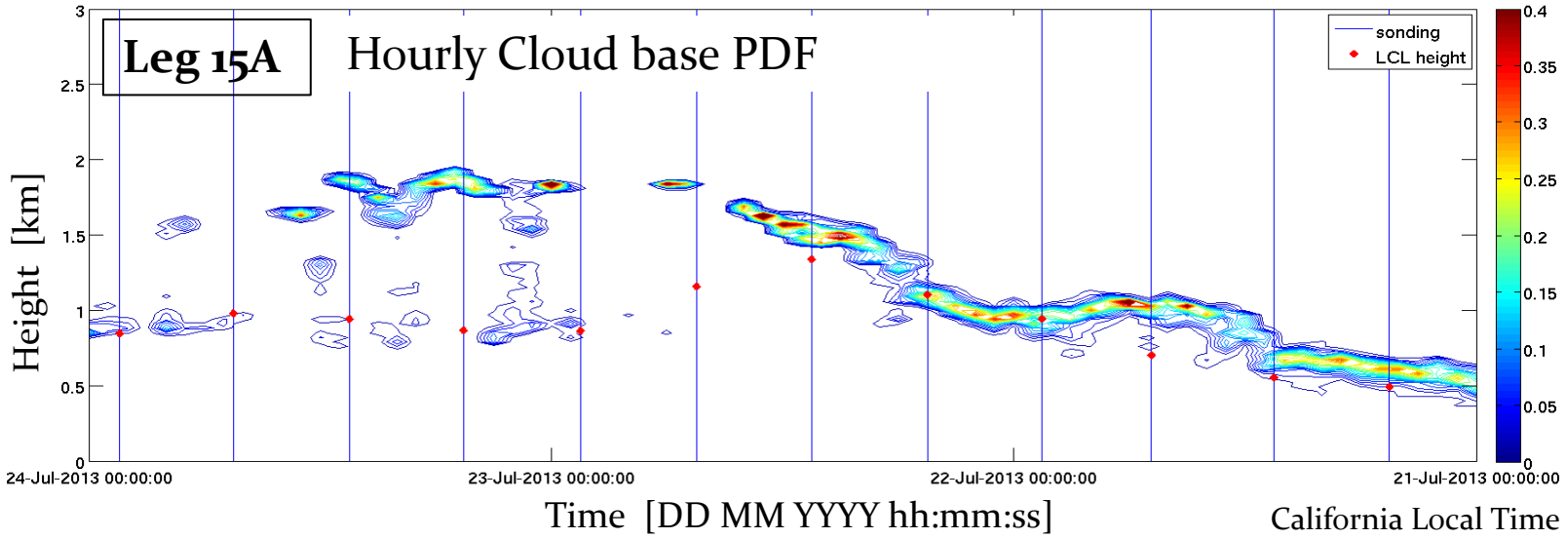


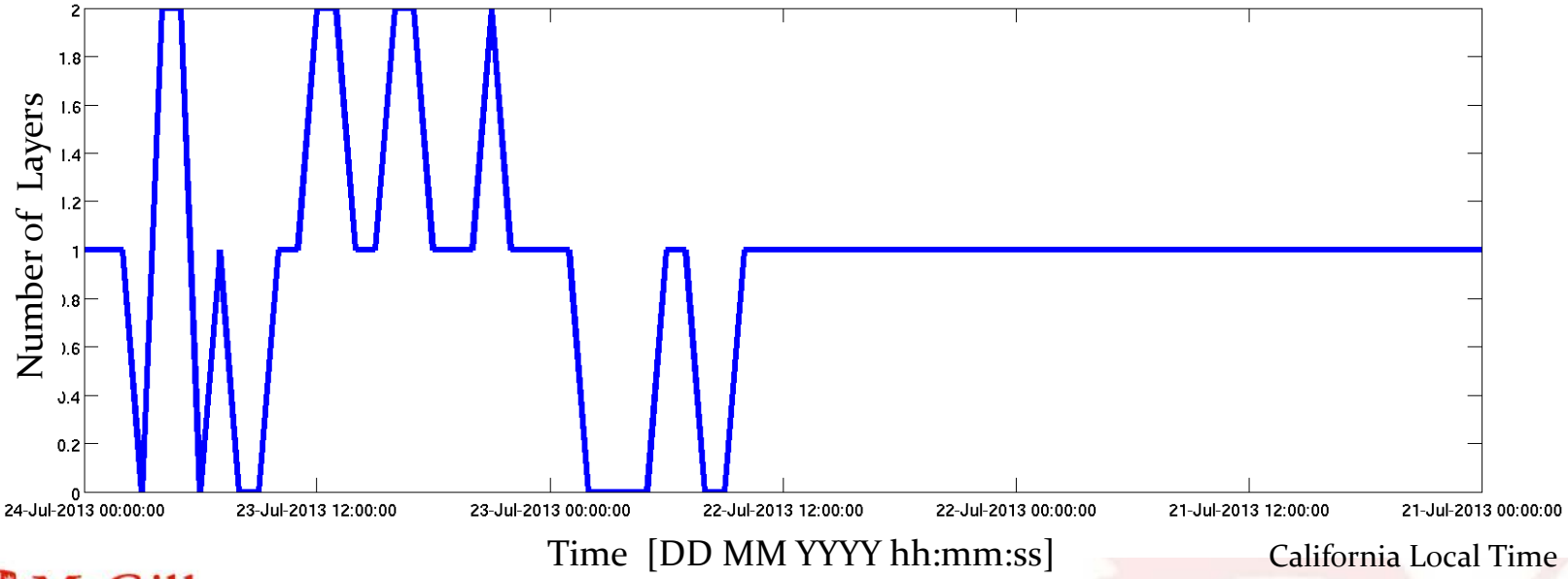


Layer Detection Algorithm

Honolulu, Hawaii

California Coast





