Comparative Analysis and Evaluation of Various Mathematical Models for Stereo IKONOS Satellite Images

Nagawa ELASHMAWY, Yasser ELMANADILI and Hazem BARAKAT, Egypt

SUMMARY

This paper presents two mathematical models for stereo IKONOS imagery restitution and summarizes the results of their assessment using the first stereo pair acquired in Egypt over an area in the south-east of Cairo. A well distributed set of 25 ground points was selected on the stereo images and then surveyed using differential GPS static technique. These points were then divided into control and check points for the evaluation of the two models.

Most of the mathematical models incorporated in the software packages that were used in this research (ERDAS OrthoBase, PCI OrthoEngine, Z/I Imaging SSK) are based on the rational function model (RFM). This model uses the rational polynomial coefficients (RPCs) supplied with the images, since IKONOS precise sensor and orbit parameters are not released by the satellite company. An alternative model was also presented based on the Affine transformation between the 2D image coordinates and the 3D ground coordinates. A computer program was developed to implement the 3D Affine projection mathematical model.

Several experiments were performed to evaluate the two mathematical models for both single and stereo IKONOS images. Results of the experiments were presented and comparisons were carried out. It was found that sub-meter horizontal accuracy and 1.3-1.7m vertical accuracy can be obtained using either the refined RFM model or the 3D Affine projection model for the stereo images.

Finally, conclusions and recommendations for further research were presented especially regarding the development of rigorous modeling approaches for stereo high resolution satellite images with available precise sensor information such as QuickBird.

TS 27 – Remote Sensing and Photogrammetry   1/16
Nagawa El Ashmawy, Yasser Elmanadili and Hazem Barakat
TS27.3 Comparative Analysis and Evaluation of Various Mathematical Models for Stereo
IKONOS Satellite Images

From Pharaohs to GeoInformatics
FIG Working Week 2005 and GSDI-8
Cairo, Egypt, April 16-21, 2005