SOIL MOISTURE INVERSION AND VALIDATION BASED ON

NEW REMOTE SENSING PLATFORM

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1. Introduction

Soil moisture not only is an important parameter in precision agriculture, but is the main parameter in crop condition monitoring. The exact inversion of soil moisture is able to provide a reliable basis for precision agricultural data, and it can also provide accurate scientific basis and programs in crop management.

The project is one of the tasks in research of verification field on new remote sensing platform, and the research is one of National High-Tech Program Ministry of Science and Technology, China (Grant2008AA121806).

2. Methodology

Our experiments used PDI(perpendicular drought index，PDI), MPDI(modified perpendicular drought index，MPDI)   to monitor and evaluate soil moisture in the research field. In the PDI-PVI Cartesian Coordinate System, we found when PVI=0, soil moisture could almost replace by PDI (Fig 1). And, any points in the triangle ABC represent the soil moisture in any place. So the intersection of axis and line which connected between A and any points in the triangle can replace the soil moisture. According to the Triangle similarity theory, we can calculate modified PDI to replace the soil moisture. In the Fig 1, point A is the point of totally covered by vegetable, and OF is the modified PDI, so
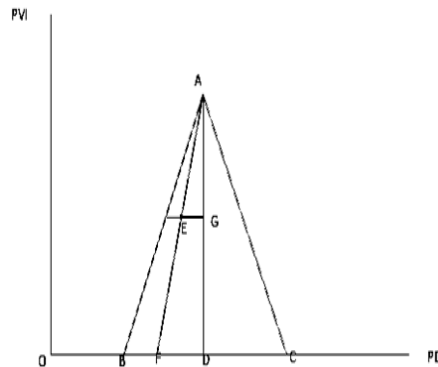
$$OF=OD-DF=OF-AD*EG/AG$$

Fig 1 points distribution in the PDI-PVI

We used TDR300 to measure soil moisture in demonstration area (Fig 2) in September 3, 2011.
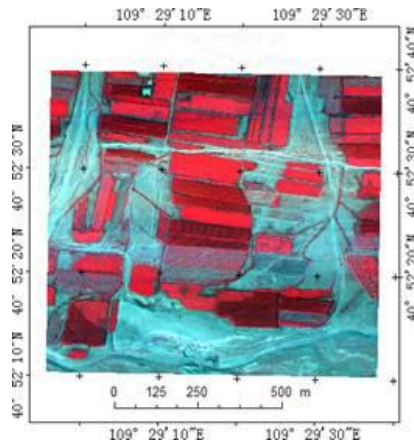
Fig 2 soil moisture in experimental area

Meanwhile, we calculated the PDI, MPDI according the measuring data (Fig 3), and modified PDI also can be seen in Fig 4.
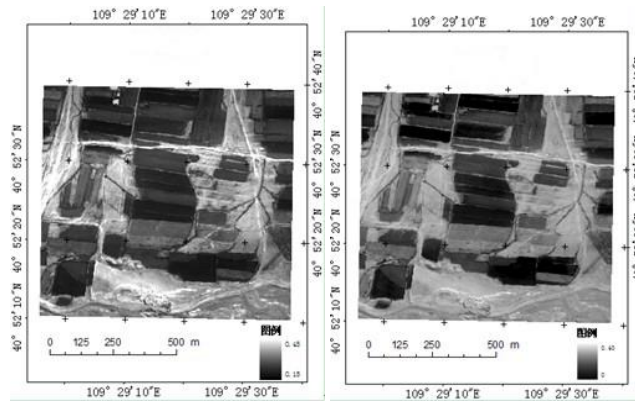

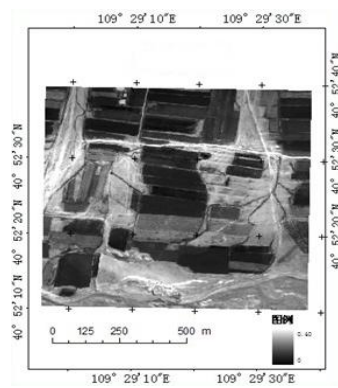Fig 3 Distribution of PDI and MPDI

Fig 4 Distribution of modified PDI

3. Results and discussion

We find relationship of PDI, MPDI and measured soil moisture in 3.8cm with TDR (Fig 5). Comparing to the two parameters, we calculate scatter diagram between modified PDI and measurements (Fig 6).
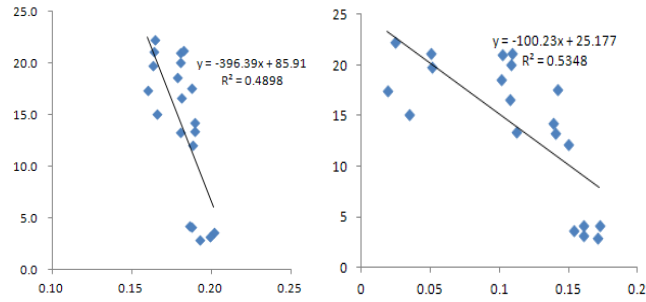
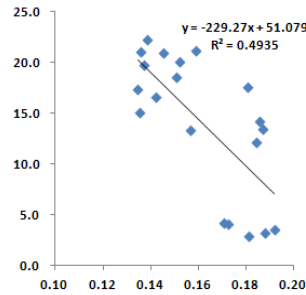Fig 5 relationship of PDI, MPDI and measured soil moisture

Fig 6 relationship of modified PDI and measured soil moisture

From the above figures, we notice that there are strong correlations between PDI, MPDI, modified PDI and measurements, R^2 are 0.4898, 0.5348 and 0.4935, and RMSE are 0.04768, 0.05283, and 0.04750.

However, the results have some contradictions with our expectation, the value of MPDI are better than the value of PDI, even the result of modified PDI. The first reason may be the large amount of cloud in that day affected relevant reflectance. And another reason may be there are a great number of vegetable in demonstration area, however, according Band 2, 3, 4 radiance histogram, we notice that most vegetable located in the low brightness area, and this eventually results the deviation of calibration. But we can still find that these three parameters adapt to monitor and evaluate the soil moisture in the demonstrate area.

However, this new vegetation index is needed to be validated with ground measured data.

Key words: Soil Moisture, PDI, MPDI, New Remote Sensing Platform, modified PDI