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信息科学

系统参数对激光测高仪海洋测距和回波脉宽影响

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摘要：星载激光测高仪的回波时间重心和脉冲宽度等系统参数对常见海态条件下的测距和反演精度有重要影响。本文根据菲涅尔衍射理论、海洋表面镜面反射理论、海洋波高和斜率统计特性以及激光测高仪回波误差理论，推导并更正了激光测高仪海洋回波光子数表达式。首次完整推导出了影响海洋回波重心和脉宽因素的表达式，证明了回波参数主要受发射脉冲宽度、测量天底角、指向角抖动和海洋表面上方风速影响。除风速为表面特性影响外，其余为系统参数影响。结合地球科学激光测高系统（GLAS）参数对其海洋回波的测距和脉宽精度做了定量分析，得出不同风速GLAS的海洋表面单回波测距误差为2~15 cm，脉宽标准差为0.5~3.5 ns。推导结果对优化设计用于海洋表面测量的星载激光测高仪系统参数、提高回波反演目标特性精度很有意义。

关键词：激光遥感 激光测高仪 激光测距 回波脉宽 海洋表面模型 地球科学激光测高系统

Effect of system parameters on ranging and pulse width in ocean satellite laser altimeter system

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Abstract: The system parameters such as the centroid and pulse width of a laser altimeter system have great effects on its accuracy in ranging and inversion under the condition of a common sea state. Therefore, this paper deduce the functions referred to influencing factors of centroid and pulse width and corrects the received photon function of ocean surface according to the theory of Fresnel diffraction, the character of specular reflection, statistical regularity of ocean surface profile and the error theory of laser altimeter systems. It gives complete influencing factors on the centroid and pulse width, which include the transmitted and received instruments, nadir angles, pointing jitters and wind speeds. Among them, the first three factors are all system parameters, and the wind speed is a surface characteristic. Combined with the parameters of Geoscience Laser Altimeter System (GLAS), the error of range and the accuracy pulse width are calculated and analyzed. The results show that the ranging error of GLAS is from 2 to 15 cm, and that of the pulse width is from 0.5 to 3.5 ns under different wind speeds. The obtained conclusion is significant for the design and accuracy analysis of ocean laser altimeter systems.

Keywords: laser remote sensing laser remote sensing laser ranging pulse width ocean surface profile Geoscience Laser Altimeter system (GLAS)

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