

## CHAPTER VI. ATMOSPHERIC PROFILES

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### A. INTRODUCTION

During the period June 9 through June 18, 1992, an intensive radiosounding program was conducted to measure atmospheric profiles of the wind velocity, the temperature and the specific humidity. The launch site was located near site MS002 in the northeastern part of the catchment of the Little Washita River; this location was selected in order to ensure that the measured profiles would reflect the catchment's surface features for the prevailing southwesterly winds during this time of the year. The launch times of the rawinsondes are shown in Table VI-1.

The measurements were carried out by a team from Cornell University consisting of Wilfried Brutsaert and Nelson Dias.

### B. INSTRUMENTS AND DATA

The radiosounding equipment used was manufactured by Atmospheric Instrumentation Research (AIR), Boulder, Colorado. The ground station was compact enough that it could be placed inside a 9 x 12 ft tent. The radiosonde system (AIR3A, spin type) consisted of disposable sondes with dry- and wet-bulb temperature and pressure sensors, of a receiving unit on the ground, and of an optical theodolite to track the sonde. During flight the sonde, attached to a balloon, measures the data in cycles approximately 4.8s in the following sequence: dry-bulb temperature is measured at time zero; 0.6 and 1.8s later, wet-bulb temperature and pressure are measured, respectively; then after approximately 3.0s the dry-bulb temperature measurement is made again to begin the next cycle. According to the manufacturer, the response of the pressure sensor is practically instantaneous, but the dry- and wet-bulb sensors have time constants of 3 and 12s, respectively. Because of these time constants, it is necessary to further process the data if they are to be used for analysis in the boundary layer. One possible procedure for this purpose was outlined by Sugita and Brutsaert (1990). The height,  $y$ , of the sonde can be obtained from the pressure, temperature and humidity. The horizontal distance between the sonde and the release point can be calculated from the elevation angle measured by the theodolite and from  $y$ . This, in turn, with the measured azimuth angle yields the horizontal position of the sonde. Finally, successive horizontal positions allow the calculation of average wind velocity

and direction over the interval; these average values are then to be assigned to the midpoint of the interval. For 5s cycles, and with typical balloon ascent rates of around 3 to 4 m/s, the vertical resolution of the measurements was around 15 to 20 m. The sounding was generally aborted above 600 hPa (i.e., 600 mb). In the figures, some examples are shown of the data that were obtained from the rawinsonde ascents. These comprise an example of a wind speed profile, and the diurnal evolution of the temperature and humidity profiles on two separate days.

### C. REFERENCES

Sugita, M. and Brutsaert, W. 1990. Wind velocity measurements in the neutral boundary layer above hilly prairie. *Jour. Geophys. Res. (Atmos.)*, 95(D6), 7617-7624.

Table VI-1. Actual Launch Times of the Soundings (CDST)

Day	Date						
161	92/06/09		1150		1540	1800	
162	92/06/10	0931	1102	1307	1530	1800	
163	92/06/11	0929	1059	1302	1531	1800	
164	92/06/12	0932	1059	1308	1529	1800	
165	92/06/13	0934	1102	1302	1530	1800	
166	92/06/14	0927	1059	1302	1531	1757	
167	92/06/15	0931	1056	1301	1530	1800	
168	92/06/16	0932	1100	1303	1530	1805	
169	92/06/17	0931	1102	1300	1530	1801	
170	92/06/18	0931	1100	1302	1532	1800	

