

Cold-Air Pooling in the Mountains— What do we need to know?

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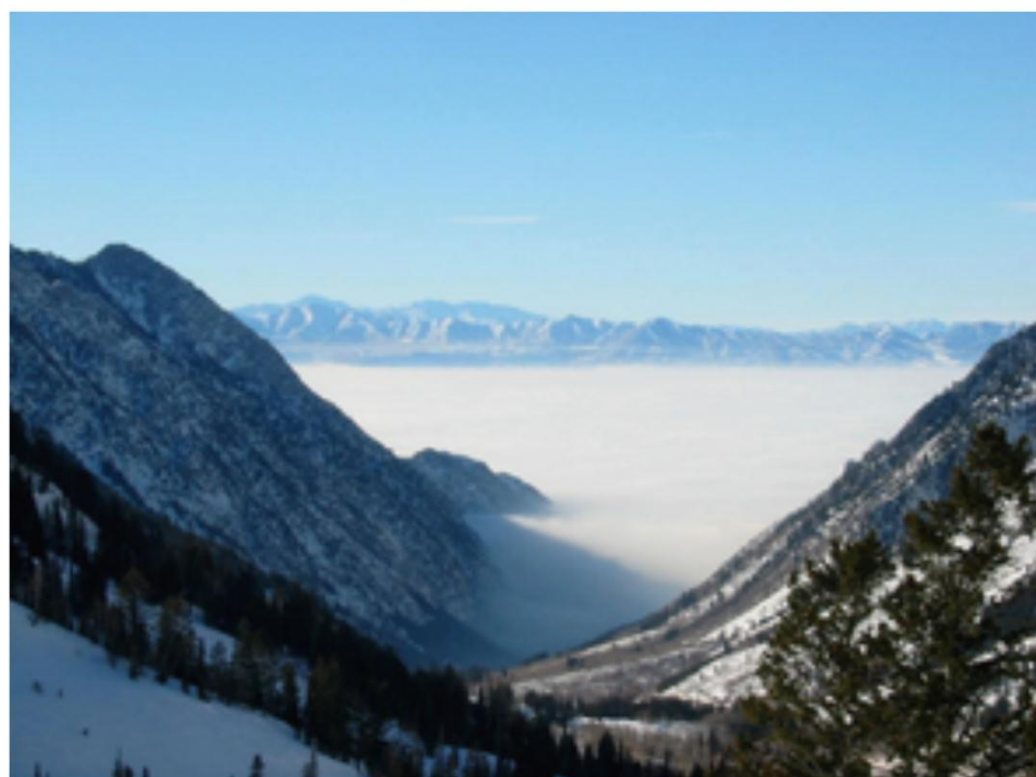
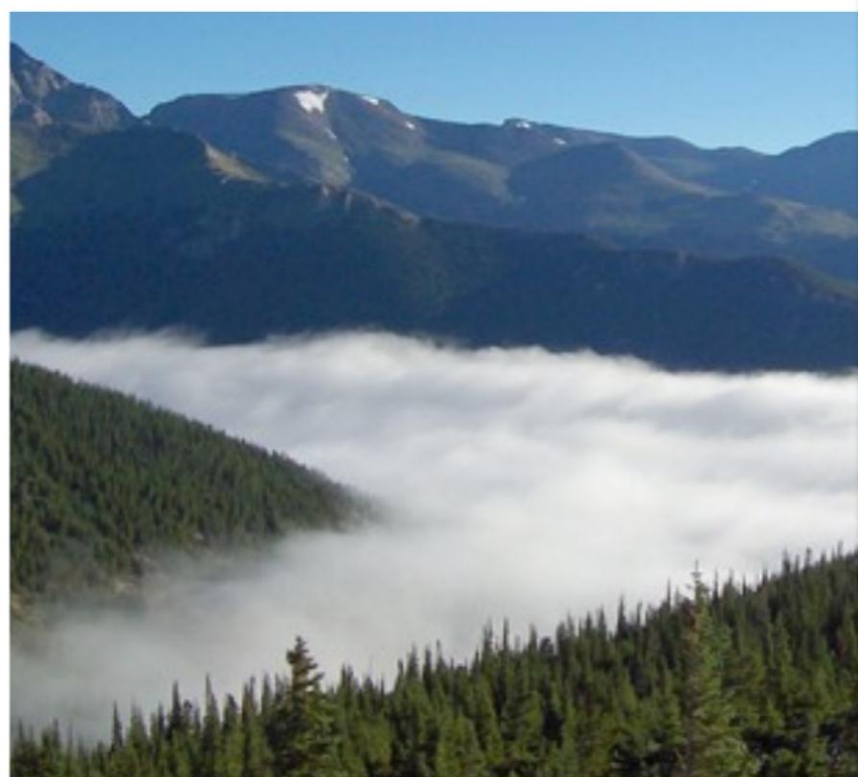
Southwest Climate
Science Center



