

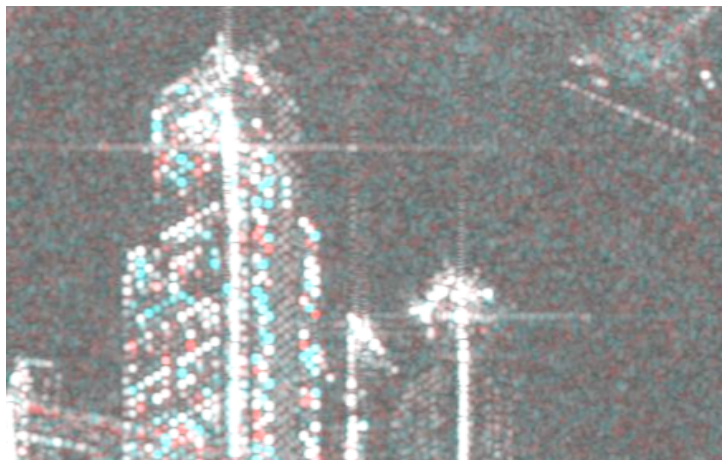
Going, Going...

For the past decade there have been a growing number of SAR applications that exploit multiple coherent SAR data collects of the same area. They go by the names of Permanent Scatterer Interferometry (PSI), Small Baseline Interferometry (SBAS) and an assortment of proprietary and otherwise related algorithms. The power of these multi-scene approaches is impressive. Not only can subtle ground and target motions be detected (at the millimeter level) through exploitation of the data stack, the redundancy of data can be used to estimate and correct otherwise limiting "noise" sources such as tropospheric delay and unknown target heights. Of course, one person's noise is another's signal and, for instance, knowledge of target height is a very useful measure in and of itself... but that's a topic for later.

These new approaches for SAR data exploitation were pioneered in Europe using widely available data from European spaceborne SAR systems. ERS-1, ERS-2 and the follow-on mission ASAR (flown on the Envisat platform) were critical to the development of these algorithms. Without this easily accessible and affordable data, as well as the well-controlled repeat orbits, these new techniques would have not been possible. Like many other scientific and engineering disciplines, access to high-quality data is the key to innovation in the SAR world.

But the landscape with respect to civil SAR systems is changing. The first-generation, or legacy SAR systems represented by ERS and ASAR, have reached their useful lifetimes. (Only ASAR is really available now, and only in a limited sense.) Recently a much more sophisticated generation of SAR sensors have been launched by Germany, Italy and Canada. These new systems have multiple polarizations and much higher resolutions. But, unfortunately, accessibility to the data for most users has been significantly reduced.

Many scientists have had free, or very inexpensive, access to legacy SAR data through various consortiums and academic groups. Researchers, grad students and even undergraduate students, have been able to contribute to the development of state-of-the-art SAR



exploitation techniques. If you had a computer and some disk space, you could be a player, because the data itself was ubiquitous. For commercial companies like Neva Ridge, a 100km x 100km scene could be acquired for \$1,000, and often even significantly less. This sort of pricing made the SAR data quite accessible to all. Development of new techniques flourished. Commercial entities could invest in purchasing a stack of SAR data using internal funds in order to demonstrate some new application to a potential (and always suspicious of the sensor of last resort) customer. This is commercial innovation.

One might think things would have improved with the wonderful new SAR sensors that are now available, and in many ways they have. The high-resolution imagery and polarimetric information now available offer a fresh opportunity to develop new and exciting techniques for exploitation. Applications never before thought possible can now be realistically considered. But accessibility has been drastically reduced through the price of this data. Playing with SAR data has become a rich man's game. As far as I know, large government-sized entities are the only ones who can really afford to invest in a stack of SAR data "on spec." I know Neva Ridge can't afford to spend \$100,000 on a stack of data as an investment with hopes to demonstrate a new application to a customer who might want to order that (now expensive) product in the future.

The costs associated with SAR services will increase due to this new reality. One of the few areas of commercial success in the SAR world involves monitoring areas of interest for ground motion for a number of applications (oil and gas, ground water management, landslide hazards etc.). In many of these cases, SAR is only one of several types of monitoring that are being carried out. It has been a hard fought battle to convince customers to include and fuse SAR results with more traditional ground survey approaches; but the key selling point was that it did not add much cost to the overall project. In short, it was a good value. This is now changing. Justifying and selling this service has become more challenging.

This is not to say the price of SAR data is objectively too high – have you seen the price tag on these spaceborne SAR systems? But the fact is that innovation, both scientific and commercial, and the associated economic impacts made possible through the subsidized legacy sensors will be greatly reduced. It will be large organizations with proprietary development efforts and/or classified requirements that will be users of this data. This is the best way I know of to stymie innovation.

There is a ray of sunshine however. Sentinel-1, the ESA funded C-band SAR mission will be launched in the near future. My understanding of the data policy is that all will have full and open access to the data, and it will be available free-of-charge. Unfortunately, it looks like commercial tasking will not be possible. But in general, this is great news for the continued innovation of SAR exploitation techniques. Kudos (again) to the Europeans!

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