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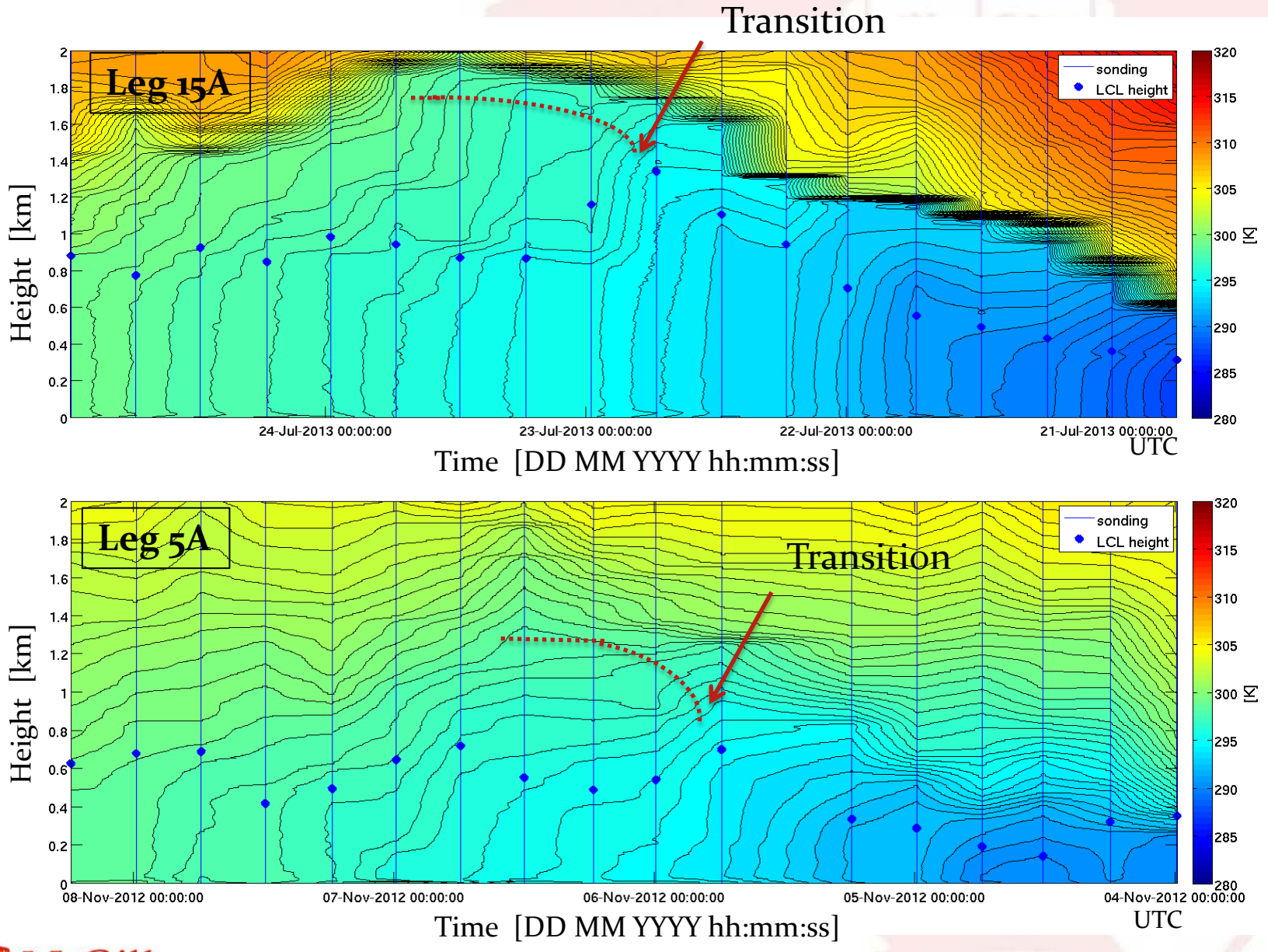
Virtual Potential Temperature Profile