CNAP

California-Nevada Climate Applications Program

**COLD AIR IS HEAVY,
IT STAYS IN LOW AREAS**



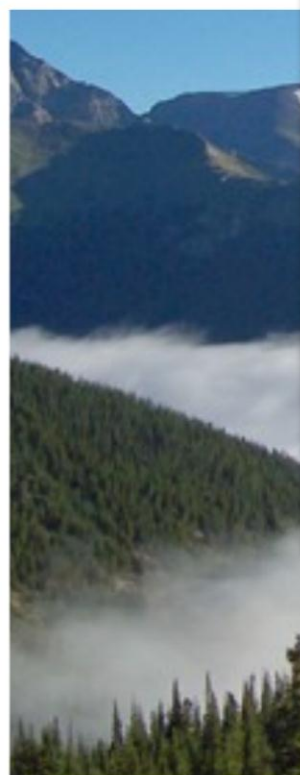
COLD AIR DRAINAGE

Cold Air
Drainage

Radiational Cooling

Cold Air
Drainage

Coldest Air Collects In Lowest Terrain



Downslope flows



Gruenloch Basin sidewall
2051 UTC 2 June 2002

From R. Steinacker

Sierra Nevada is rife with possible cold-air pools of all sizes & shapes

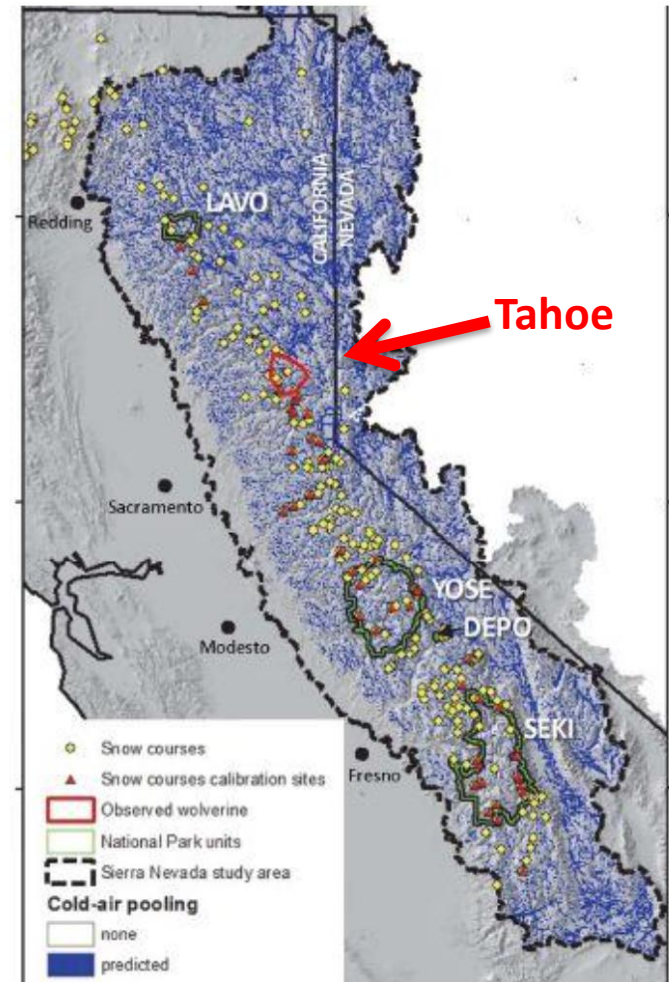
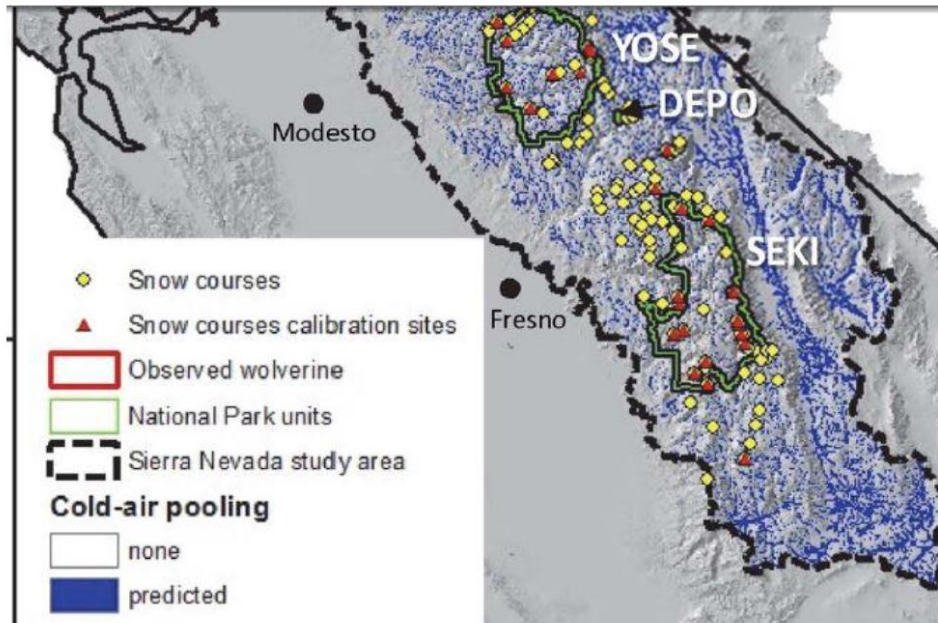
Sierra Nevada CAPs Studies and Transferability

OPEN ACCESS Freely available online



Incorporating Cold-Air Pooling into Downscaled Climate Models Increases Potential Refugia for Snow-Dependent Species within the Sierra Nevada Ecoregion, CA

Jennifer A. Curtis^{1*}, Lorraine E. Flint², Alan L. Flint³, Jessica D. Lundquist⁴, Brian Hudgens⁵, Erin E. Boydston⁶, Julie K. Young⁷

