A MODIFIED WIND VECTOR RETRIEVAL ALGORITHM FOR POLARIMETRIC SCATTEROMETER

Xuetong Xie[1,2], Mingsen Lin[1] ,Zhou Huang[3] ,Juhong Zou[1], Dongxuan Tian[4], Lixia Liu[4], Xiaoning Wang[4] , Shiwei Dong[4]

[1] National Satellite Ocean Application Service, Beijing, P. R. China
[2] ATR State Key Lab, National University of Defense Technology, Changsha, P. R. China
[3] Institute of Remote Sensing and Geographic Information System, Peking University, Beijing, P. R. China
[4] National Key Laboratory of Space Microwave Technology, Institute of Space Radio Technology, Xi'an, P. R. China
Email: xiexuetong@yahoo.com.cn

1. INTRODUCTION

Currently Scatterometer has become the main instrument that can accurately measure the wind speed and diretion above the ocean surface. However, the wind vector retrieval accuracy of the conventional co-polarized scatterometer is relatively lower due to the limited information acquired by the instrument. Both Experiments and theoretical analysis indicated that the wind vector retrieval accuracy can be further enhanced dramatically by using the polarimetric scatterometer, which measures the backscatter from the ocean surface under full polarization[1-3]. Based on the work by Tsai and Yueh, we developed a prototype simulation software for the spaceborne conically scanning polarimetric scatterometer, which is similar to SeaWinds in geometric parameters but can measure the co-polarized and cross polarized backscatter energy simultaneously. Although the performance simulation indicated that the polarimetric scatterometer can significantly improve the wind retrieval accuracy with respect to the conventional scatterometer by using the traditional MLE retrieval algorithm under the same input parameters, the distribution of objective function of the conically scanning polarimetric scatterometer varies with the wind vector cell position across the ground track. Simulation experiments showed that the distribution of the objective function around the local maxima is more flatter than that in the middle region of the ground track along the wind direction. According to this characteristic of the objective function, we derived a modified wind vector retrieval algorithm for polarimetric scatterometer in this paper. Experiments indicated that this algorithm could further improve the retrieval precision of the polarimetric scatterometer, especially in nadir and outer edge regions of the ground track.

2. THE MODIFIED ALGORITHM

Based on the characteristic of the objective function, we divided the whole ground track into three regions: (1) nadir region; (2) middle regions; and (3) outer edge regions. In the nadir and outer regions, we modified the traditional MLE algorithm by extending the range of wind direction of the first and second ambiguities using the rate of objective function along the wind direction as the criteria. The main reason for us to choose the rate of objective function as the extension criteria instead of the probability proposed by Stiles[4] is the lower computation and easiness of realization required by the retrieval algorithm.

Modifications were also made for the circle median filter algorithm in order to let it select more possible wind directions in the process of ambiguity removal. The modified ambiguity removal algorithm in this paper consisted of three main steps as follow:

Step1 Initialize the wind field using the first ambiguities for the middle regions, and perform the filter along column direction from the outer to inner boundary of the middle region.

Step 2 Taking the filtered wind field by step 1 as reference, execute the extending filter from the boundaries of the middle regions to the nadir and outer regions respectively. The moving direction of the filter window is also along the column.

Step 3 Taking the filtered results by step 1 and step 2 as the initial wind field, perform the circle median filter for the whole ground track. The moving path of the filter window is along row direction.

It is worth to be noted that the modified filter algorithm should consider more wind directions to determine the appropriate circle median for each center wind vector cell of the filter window when the filter window lies in the nadir and outer regions.

3. CONCLUSIONS

In order to eliminate the effect of some individual orbit on the wind retrieval results, we performed the wind vector retrieval using simulated data of 10 oribts. The simulation experiments demonstrated that the modified algorithm for polarimetric scatterometer can further enhance the retrieval accuracy in the nadir and outer regions of the ground track with respect to the traditional algorithm. Up to about 2° improvement in wind direction retrieval can be made in the nadir region. From the experiment results, we can conclude that the polarimetric scatterometer is a promising technology to further improve the wind retrieval accuracy, and the modified algorithm can be used in the wind retrieval of the conically scanning polarimetric scatterometer.

4. REFERENCES

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