Honolulu, Hawaii

California Coast



Well mixed below LCL- good for aerosol analysis

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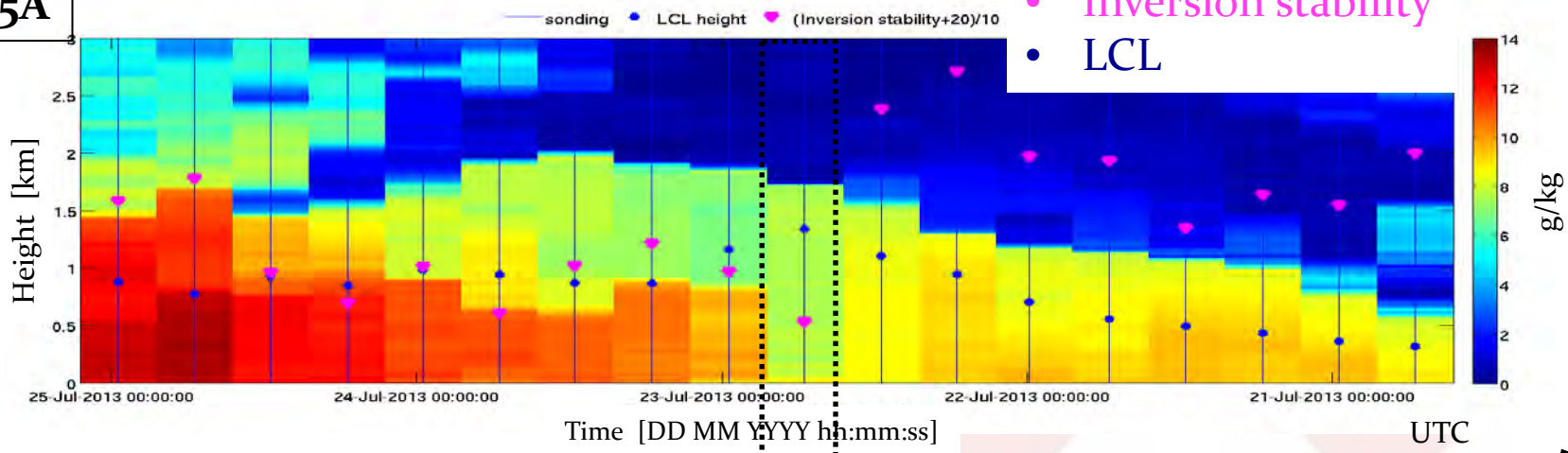
Water Vapor Specific Humidity Profile