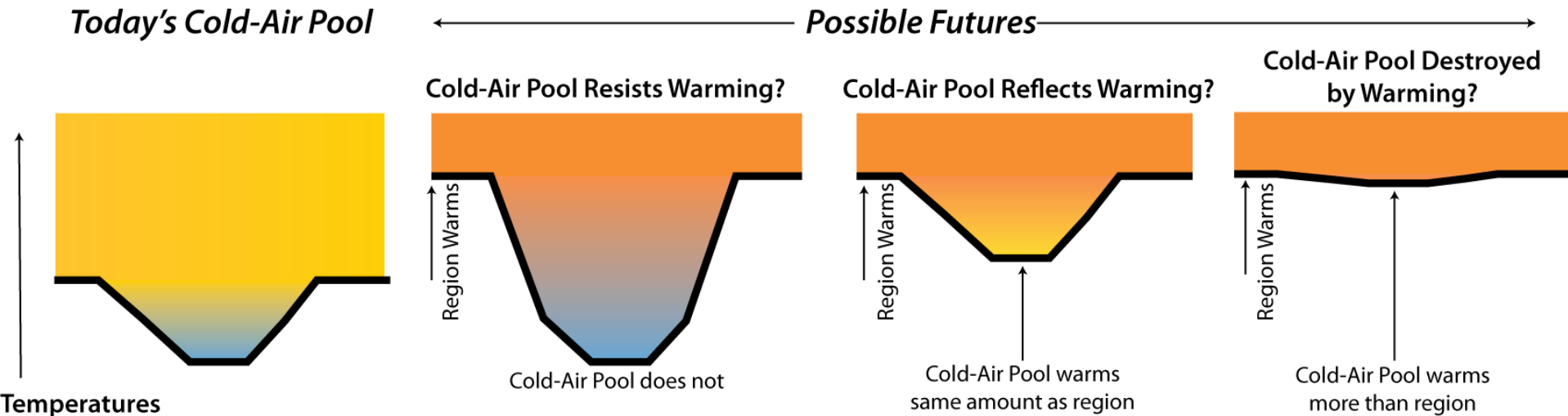


WHAT WE NEED TO KNOW

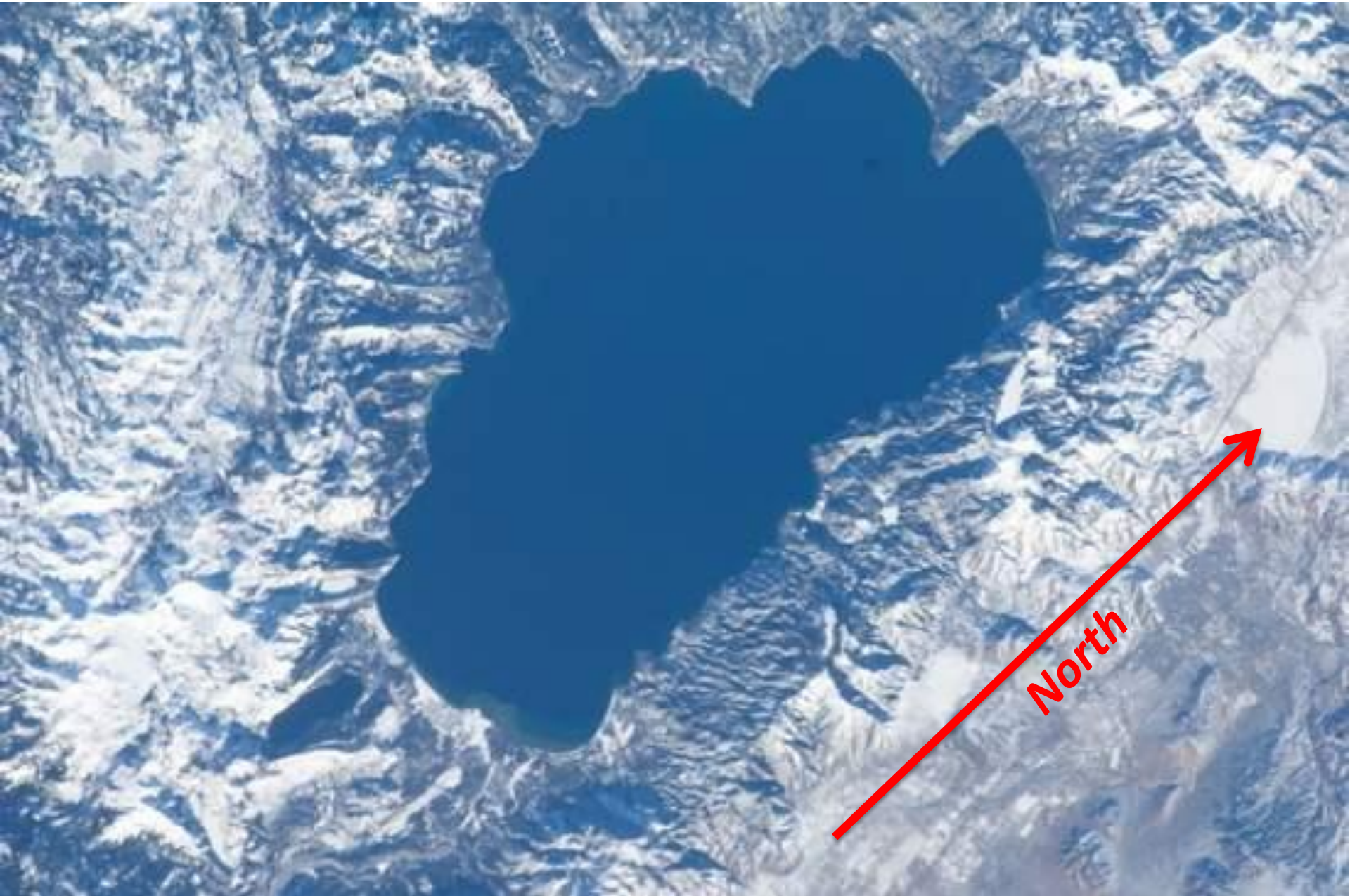
- **How dependent are our ecosystems and water systems on the occurrence and persistence of these cold-air pools?**
- **Are some cold-air pools more “useful” than others?**
- **What is the future of these cold-air pools?**
 - *Will they persist as cold settings in a warming region?*
 - *Will they warm with the region, but remain colder than their surroundings?*
 - *Will they “evaporate” and disappear so that they end up actually warming more overall than their surroundings?*

