

Large-Scale Meteorological Influences on Urban Cold Pools in the Intermountain Basin

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The VTMX experiments will be conducted under statically stable conditions in the Salt Lake Basin (SLB), an urban basin located on the western edge of the Intermountain Basin (IB) between the Rocky and Sierra-Cascade Mountains. The IB is affected by a variety of regional and synoptic scale flow and stability phenomena. Sub-basins within the IB are affected not only by local processes but also by processes on a range of scales extending all the way up to the scale of the Intermountain Basin. Thus, the meteorology of the SLB is expected to be influenced by lake breezes from the Great Salt Lake north of the SLB, from thermally driven circulations from the Utah Lake Basin to the south, from persistent temperature inversions that develop over the entire IB, and from blocked flow situations upwind of the Rocky Mountains.

We hypothesize that mechanisms responsible for vertical transport and mixing in the Salt lake Basin are frequently affected by circulations and boundary layer structures on scales that extend beyond the urban basin, and that the understanding of regional-scale effects is critical to the interpretation and understanding of mechanisms in the SLB.

The research has three objectives. First, we propose to conduct basic climatological investigations to assist in the design of fall and mid-winter meteorological and air quality experiments in the SLB. These investigations will focus on boundary layer and diurnal wind system development and timing, their seasonal variations, and on variability associated with passing disturbances. Second, we propose to determine the effect of large-scale blocking and cold pools in the IB on cold pools and stagnations in the SLB. Third, we propose to put the SLB investigations within their proper climatological and regional contexts and to aid in their interpretation by performing case study analyses for the VTMX experimental periods.

The investigations will proceed through analyses of local- and regional-scale phenomena from existing data networks or stations in the IB (rawinsonde, radar profiler, RASS and Utah Mesonet stations), from instruments that will be operated in the 3-week VTMX experiment or will be operated over longer periods following these short-term experiments, and from model-assimilated NCEP/NCAR 40-year Reanalysis data. Additionally, high-resolution thermal infrared satellite imagery from Landsat 7 will be tested for its utility in measuring temperature inversion characteristics in the IB.

We invite other investigators to participate in our proposed research. Please contact Dave Whiteman (509-372-6147, Dave.Whiteman@pnl.gov) or Xindi Ban (509-372-6141, Randy.X.Bian@pnl.gov) for further information.