1.2

DOWN-BASIN DRAINAGE JET OBSERVED DURING VTMX: LARGE-SCALE CONTROLS AND EFFECTS ON LOCAL-SCALE FLOWS

Robert M. Banta, Lisa S. Darby, and Brad W. Orr

Environmental Technology Laboratory / NOAA, Boulder, Colorado

During VTMX wind profiling instruments found a strong, southerly, basin-scale jet that dominated the flow in the valley on most of the nights chosen for study. The strength and frequency of this downvalley jet were unexpected. Its dominance as a flow in the basin affected most of the other research objectives of the VTMX project. In this paper we study the night-to-night variability of the properties of the down-basin jet and also the variability of its effect on other flows in the basin (such as thermally forced slope flows and canyon outflows). The primary instrument used in the present study is ETL's Doppler lidar, which provided vertical profiles of the horizontal wind in addition to mapping the wind in the vertical and horizontal, using scans in azimuth and elevation. This scanning capability provided an overview of the 3-D structure of the wind field and its variability over most of the basin. Other key instrumentation in the valley included wind profilers, rawinsonde and tethersondes, and a surface mesonet. On many of the study nights tracer was released, and this gave further insight into the effects of the various flow systems (Darby et al. 2002)..

Vertical profiles of the wind showed that typically the along valley wind reversed from daytime up-basin to nighttime down-basin flow between 2000 and 2200 Mountain Standard Time (MST). Lidar scans showed that canyon outflows and slope flows from the Wasatch Range formed in the light-and-variable transitional wind period between the two along-basin flow regimes. On one night (18 Oct) when the down-basin jet formed early, the slope and canyon flows were weaker and more disorganized, and on another night (26 Oct) when the flow was down-basin even in the afternoon before sunset, no local slope or canyon flows formed at all.

Corresponding author address: Robert M. Banta, NOAA/ETL (ET2), 325 Broadway, Boulder CO 80305. E-mail: robert.banta@noaa.gov

To put these in-basin observations into context, we also plotted the synoptic-scale surface pressure difference between a station to the south of the basin (Price UT) and one north of the basin (Pocatello ID). Those nights, when the down-basin flows were strong and the local flows were weak and more inhibited, were nights when the large-scale pressure gradient favored down-basin flow. Thus, this larger-scale pressure difference and its variation through the night had a strong influence on the development of the down-basin jet, and consequently on development of the other local flows in the basin.

Vertical profiles of the flow in the basin were affected both by the large-scale pressure gradient and by the direction and speed of the winds above the ridgetops. Time-height cross sections of the along-basin flow obtained from Doppler lidar scans illustrate these effects and will be presented and described.

Acknowledgments: This work was sponsored by the U.S. Department of Energy, under the auspices of the Environmental Meteorology Program of the Office of Biological and Environmental Research.

Reference

Darby, L.S., K.J. Allwine, and R.M. Banta, 2002: Relationship between tracer behavior in downtown Salt Lake City and basin-scale wind flow. *Preprints, 10th Conf on Mountain Meteorology and MAP meeting*, 17-21 June, Park City UT, American Meteorological Society, Boston, this volume.