WHAT WE NEED TO KNOW

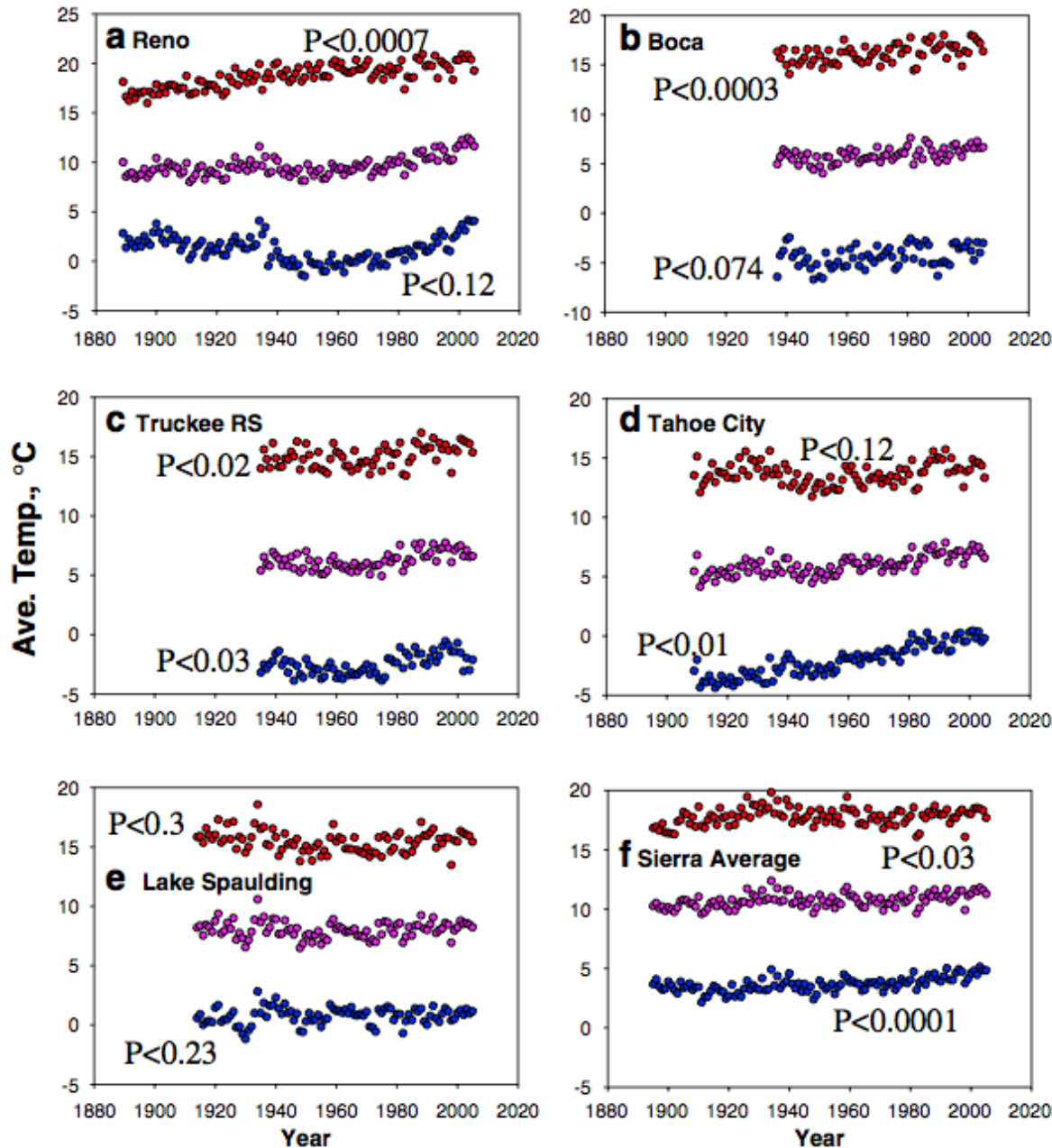
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A quick Observed Example: Lake Tahoe



