1.5 CIRCULATIONS IN THE SALT LAKE CITY BASIN: THE INFLUENCE OF AIR EXCHANGES WITH ADJACENT BASINS AND CANYONS

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1. INTRODUCTION

The Salt Lake City basin is one of a number of broad valleys, separated by a series of north-south mountain ranges, in northern Utah. It is bordered by the Wasatch Mountains on the east and the Oquirrh Mountains on the west. The basin opens to the Great Salt Lake on the north and Traverse Mountains on the south end of the basin divide it from the Utah Lake basin and the Cedar Valley to the south. Similarly, the Tooele Valley is bounded by the Oquirrh Mountains on the east and the Stansbury Mountains on the west. It also opens to the Great Salt Lake on the north and is separated by South Mountain from Rush Valley to the south. While the Oquirrh Mountains reach 3200 m in height and provide a significant barrier between the Salt Lake City and Tooele Valleys, the barrier between the Rush and Cedar Valleys is lower and includes several passes.

The Salt Lake City basin was the location of the Vertical Transport and Mixing (VTMX) program field experiment in October of 2000 (Doran, 2000), and it is an area that has experienced urban air quality problems. During this experiment, flow through the Jordan Narrows, the gap in the Traverse Range that divides the Salt Lake basin from the Utah basin to the south, was found to be significant, in addition to the known night time drainage from canyons that enter the valley from the east. Stone et al. (1989) documented similar flow between the Tooele and Rush Valleys, just to the west. Their study also indicated flows, through the series of passes that separate Rush Valley and Cedar Valley to its east.

This paper will present the results of numerical simulations of the Salt Lake City Basin and the surrounding region, including the Utah Lake basin and the Tooele and Rush Valleys. The discussion will focus on how the circulations and vertical mixing within the Salt Lake City basin are influenced by flows that enter or exit the basin from nearby basins and by drainage flows from the canyons that enter the valley from the east. We will also run the model for several cases to investigate the role of synoptic weather conditions in this exchange of air and in vertical mixing in the Salt Lake City basin.

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2. MODEL SIMULATIONS

We have begun simulating IOP 8 (the night of 19-20 October) of the VTMX field experiment with the Regional Atmospheric Modeling System (RAMS) model (Pielke, et al., 1992). Three nested grids are used, in order to simulate regional to local scale flows, with horizontal grid spacings from 3.6 km to 400 m. Vertical grid spacing near the surface is 100 m. The simulation begins at 0000 UTC 19 October 2000 and ran for 48 hours.

Preliminary results from these early runs do produce flows between the basins and drainage flows from the canyons. Figure 1 shows the model horizontal flows on grid 2 at 1215 UTC on 20 October 2000. Drainage flows from the canyons in the Wasatch Mountains can be found in both the Utah Lake and Salt Lake City basins. In the Utah Lake basin, the drainage flow turns northward and continues through the Jordan Narrows in the down valley flow. The canyon drainage in the Salt Lake City basin also turns northward with the down valley flow. Down valley flow is also found to flow around South Mountain and into the Tooele Valley. Easterly flows from Cedar Valley to Rush Valley are also simulated and agree with the findings of Stone et al. (1989). These flows are also consistent with the MesoWest (Horel, et al., 2002) mesonet observations at that time.

3. ACKNOWLEDGMENTS

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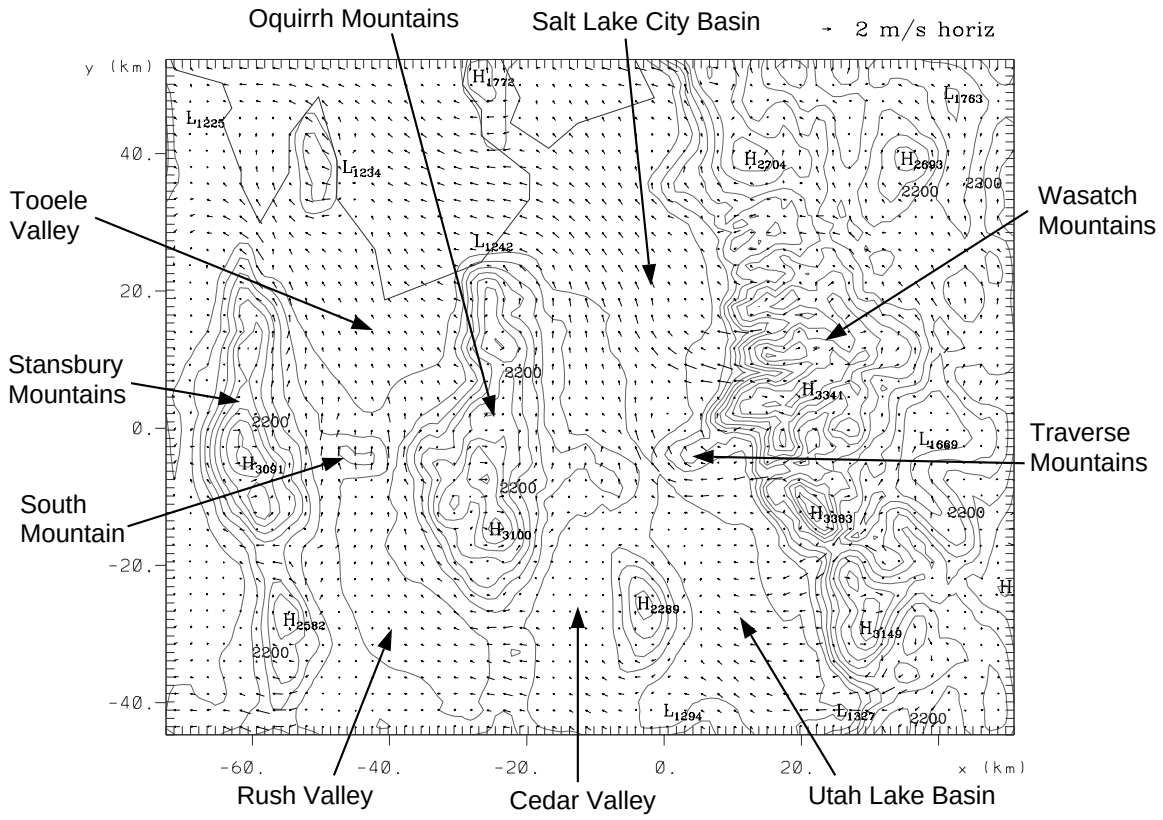

Figure 1..Topography and horizontal winds on RAMS grid 2 at 1215 UTC 20 October 2000. Contour intervals are 200 m.

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