Leg 15A

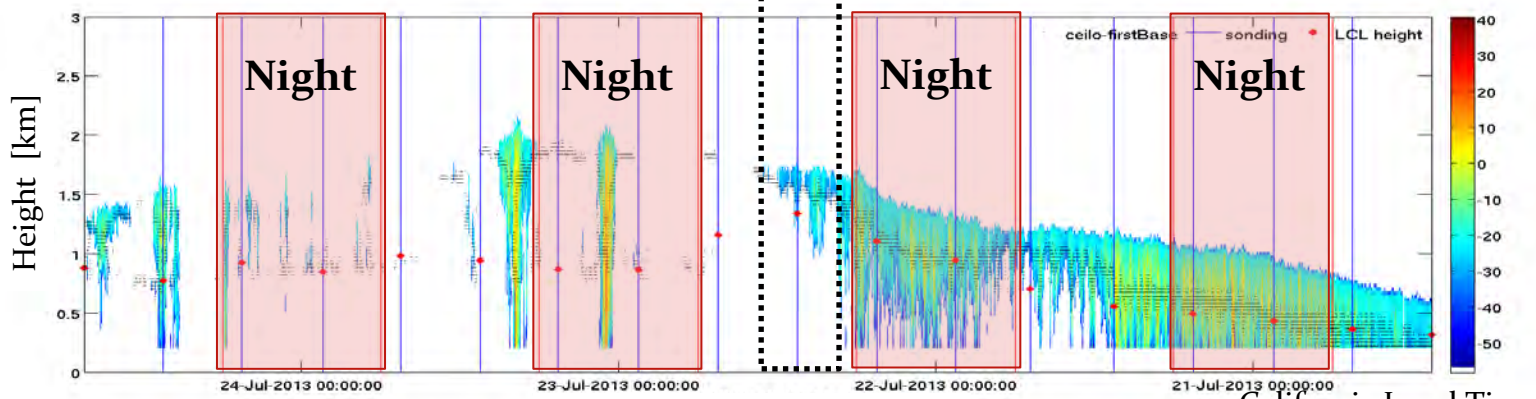
- Inversion stability
- LCL



Time [DD MM YYYY hh:mm:ss] UTC

Honolulu, Hawaii

California Coast



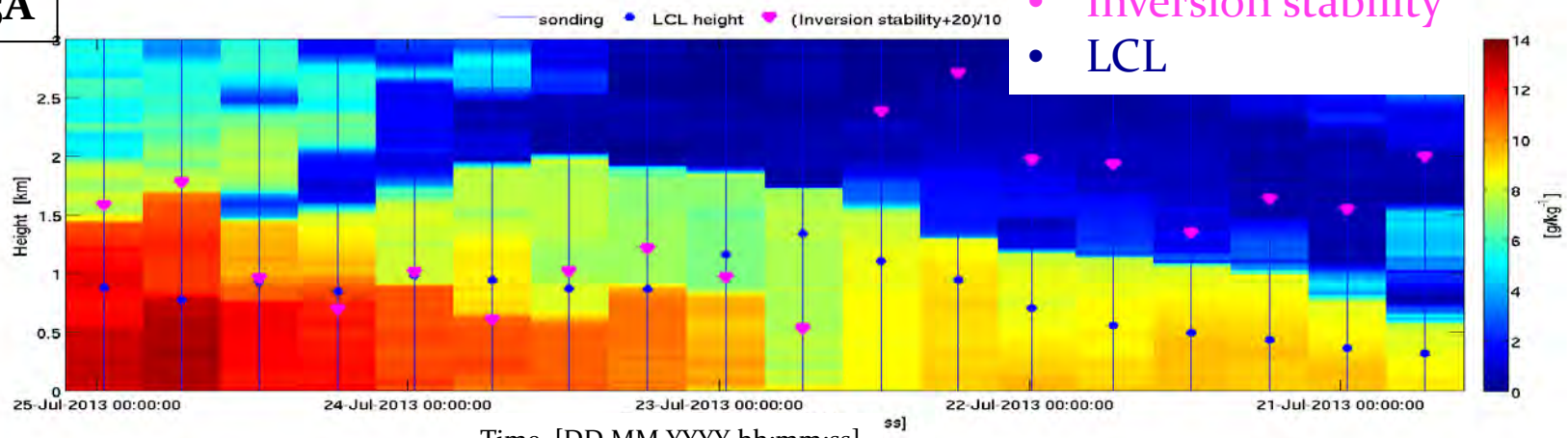
Time [DD MM YYYY hh:mm:ss]

