应用气象学报 Journal of Applied Meteorological Science



# 风廓线雷达探测大气返回信号谱的仿真模拟

Simulation of Return Signal Spectrum of Wind Profile Radar



**基金项目**：资助项目：国家自然科学基金项目（41075023）,公益性行业（气象）科研专项（GYHY20090603）

| 作者 | 单位 |
| --- | --- |
| 王 莎 | 成都信息工程学院，成都 610225;中国气象科学研究院灾害天气国家重点实验室，北京 100081 |
| 阮 征 | 中国气象科学研究院灾害天气国家重点实验室，北京 100081 |
| 葛润生 | 中国气象科学研究院灾害天气国家重点实验室，北京 100081 |

**摘要：**

利用2008年1—9月北京延庆地区对流层CFL 08风廓线雷达和2009年7—12月广东东莞地区边界层CFL 03风廓线雷达晴空大气探测资料，对大气返回信号功率谱密度分布及雷达系统噪声幅度统计特征进行分析。基于大气返回信号的谱分布符合高斯分布的统计结果，采用高斯模型对大气返回信号谱进行模拟；雷达系统噪声是白噪声，其谱线幅度的统计特征呈高斯分布，在此基础上，通过生成高斯分布随机函数对雷达探测输出信号进行信号谱分布的仿真模拟，并采用雷达探测信号的谱参数对仿真模拟进行检验，效果较好。该文应用仿真模拟的数据，对风廓线雷达信息处理方法及其处理精度进行了初步试验和分析。

**关键词**：风廓线雷达 大气返回信号 信号仿真

Abstract:

Wind profile radar uses coherent accumulation technology to improve sounding sensitivity, which can obtain high resolution spectral data and entire spectrum information of return signal compared to the Doppler weather radar, so it is applied in precipitation, cloud body structure detection and research aspects widely. The concrete implementing schemes of noise signal processing and spectrum parameters extraction leads to the differences in ability of extraction the useful signal from atmosphere return signal and estimation accuracy, so the method of signal processing and information extraction is the key technologies of signal process.The simulation of radar return signal is an important method to evaluate ability of extracted information. Based on the clear sky atmospheric detection data of different types of wind profile radars which are placed at Yanqing of Beijing and Dongguan of Guangdong, both the power spectral density distribution of atmospheric return signals and the statistical characteristics of radar system noise amplitude are analyzed. The distribution of atmospheric return signal is Gaussian distribution. Radar system noise is white noise, the noise amplitude statistical characteristics presents Gaussian distribution. Based on this, radar output signal is simulated by Gaussian random function generating method. Comparison is conducted between the detected and simulated signal spectrum parameters 1000 times, showing good accordance, the average relative error of the average signal power for CFL 08 wind profile radar is 2%, the error of average Doppler velocity is 3%, the average relative error of spectral width is 1%; the average relative error of the average signal power is 3% for CFL 03 wind profile radar, the error of average Doppler velocity of which is 2%, and the average relative error of spectral width of which is 2%. Furthermore, preliminary test and analysis for wind profile radar information processing method and its processing precision are carried out by using the simulation data.

Keywords:wind profile radar atmospheric return signal signal simulation

王 莎,阮 征,葛润生.风廓线雷达探测大气返回信号谱的仿真模拟[J].应用气象学报,2012,23(1):20~29.Wang Sha,Ruan Zheng and Ge Runsheng.Simulation of Return Signal Spectrum of Wind Profile Radar[J].Journal of Applied Meterological Science,2012,23(1):20~29