Atmospheric artifacts in ERS DEMs. ISTAR's experience over multiple sites and large areas.

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Abstract:

Since 1991 ISTAR has developed a DEM processing chain together with CNES
(French Space Agency) as an alternative to SPOT for DEM production.
Feasibility was demonstrated in 1993, a pre-operational software was set
up in 94-95 and production tests on a large scale took place in 1996.
Processing starts from raw images and includes DIAPASON software from
CNES for interferogram generation. We then use three ISTAR modules,
namely phase unwrapping, baseline adjustment with Ground Control Points
and last, geocoding of the unwrapped phases to get the DEM. To validate
this chain on a large scale, multiple test sites were chosen. This
includes Utah (2 ERS 1 pairs, 10,000 sq. km), Brittany (4 ERS 1 triplets,
30,000 sq. km), Luxemburg (10 tandem pairs, 40,000 sq. km), Angouleme (1
triplet, 10,000 sq km), Nevada (12 tandem pairs + 6 ERS 1 pairs, 40,000
sq km) and Australia (1 triplet 10,000 sq km). The results show large
perturbations probably due to refractive index variations (probably cloud
cover). These large perturbations introduce topographic elevation errors
up to 3 phase cycles (60m with a 400m baseline, 300m with a 100m
baseline). This is a severe limitation for DEM generation: with large
baselines the error is less important but phase unwrapping is difficult
and the decorrelation noise is high, whereas with small baseline the
accuracy is very poor.