PROCESSING FOR AIRBORNE INTERFEROMETRIC SAR DATA WITH HIGH SQUINT

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1. INTRODUCTION

In this paper, some factors which caused the squint in the airborne dual-antenna interferometric SAR (InSAR) systems are firstly discussed. Then, the interferometric capability influenced by the squint is analyzed in brief. To eliminate such adverse effects, several measures are discussed and a novel processing approach is proposed. Using the inertial measure unit (IMU) data to resolve the Doppler ambiguity and moving azimuth windows according to the Doppler centroid varying in different range, as well as combining the auto-registration imaging algorithm, the novel approach not only can compensate the squint effect and motion error directly at the imaging processing stage, but also can improve the coherence and restrain the interferometric phase error of the image-pair. The simulative and practical results indicate that the proposed approach is very suitable for the processing of the data with a high squint for a dual-antenna airborne InSAR system with its efficiency in improving the image quality and enhancing the interferogram and coherence.

2. REASONS DISUCSSION

Profit from its fixed length of the baseline and elimination of the time correlation, the airborne single-pass or dual-antenna InSAR system has shown higher production capacity and wider development potential in the precise DEM generation for a large area[1].During the topographic mapping for a mountain area using a high performance airborne InSAR system, it is necessary to implement several flights in various directions in order to eliminate the overlay and shadow effect. Affected by the various wind directions, the heading of the airplane will vary from the flight direction, therefore induce squint effect in the raw data.

Analyzing the fact situations, the following factors may cause a squint in the InSAR system:

- Antenna mounting error
- Vehicle attitude variety
- ….

3. THEORY ANALYSE

The presence of a squint in the InSAR system will not only cause the spectral shift both in the azimuth and range, but also cause the defocus in the azimuth [2].

In order to eliminate the effects causing by the squint, the following measures can be inducted during the imaging process:

- Resolving Doppler ambiguity using the inertial navigation
- Moving azimuth windows according to the Doppler centroid varying in different range

4. DATA PROCESSING

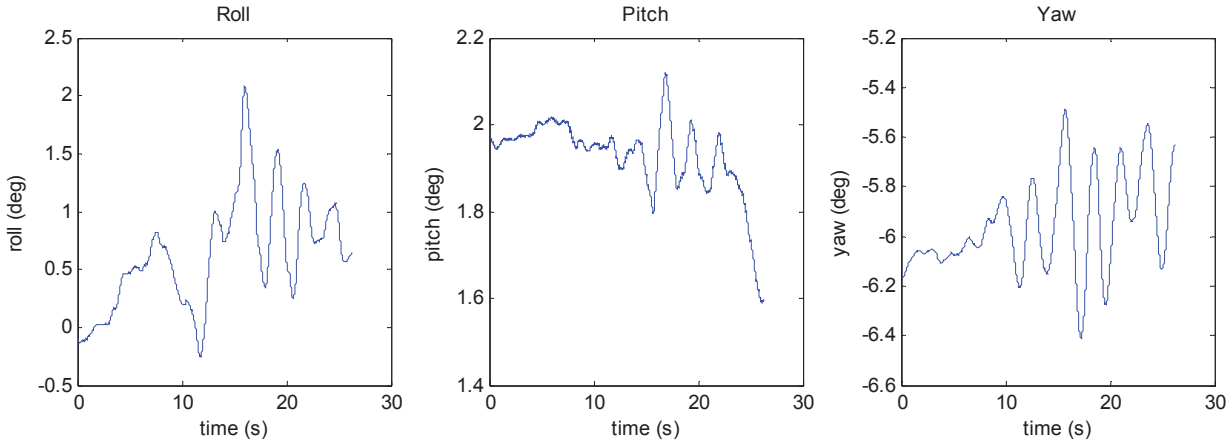
For the purpose of obtaining a high precise DEM from the airborne InSAR data with a high squint, a novel approach using the IMU data to resolve the Doppler ambiguity and moving azimuth windows according to the Doppler centroid varying in different range, as well as combining the auto-registration imaging algorithm is presented in this paper[3][4].