Annual-Mean Air Temperatures

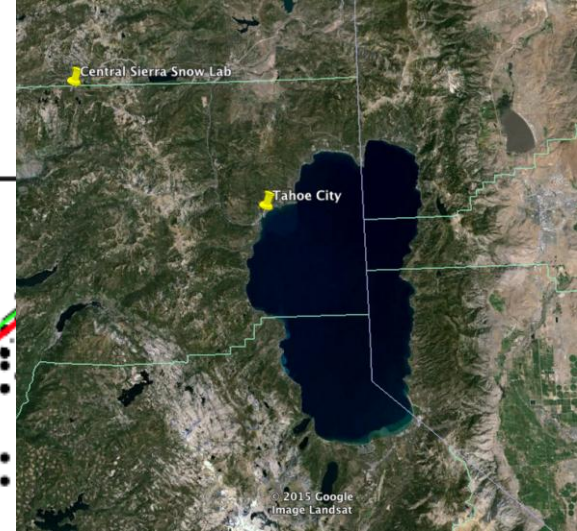
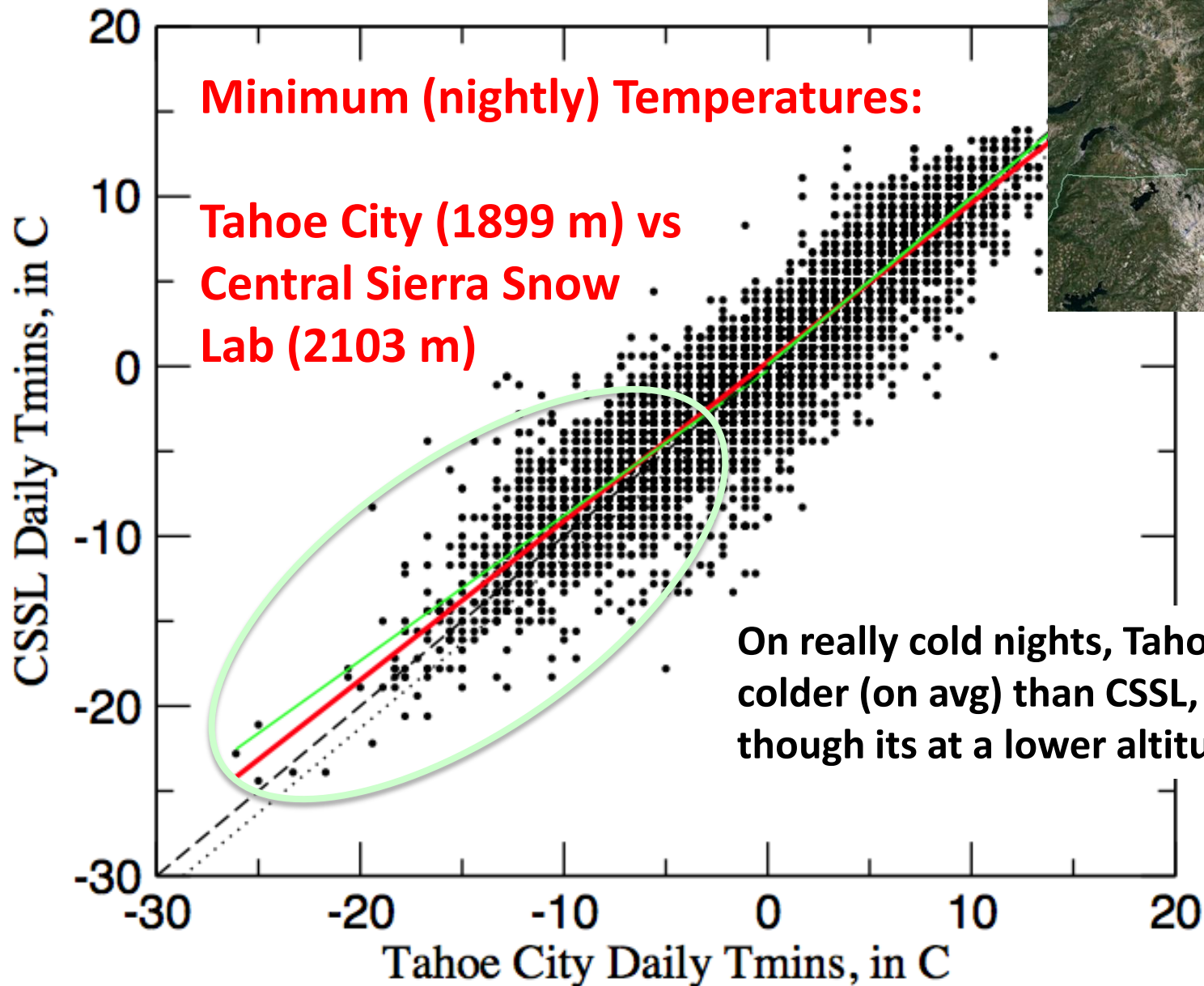


The Lake Tahoe basin and its regional surroundings warmed by about +5°C/100 yr in the 20th Century

