Figure 11 shows in parallel, the seed DSM computed in ground range along with the improved one obtained after 25 iterations.

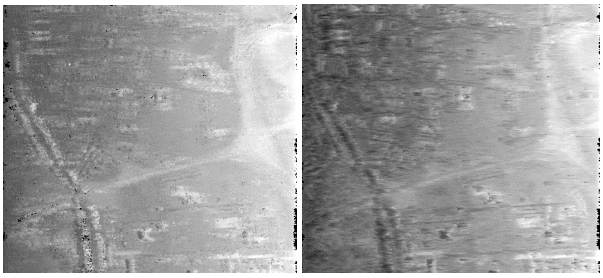
Figure 11: Seed and improved DSM

While the simulated SAR scene is clearly improved after 25 iterations, improvement is less evident observing the obtained DSM.

Figure 12 represents a DSM sample line, in ground range, before and after improvement. Globally, we observe that the modified DSM appears less noisy and more structured. At this stage, it is difficult to assert if the reached structure is a correct representation of the observed scene and if it can be used in man-made structure detection or identification. But, we can conclude that the achieved structure, together with the proposed model and the used parameter set, allows simulating a SAR intensity image close to the really detected one.

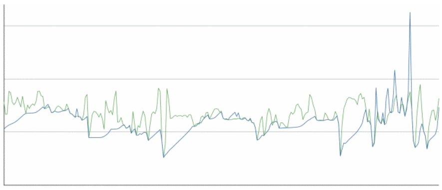
Figure 11: DSM sample line before (green) and after (blue) improvement

Obtaining a DSM representation closer to the observed one will require testing the influence of all parameters as also improving our simplistic model. But, the main point is that we performed a proof of concept of the proposed principle: "Iterative DSM improvement through SAR scene simulation and comparison with observed one".

Since the proposed method is global and does not require any a priori knowledge on buildings shapes and orientation, it can be envisioned as a first improvement of the DSM to be used in more sophisticated and context-based man-made structure detection techniques.

Nevertheless, if stable, the reached simulated SAR intensity image stays, for the moment, still far from the really detected SAR intensity image. We have well concentrated the energy where it should, but still not with the degree of details offered by the real data. One must thus keep in mind that the obtained improved DSM is just one possible representation of the observed scene. Other representations are possible provided simulation model and set of parameters that are used are optimized

6. CONCLUSIONS

We developed the tools required for simulating a SAR intensity image in slant range geometry starting from a seed DSM given in ground range and issued from InSAR processing.

Our objective was first to perform a proof of concept, showing that in its principle, it is possible to perform an iterative improvement of a seed DSM by simulation of SAR intensity image in slant range – azimuth projection and comparison with the corresponding detected one. Therefore, we developed a simplistic model allowing to associate a backscattered energy to ground range – azimuth resolution cells with respect to local heights.

Effort was principally put on the reliability and accuracy of back and forth referencing and projection processes.

Clearly, the proof of concept is performed: comparing simulated and detected backscattered energy in slant range allows correcting iteratively the underlying DSM.

The process converges monotonically toward a DSM structure that is thus one possible representation of the observed scene. Monotonic convergence shows that the obtained solution is stable and is, in itself, the result that had to be obtained to validate the proposed iterative process.

Complementary analysis must be performed to assess if the derived DSM can efficiently be used for man-made structures detection.

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