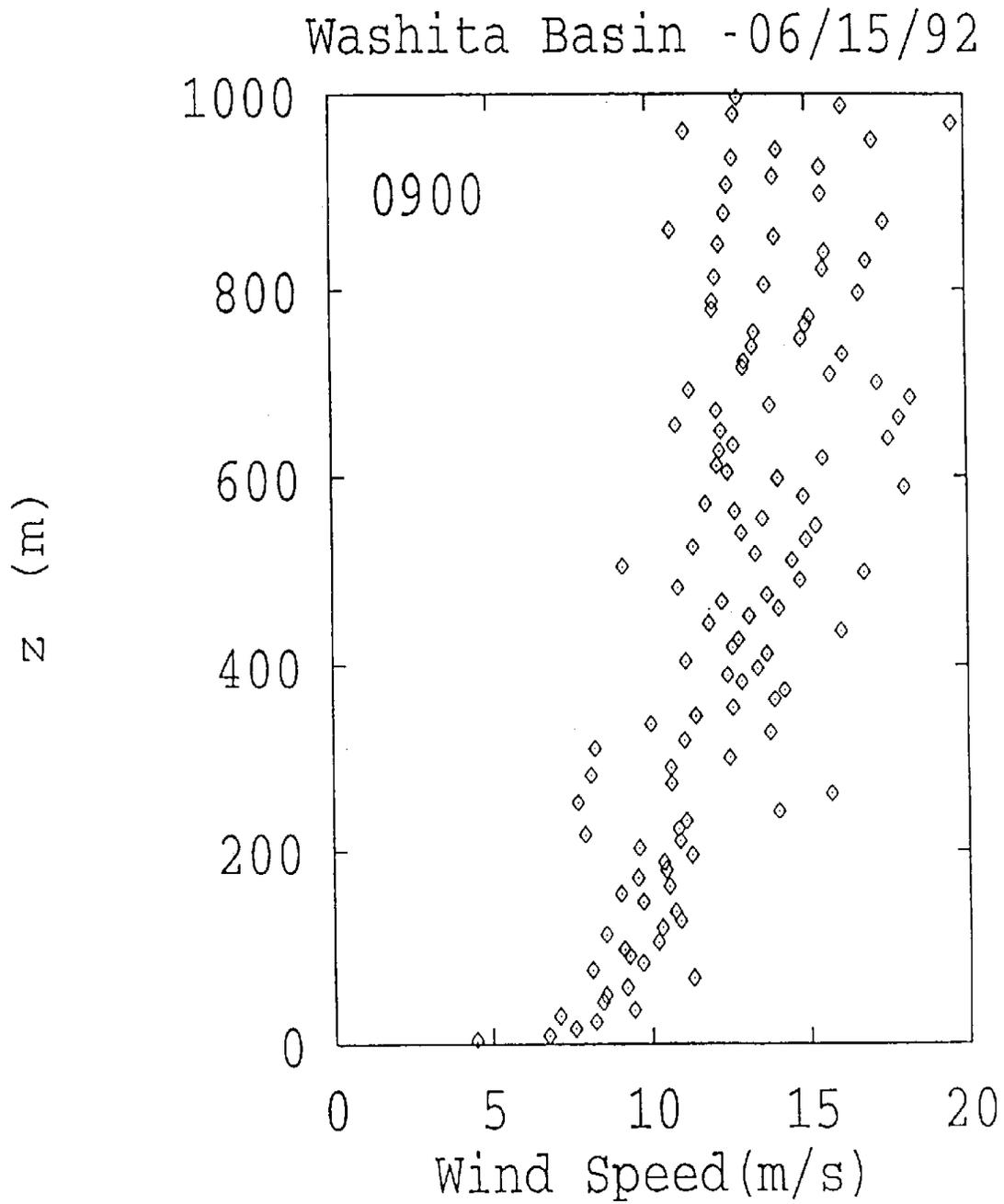


Figure VI-1. Atmospheric wind profile acquired at 0900 on June 15.  
(z is the distance above the ground)

