

Inversion Methods in
Atmospheric Remote Sounding

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INVERSION OF PASSIVE MICROWAVE REMOTE

SENSING DATA FROM SATELLITES

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Global passive microwave observations from Earth-orbiting satellites have mapped humidity and liquid water over ocean, temperature profiles, ice and snow, and other geophysical parameters. Future satellites will extend the altitude range above 100 km and will expand the list of trace constituents that can be monitored.

In most applications, the inversion problem is adequately approximated as linear with jointly Gaussian statistics, and, thus, a linear retrieval performs well. In some cases, the problem is typically factored into a decision process followed by appropriate linear or quasi-linear processes. Certain problems, however, require more powerful nonlinear or nonstationary procedures, such as Kalman filtering.

I. INTRODUCTION

Passive microwave sensing techniques are employed in geophysics, radioastronomy, biomedical and other areas. The special value of these techniques results primarily from the facts that

1. microwave receivers can sense thermal radiation with one-second sensitivities as high as 10^{-2} K.

2. microwave radiation penetrates most matter much more readily than does infrared radiation, which is the usual alternative technology; and

3. many gases have microwave resonances which can readily be resolved, and which permit observation even in some cases where