5. RESULTS

Using the approach discussing above, some data acquired by an airborne InSAR system with the system parameters in table 1 are processing. Figure 1~2 show the results of such data.

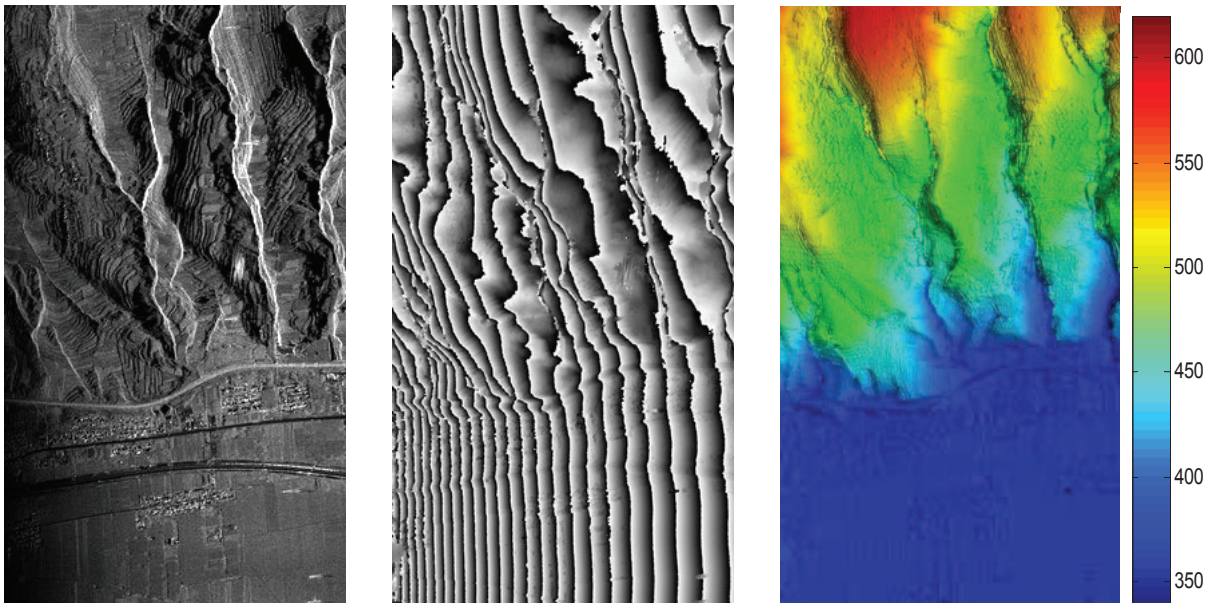
Table 1 System Parameters

Wavelength(m)	0.03125	PRF(Hz)	1250	Baseline(m)	2.2
Bandwidth (MHz)	250	Velocity (m/s)	101	Baseline tilt(°)	0
Viewing (°)	50	Altitude (m)	3300		



(a) (b) (c)

Figure 1 Vehicle Attitude Varying (left to right: Roll, Pitch and Yaw)



(a) (b) (c)

Figure 2 Processing Results (left to right: SAR image, Interferogram and DEM)

6. CONCLUSION

A novel approach which not only can compensate the squint effect and motion error directly at the imaging processing stage, but also can improve the coherence and restrain the interferometric phase error of the image-pair is proposed. The simulative and practical results indicate that the proposed approach is very suitable for the processing of the data with a high squint for a dual-antenna airborne InSAR system with its efficiency in improving the image quality and enhancing the interferogram and coherence.

7. ACKNOWLEDGE

Thanks to the HTRDP (No. 2007AA120302) and the NKBRP (No. 2009CB724003) for funding. Thanks to Tang Xiaoqing for the prophase work.

8. REFERENCES

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