Washita Basin -06/10/92

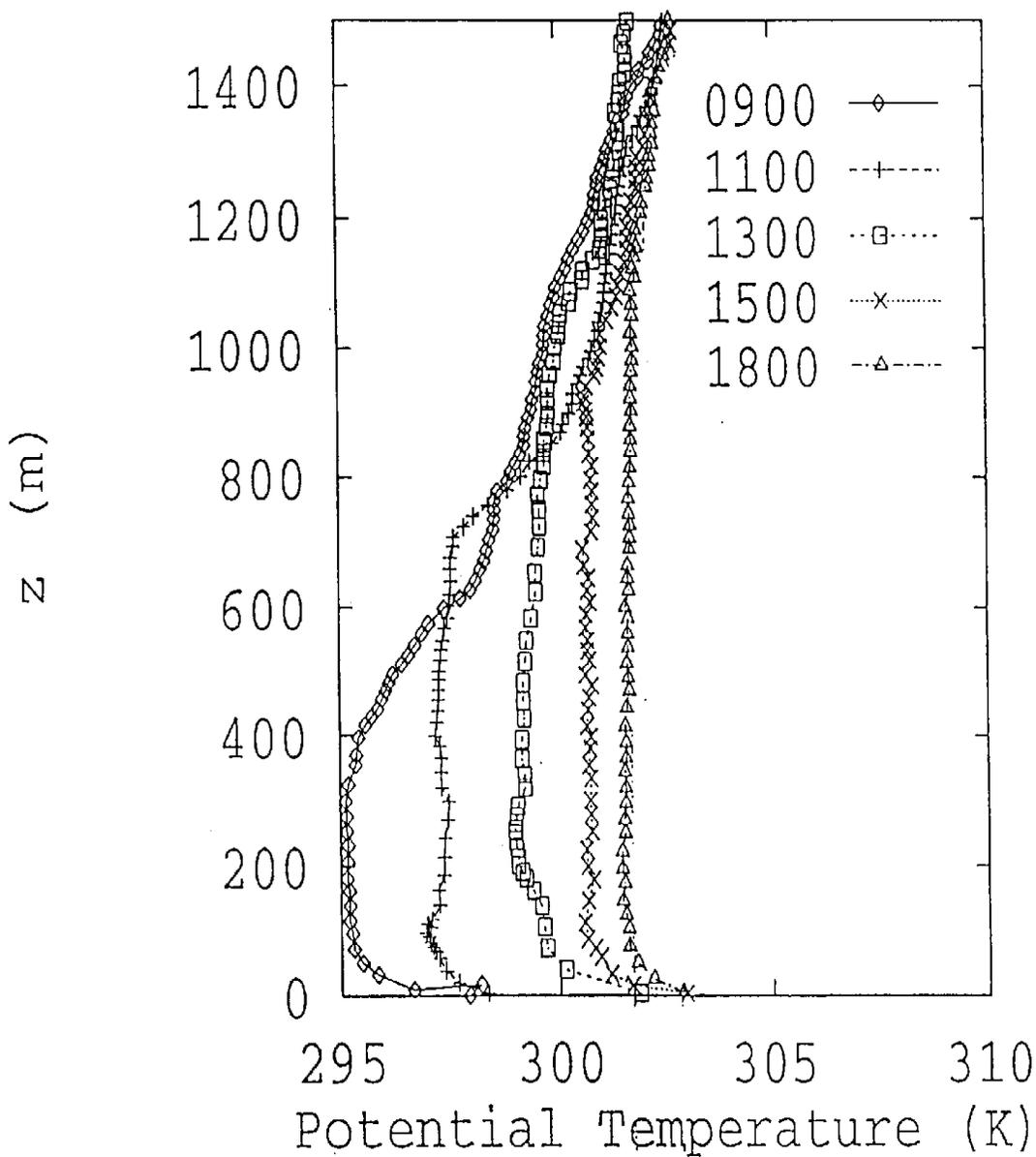


Figure VI-2. Atmospheric profiles of potential temperature on June 10.  
(z is the distance above the ground)