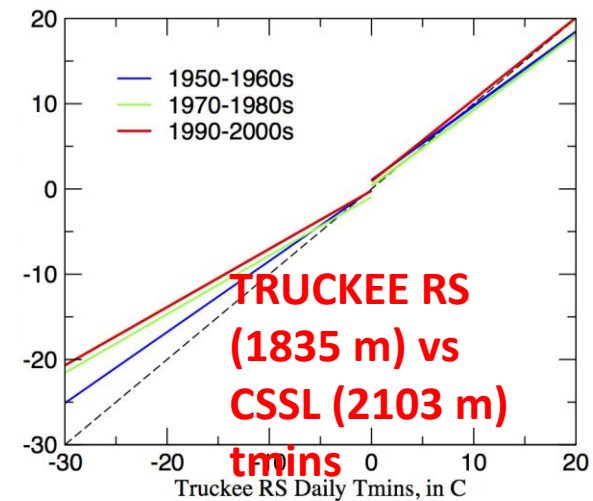
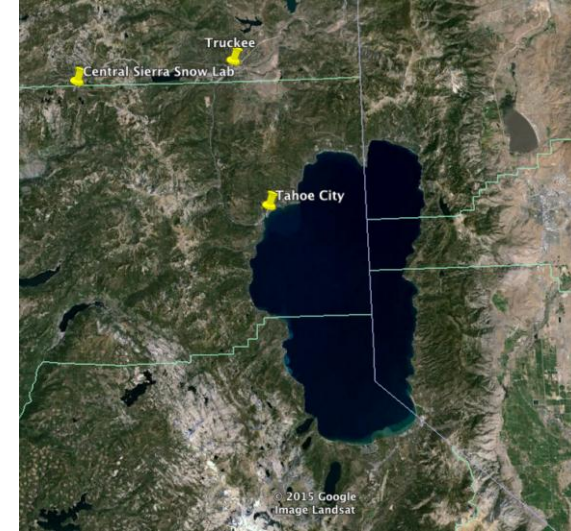
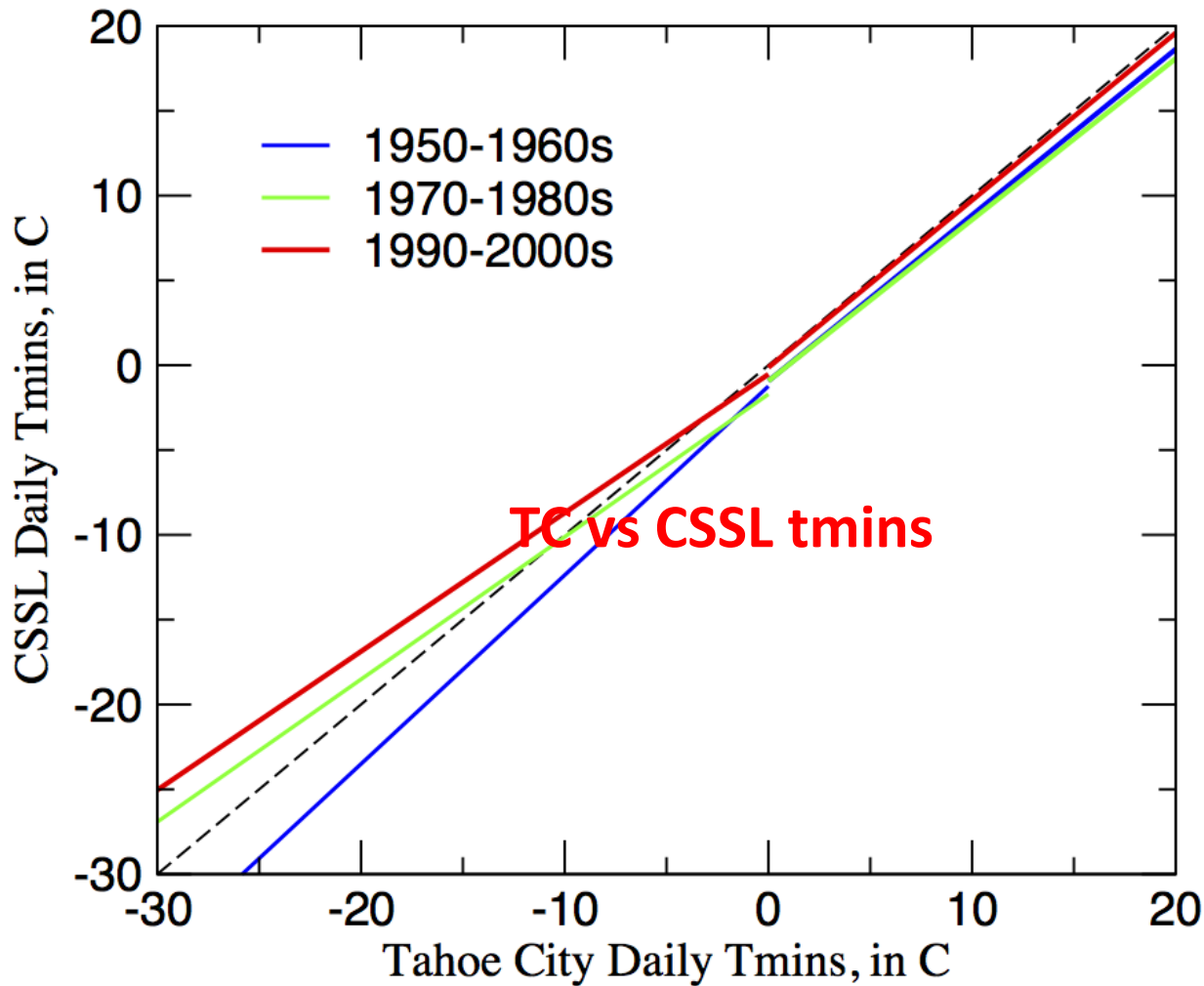
Trends at Tahoe City:

Tmin trend = 4.7 C / 100 yr ($P < 0.01$)
 Tmax trend = 0.6 C / 100 yr ($P < 0.12$)