California Local Time

Water Vapor Specific Humidity Profile

Leg 15A

- Inversion stability
- LCL



Honolulu, Hawaii

California Coast

Inversion getting weaker

Entrainment of dry air

Increasing latent heat flux at cloud base

Increasing buoyancy flux at cloud base

Negative sub-cloud buoyancy flux

Sea surface

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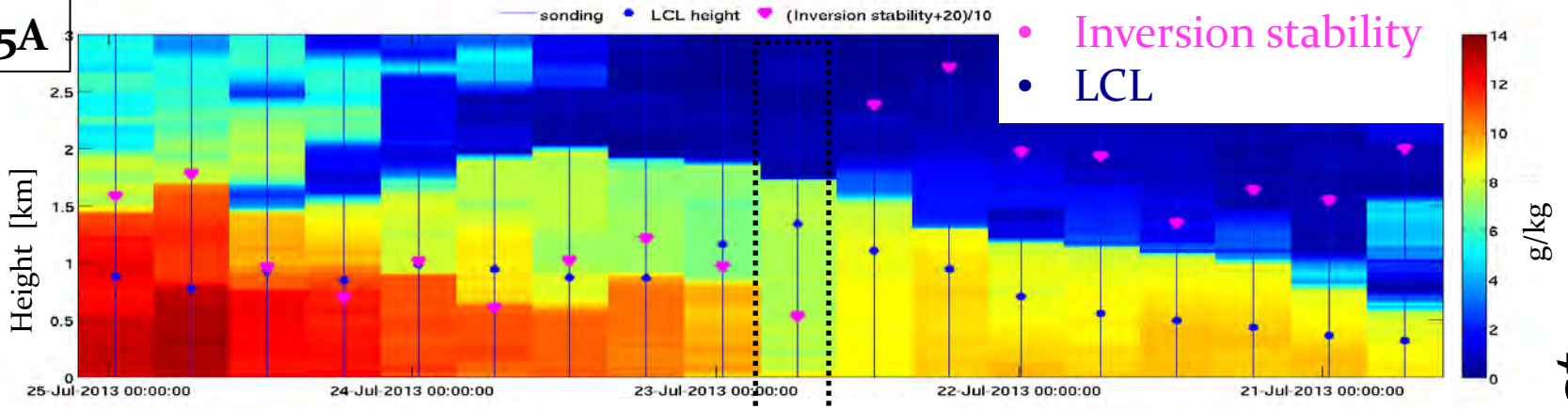
Water Vapor Specific Humidity Profile