Washita Basin -06/10/92

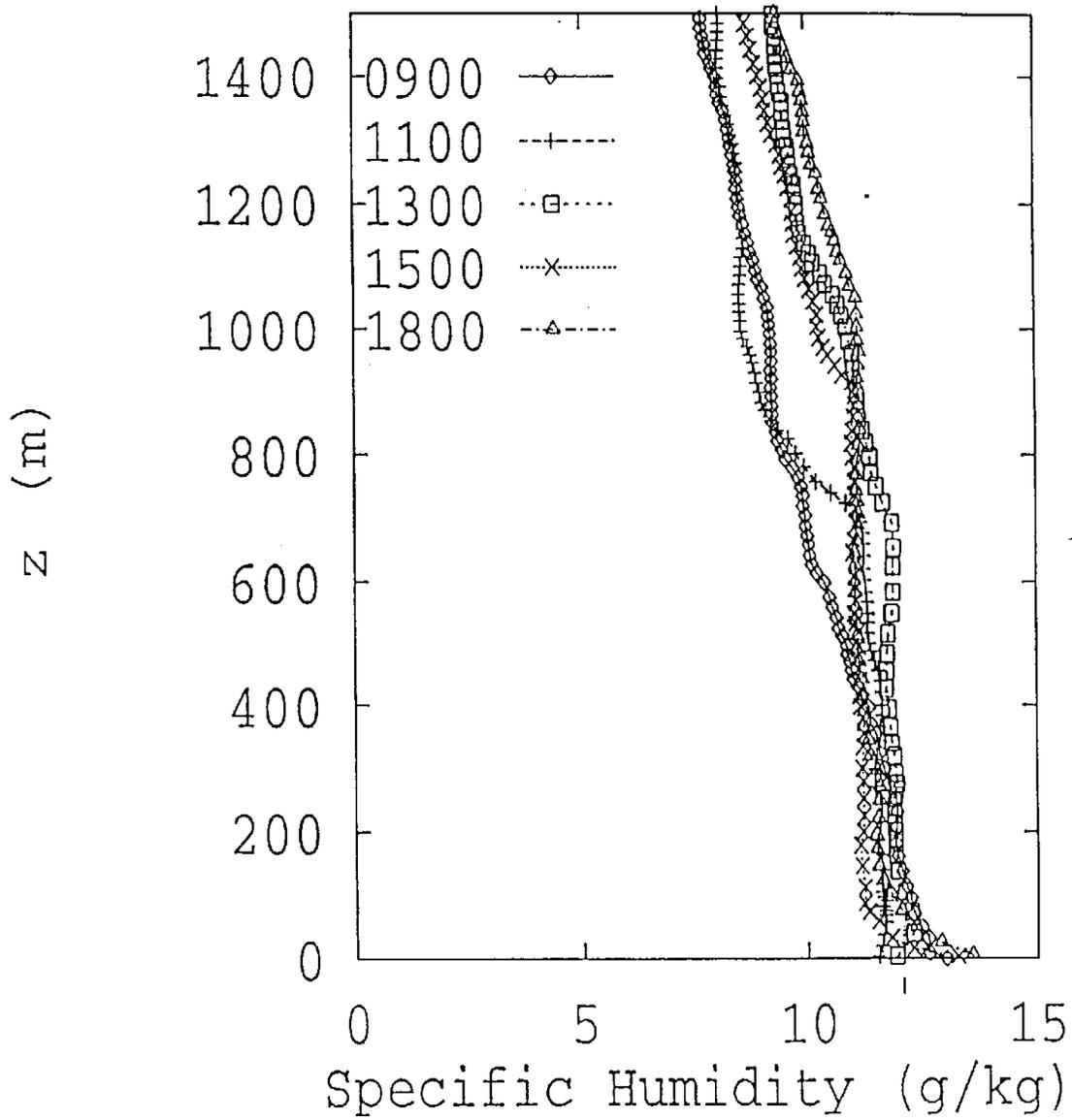


Figure VI-3. Atmospheric profiles of specific humidity on June 10.  
(z is the distance above the ground)