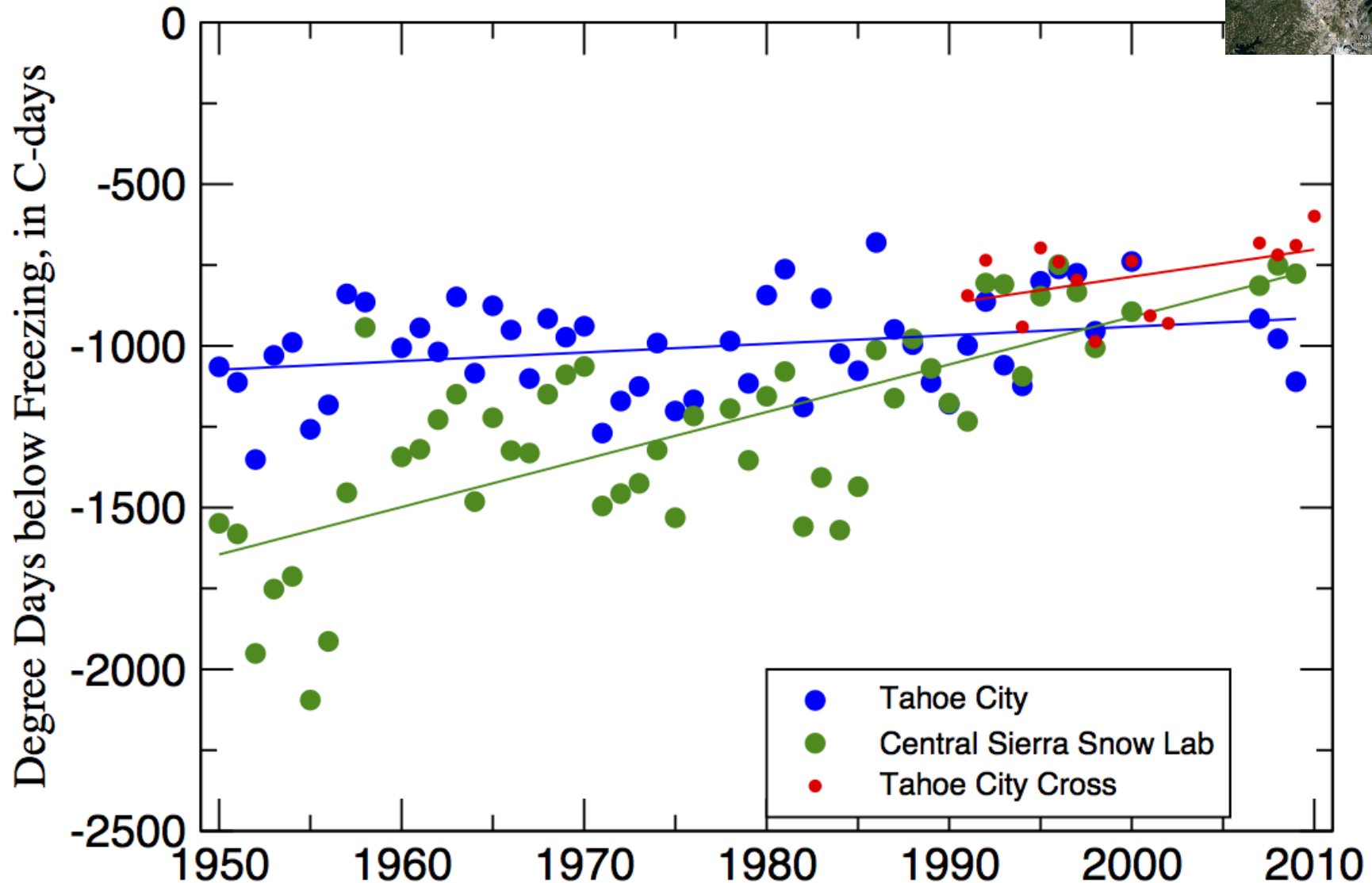
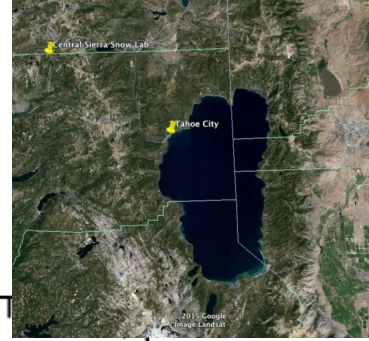
Coats et al., 2006, Clim Chg



How has the cold-air pooling at Tahoe held up under the regional warming described earlier?

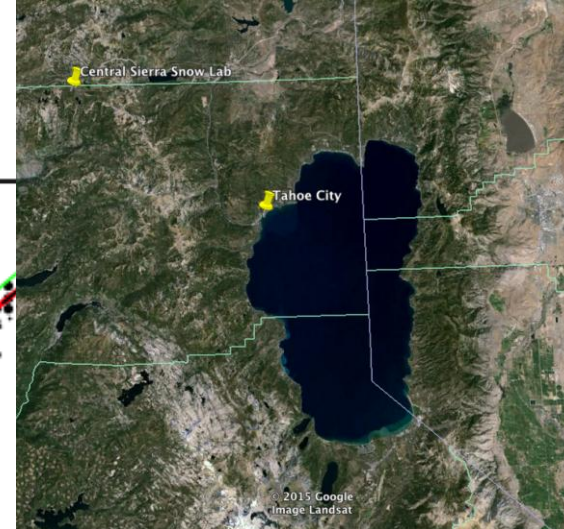
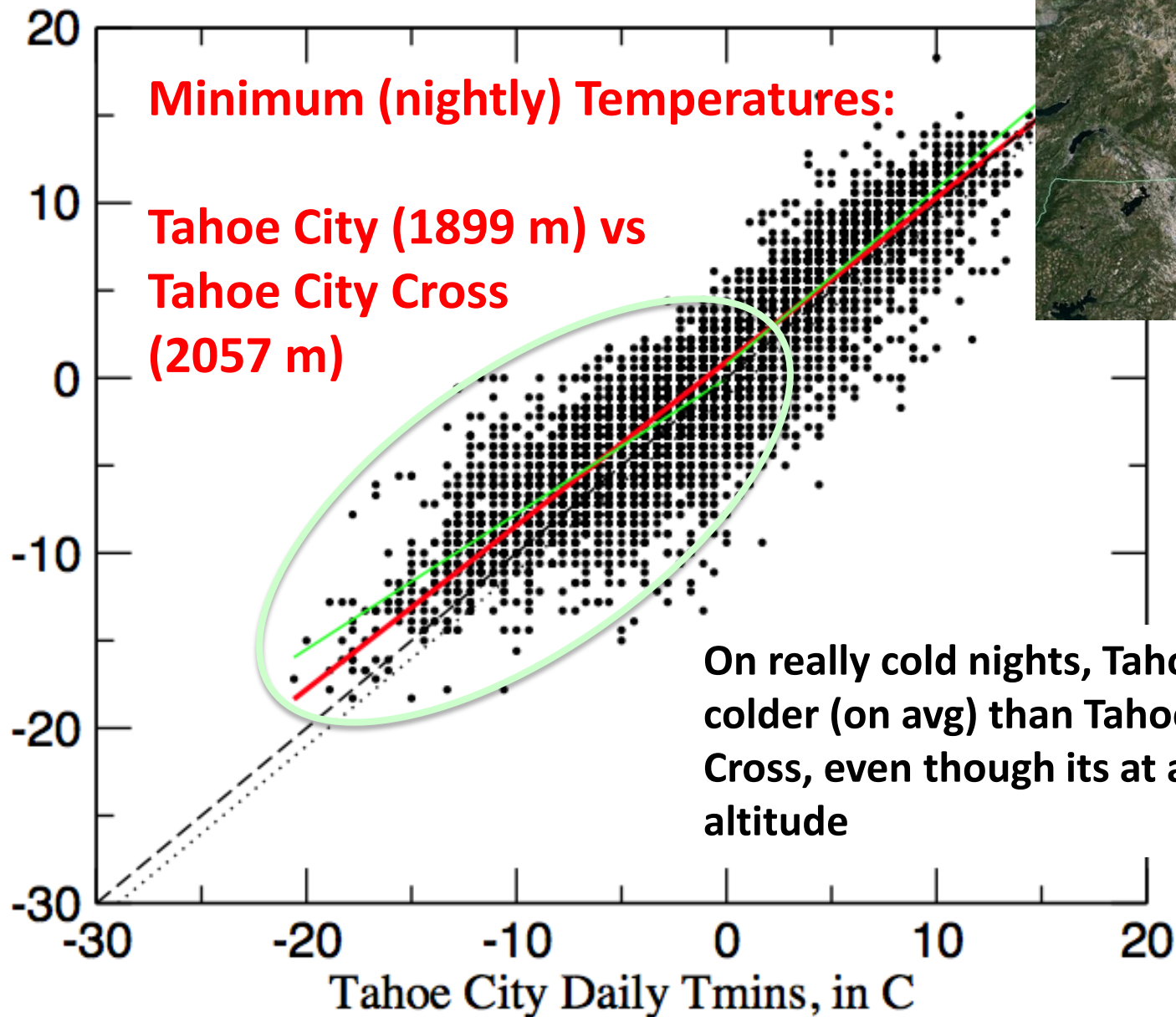


