SOME PHYSICAL CONCEPTS IN COMPLEX TERRAIN METEOROLOGY DERIVED FROM THE U. S. DEPARTMENT OF ENERGY'S ASCOT PROGRAM

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1. INTRODUCTION

In 1978 the United States Department of Energy (DOE) initiated a program directed specifically at atmospheric studies in complex terrain (ASCOT). The two broad objectives of the ASCOT program are:

- To improve fundamental knowledge of atmospheric transport and dispersion processes in complex terrain.
- Building on this improvement in the understanding of the physics to provide a methodology for performing air quality assessments.

These objectives are approached through an integrated program consisting of atmospheric physics theory, computer modeling, laboratory modeling, and field experimentation. The ASCOT team is composed of scientists from DOE-supported research laboratories, other federal laboratories, and universities. The accomplishments of the ASCOT program are the result of the combined efforts of many dedicated individuals. A complete list of participants is given by Gudiksen and Dickerson (1984). The initial emphases of the research are on nocturnal drainage winds, the effect terrain has on them, and their interactions with external flows. This paper describes some physical concepts of nocturnal drainage wind derived mainly from the results of the meteorological measurements portion of the field experiments.

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Detailed descriptions of any part of the ASCOT program is not the intent of this overview paper. A comprehensive summary of all phases of the ASCOT program is given by Dickerson and Gudiksen (1984). Interested readers are encouraged to seek out this and all other references given in this paper for further information.

2. THE FIELD SITES

ASCOT has conducted intensive field studies at the five locations shown in Fig. 1. The topography of each of these sites is very different. The general characteristics of each site will be briefly described below in the order of their relative complexity. In each case references are given to more detailed descriptions of the sites and the experiments conducted.

RATTLESNAKE HILL: Located in the southeastern corner of the state of Washington, Rattlesnake Hill approximates a fairly uniform two-dimensional slope. It slopes from southwest at 595 m MSL to northeast at 366 m MSL for a distance of over 900 m. In the area of the hill where measurements were made there are two distinct angles to the slope. From the summit to about 495 m MSL the slope is 20° and below this point it is 8°. The average slope from the summit to the bottom is 16°. (Doran and Horst, 1983a,b; Horst and Doran, 1981, 1982)

PAJARITO MOUNTAIN: In 1979 and 1983 slope experiments were conducted on a fairly uniform ski run on Pajarito Mountain in the north central New Mexico. The ski run slopes from the south at 3090 m MSL to the north at 2830 m MSL for a distance of 850 m with an average slope angle of 18°. It is 50 m wide and is bordered on each side by dense stands of aspen and spruce approximately 15 m high. This site