Leg 15A

Honolulu, Hawaii

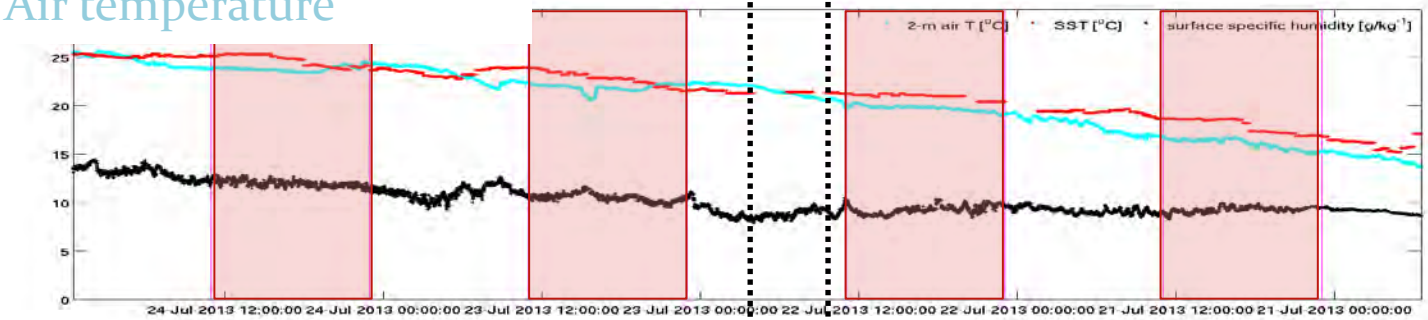
California Coast



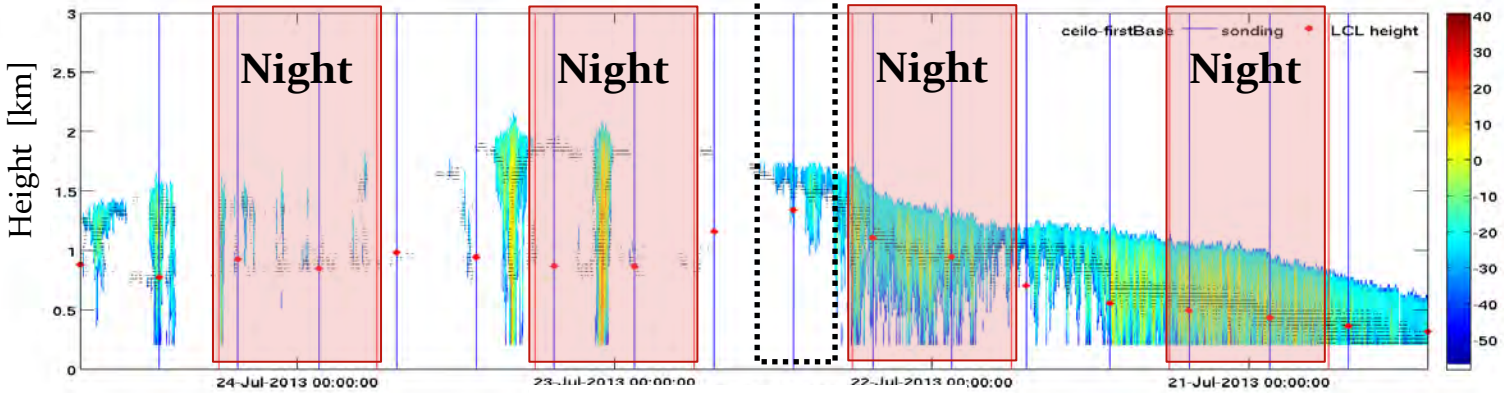
- Inversion stability
- LCL

Time [DD MM YYYY hh:mm:ss] UTC

- Sea surface temperature
- Air temperature



Time [DD MM YYYY hh:mm:ss] California Local Time



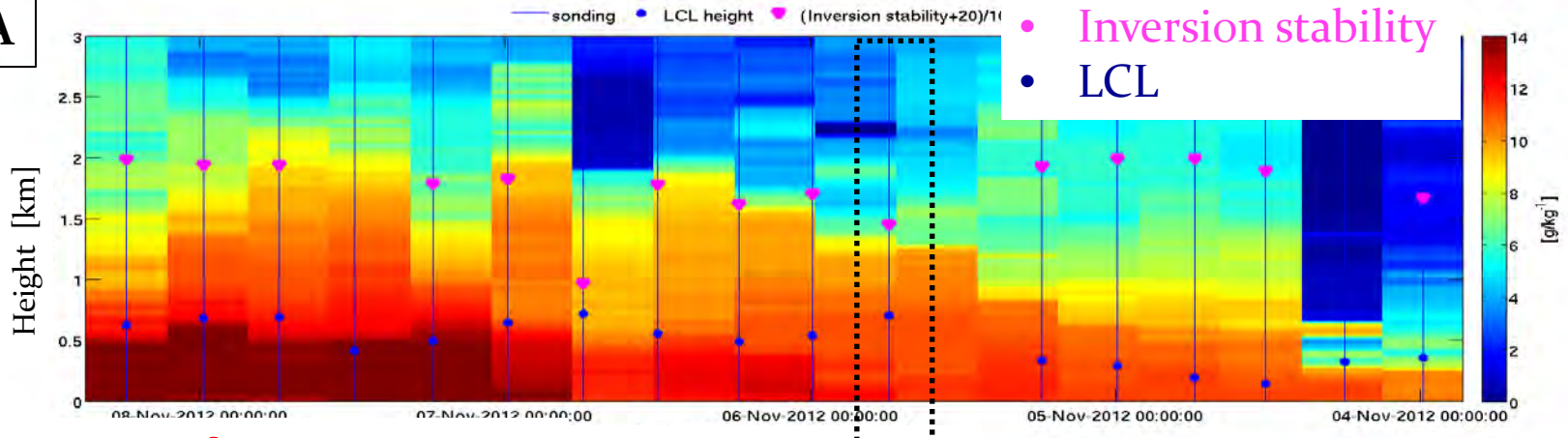
Time [DD MM YYYY hh:mm:ss] California Local Time

