Traffic Monitoring with Spaceborne SAR - Theory, Simulations, and Experiments

Abstract:
This paper reviews the theoretical background for upcoming dual-channel radar satellite missions to monitor traffic from space and exemplifies the potentials and limitations by real data. In general, objects that move during the illumination time of the radar will be imaged differently than stationary objects. If the assumptions incorporated in the focusing process of the synthetic aperture radar (SAR) principle are not met, a moving object will appear both displaced and blurred. To study the impact of these (and related) distortions in focused SAR images, the analytic relations between an arbitrarily moving point scatterer and its conjugate in the SAR image have been reviewed and adapted to dual-channel satellite specifications. Furthermore, a specific detection scheme is proposed that integrates complementary detection and velocity estimation algorithms with knowledge derived from external sources as, e.g., road databases. Results using real SAR data are presented to validate the theory.