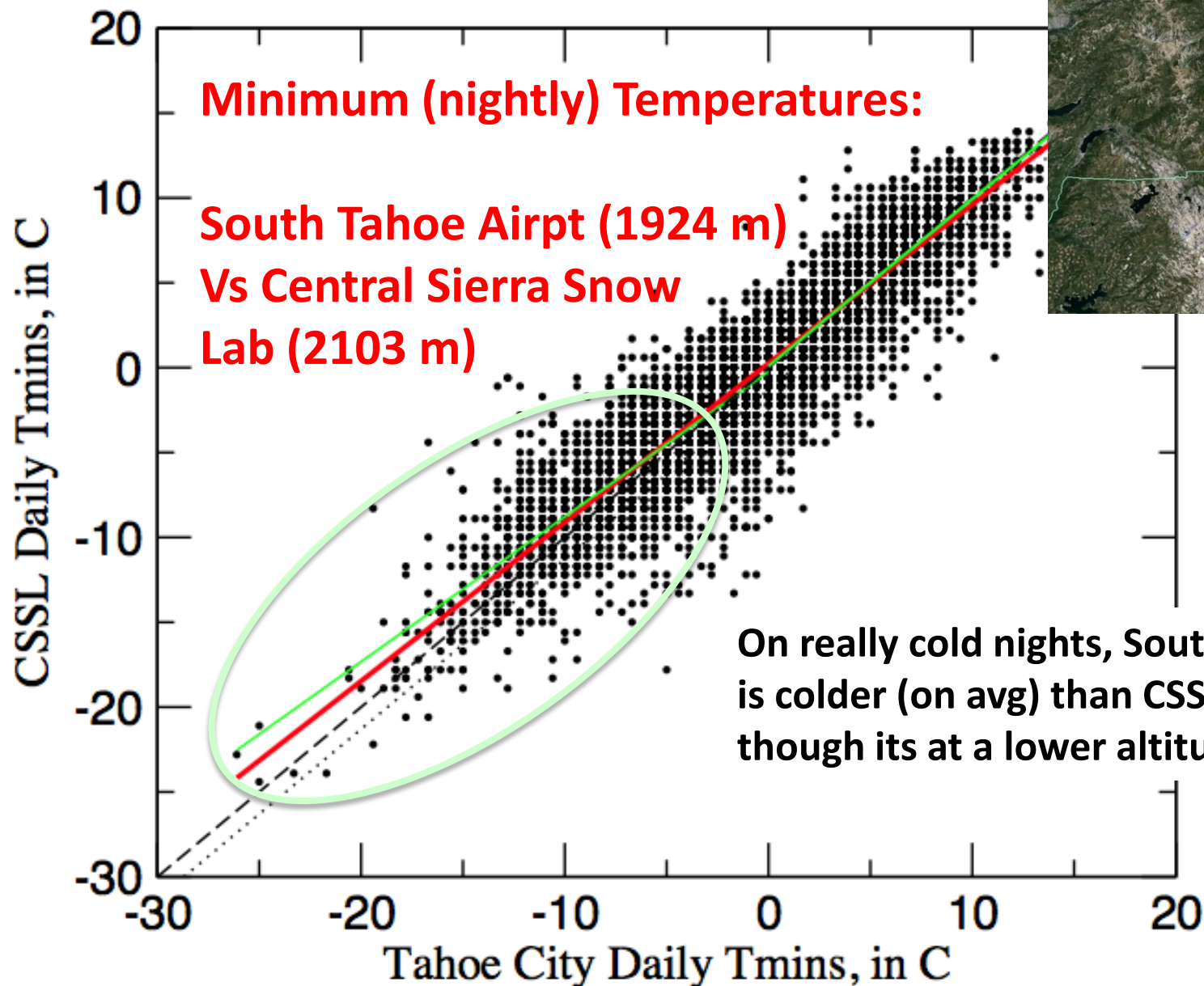
Tahoe Cold-Air Pooling has been resisting the regional warming, almost entirely, since 1950!



Conclusions

Tahoe City Cross Daily Tmins, in C





On really cold nights, South Tahoe is colder (on avg) than CSSL, even though its at a lower altitude

