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Spaceborne passive microwave sounding for ABL

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The Atmospheric Boundary Layer (ABL) is a key object in weather forecasting and climate prediction studies (especially for catastrophic high-impact weather and climate events), and is also a core link in the scientific understanding of the impact of weather and climate on ecosystems and living environments. Obviously different from the upper free atmosphere, the ABL is temporally and spatially variable and is an important pathway for water vapor exchange between the Earth and the atmosphere.

This study demonstrates the potential of satellite-borne microwave radiometer in boundary layer detection, proposes a feasible design scheme to realize satellite-borne passive microwave downward-looking atmospheric boundary layer detection, and focuses on solving the following three problems: (1) Based on the temporal and spatial evolution characteristics of the boundary layer, the authors propose a systematic scheme with detailed channel specifications, and through the systematic optimal design and reasonable error allocation and model analysis, channel sensitivity (not less than 0.5K) can be improved, especially under the very narrow bandwidth channel to ensure the high sensitivity detection. (2) Consider the channel frequency, polarization, sidebands, bandwidth and other parameters, using the channel selection optimization algorithm, intelligent and effective microwave hyperspectral will be designed to achieve the high vertical resolution (100-meter level). (3) Based on the mechanism of

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atmospheric detection and the boundary layer measurement database, it will study all-weather multi-dimensional boundary layer meteorological information and turbulence characteristics, explore the triggering signals and mechanisms of pre-disaster weather such as strong convection, reveal the mechanism of cloud and rainfall evolution in the lower atmosphere, improve the fine prediction of strong convection and precipitation, and provide technical support for the expansion of the functions of a new generation of meteorological satellites.