Washita Basin -06/12/92

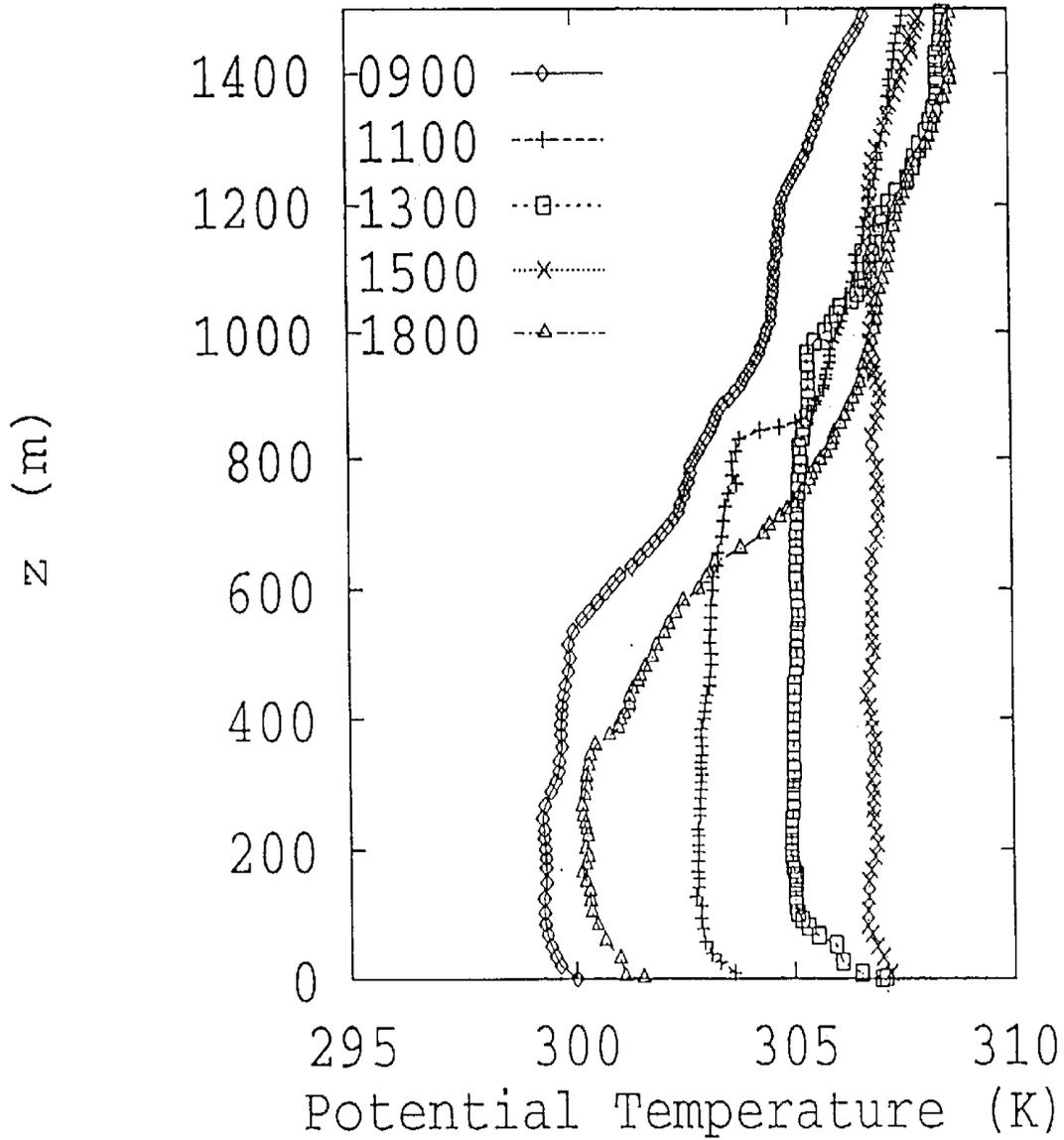


Figure VI-4. Atmospheric profiles of potential temperature on June 12.  
(z is the distance above the ground)

