SOIL CONCENTRATION REVERSE METHOD BASED ON SPECIAL SPECTRAL POSITION

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1. INTRODUCTION

Soil is an important parameter on water quality and plays a key role in water quality evaluation, especially for inland water. Many remote-sensing methods have now been developed to reverse soil concentration [1]. However, in natural water, the existence of Chla damages the precision of soil concentration reverse. In order to study the Chla's influence to soil spectral curve, a water-tank experiment is designed to controls the Chla and soil concentration. Through the analysis of spectra curve, we try to find a method to remove Chla's influence and thus improve the soil reverse precision.

Based on analysis, the possible positions that can be used to investigate soil concentration reverse are reflective apex of 532nm and peak value places (686nm, 730nm and 830nm). 686nm is in the range of 550-709nm (Chla influence range), so we use positions of 532nm, 730nm and 830nm to apply methods of reversing soil concentration.

2. Methods and Result

Choosing spectral derivatives at 532nm, 730nm and 830nm, we develop a regress method.

The software of SPSS is used in regression. The relation coefficient between 532nm reflective apex locations and soil concentrations is 0.969. There is high correlation between two series of data. The polynomial relative formulas are as follows.

$$y = 0.7581x^2 - 818.22x + 220869 \qquad (1)$$

R^2=0.9911

$$y = 0.00044x^3 - 385.348x + 138625.5 \qquad (2)$$

R^2=0.9900

where y is SS concentration (mg/L), and x is 532nm reflective apex location (nm). two regress formulas have a high precision in high soil concentration water (the relative error is under 5% when soil concentration is higher than 540 mg/L). The precision is low in low soil concentration water (the relative error is between 30%-40%). The formulas do not fit for clear water (soil concentration is lower than 50 mg/L, red background).

The relation coefficient between 730nm SD values (*1000 in process because of too little value) and soil concentrations is -0.947. There is high negative correlation between 730nm SD values and soil concentrations. The polynomial relative formulas are as follows.

$$y = 12328x^2 + 6351x + 856 \qquad (3)$$

R^2=0.981

$$y = -16071x^3 - 5660x^2 + 150 \qquad (4)$$

R^2=0.9886

Where Y is SS concentration (mg/L); and x is 730nm SD value. these two regress formulas have a high precision in high soil concentration (the relative error is under 5% when soil concentration is higher than 900 mg/L); and the precision is low in low soil concentration water (relative error is between 20%-30%); and Cubic polynomial is unfit for clear water (soil concentration is lower than 50 mg/L, red background).

The relation coefficient between 830nm SD values (*100000 in process because of too little value) and soil concentrations is -0.971. There is high negative correlation between 830nm SD values and soil concentrations. The polynomial relative formulas are as follows.

$$y = 0.73x^2 + 17.2x + 179 \qquad (5)$$

R^2=0.9928

$$y = -0.0164x^3 - x^2 - 38x - 332 \qquad (6)$$

R^2=0.996

Where Y is SS concentration (mg/L); and x is 830nm SD value. these two regress formulas have a high precision in middle and high soil concentration (the precision is under 8% when soil concentration is higher than 360 mg/L). Cubic polynomial reverse result is the best with the relative error under 8%.

3. CONCLUSION

At the three characteristic positions of 532nm, 730nm and 830nm, Chla slightly influences soil curve. The regress method in 830nm has the best reverse result. The relative error of cubic polynomial is under 8% which is much less than average error of soil RS reverse methods. However, 830nm SD cannot be obtained by multi-spectral image, so it is hard to apply this method to multi-spectral RS images such as TM and MODIS. With the development of hyper-spectral RS technology, it can be expected that this RS method based on spectral shape or position will be widely applied in the future.

3. REFERENCES

[1] IOCCG (2000). Remote sensing of ocean colour in coastal and other optically complex waters. In S. athyendranath (Ed.) Reports of the International Ocean Colour Coordinating Group no. 3, IOCCG. Canada: Dartmouth.