Water Vapor Specific Humidity Profile

Leg5A

Honolulu, Hawaii

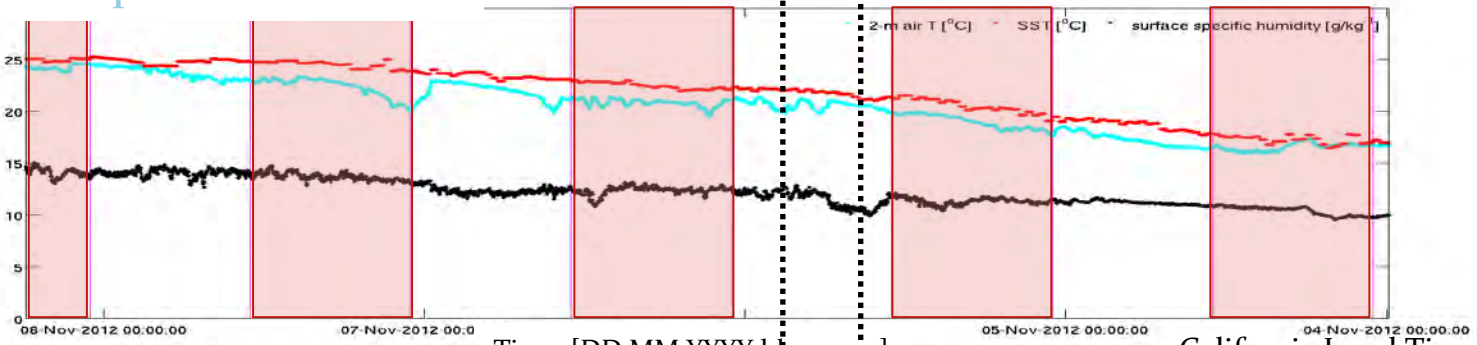
California Coast



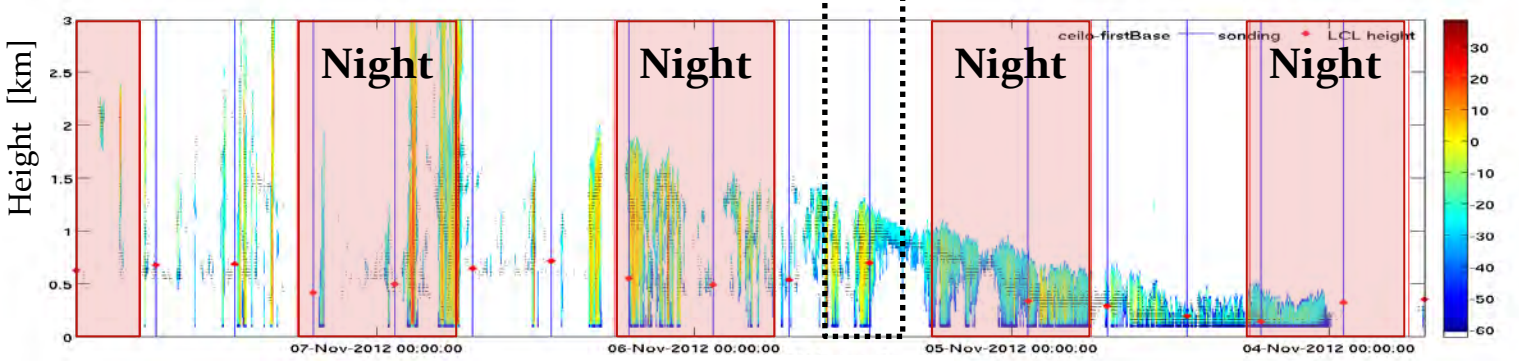
- Inversion stability
- LCL

Time [DD MM YYYY hh:mm:ss] UTC

- Sea surface temperature
- Air temperature



Time [DD MM YYYY hh:mm:ss] California Local Time



Time [DD MM YYYY hh:mm:ss] California Local Time

Future Work and Ideas

1. Combine Satellite images to know the evolution of the clouds during the transect

1. Analyze the Liquid Water Flux (LWF) and estimate the time scale of cloud liquid water depletion by drizzle based on Ewan J.O'connor et al. 2004:

$$LWF = (9.3 \times 10^{-6}) Z^{0.69}$$

$$\tau = \frac{LWP}{LWF_d}$$

1. Investigate the relationship between LWP and cloud thickness for coupled and decoupled clouds to infer the liquid water density

2. Add surface latent heat flux

3. Add surface aerosol data