Washita Basin -06/12/92

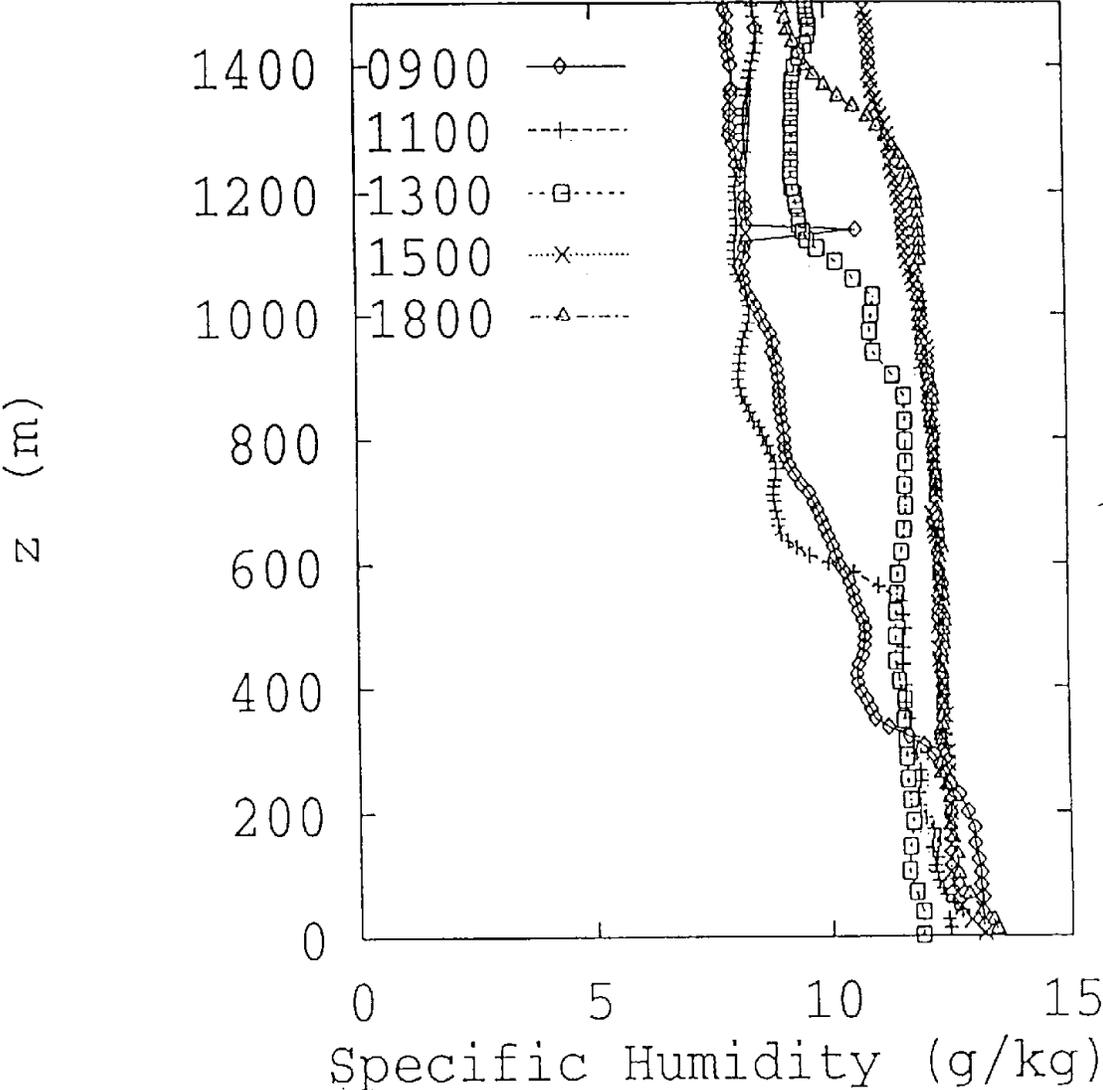


Figure VI-5. Atmospheric profiles of specific humidity on June 12.  
(z is the distance above the ground)