



Project Summary

Meteorology and Air Quality Modeling in Complex Terrain— A Literature Review

Gerard A. DeMarrais and Terry L. Clark

Modeling air quality in complex terrain has been and remains to be a difficult task simply because of the difficulty in parameterizing the complex wind flow regimes. Due to the complex terrain, significant submeso-scale forces are established to perturb the mesoscale wind field. These forces must first be better understood and the algorithms must be developed to adequately simulate the effects of these forces before one can hope to reasonably model air quality in complex terrain. This literature review summarizes over 250 studies of meteorology and air quality modeling in complex terrain for the benefit of those who wish to broaden their knowledge of the subject.

This Project Summary was developed by EPA's Environmental Sciences Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

The concern for air quality in valleys and the effects of plume impaction on mountain slopes in the Appalachian Mountains and in the western United States created the need for accurate air quality simulation models applicable to complex terrain to (1) assess environmental impacts of proposed power plants and smelters and (2) predict the likelihood of violating environmental

standards near proposed or existing plants assuming various emission and meteorological scenarios. The process of developing accurate air quality simulation models for complex terrain has been slow because meteorological variables are greatly influenced by complex factors that are difficult to model adequately. One must understand the effects of terrain on the meteorological variables before it is possible to accurately model the air quality.

As an aid to better understanding terrain effects on meteorological variables in complex terrain, this literature review provides a historical perspective and an extensive bibliography of over 250 studies with a brief description of each study of meteorology and air quality modeling in complex terrain. For the convenience of the user, brief descriptions of these studies are categorized and listed chronologically in 13 tables according to topic. Some listings are found in more than one table since they relate to more than one topic. In addition, an uncategorized, chronological listing of references accompanied by a short description of the study is included.

Topics considered in this report are as follows:

1. Meteorological phenomena observed in complex terrain
2. Theories on flow in complex terrain
3. Long-range transport in complex terrain
4. Windward slope phenomena

5. Leeward slope phenomena
6. Results of field studies – meteorological phenomena
7. Results of field studies – transport and diffusion
8. Models of meteorological phenomena
9. Models of transport and diffusion
10. Numerical, statistical, and computer simulation studies
11. Wind tunnel, water channel, and other laboratory experiments
12. Isolated mountain studies
13. Summary reports

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The complete report, entitled "Meteorology and Air Quality Modeling in Complex Terrain—A Literature Review," (Order No. PB 82-200 247; Cost: \$12.00, subject to change) will be available only from:

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5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650*

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