



The growing impact of satellite data in daily life

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Abstract

Satellite images have a growing role in our daily life. Weather previsions, telecommunications, environmental monitoring, these are only some of the fieldworks where space remote sensing data, and related processing techniques, provide extremely useful information to policy/decision makers, scientists, and the general public. The use of new technologies and satellite Earth Observation, in particular, onto everyday life is testified by the recent and forthcoming developments. Satellite data properly managed can be used to measure the structural movements of buildings and infrastructures. It has been demonstrated how long term monitoring of ground displacements might provide useful hints to prevent such dramatic events. Or, in different frameworks, satellite data can be an advanced instrument for intelligence and military purposes, ethic issues assume a key role to properly address the use of satellite technologies.

Introduction

The availability of a new generation of remote sensing instruments has definitely changed the impact of Earth Observation. Satellites orbiting around the Earth are able to provide a continuous view of every point of the surface with unprecedented spatial resolution. Optical (visible) and SAR (Synthetic Aperture Radar) sensors have now reached submetric resolution (see Figure 1), so that they can identify small surface changes. Actually, a large number of Low Orbiting Missions (altitude between 400 and 1500 km) are available (see Figure 2).

In addition, satellite systems provide the user and the decision maker with a huge fan of informations, ranging from the exploitation of water reservoirs, from the gas/hydrocarbon storage/extraction to the deformation of infrastructures, up to applications in military fields (see, for instance, the target detection). Stemming from such scenario, it cannot be postponed the need to investigate and disseminate the use of satellite instruments (see Slonecker E.T. et al., 1998).

In the following pictures some frameworks have been identified: Humanitarian aid and human rights; Immigration and refugees. Among the abovementioned applications, it is not difficult to identify those cases where ethical implications are present. These treatments are not fully developed and customised. The aim is to provide hints for reflecting on the big impact of satellite technologies in our World.



The Citizen in H2020 calls
The role of the citizen and his security is highly emphasized in H2020, the EU Framework Programme for Research and Innovation. In particular, it occurs under the pillar Societal Challenges, the use of societies Protecting freedom and security of Europe and its citizens (see left picture), that contains

life requires a detailed analysis, is quite complex and needs specific law expertise. However some can be easily derived from the scenarios we can easily derive from daily chronicles.

Humanitarian aid and human rights

UNOSAT is home to an advanced centre of excellence for satellite imagery and data analysis operations since 2001. UNOSAT continues the tradition of high quality map and geospatial data production for UN since 2003. In accordance with UNITAR (United Nations Institute for Training And Research) strategic objectives, a geospatial support to to the UN system and other organizations is provided in the following areas of:

- disaster response
- humanitarian operations
- human security and the application of international humanitarian law
- human rights

The Satellite Sentinel Project (SSP) and Amnesty International (Eyes on Darfur) have been using satellite imagery to monitor human rights abuses in Sudan and South Sudan since December 2010. Satellite images have (see Figure 3) shown military outposts and troop movements, and evidence of mass graves and the destruction of villages. See more at <http://www.satsentinel.org> and www.eyesondarfur.org

Satellite imagery has shown the unlawful demolition of thousands of residential buildings in Damascus in Hama in 2012 and 2013, according to Human Rights Watch. The satellite image shows the Mezzeah area of Damascus in February 2013. The second image shows the same area in July 2013. The extent of destroyed residential buildings is visible along this main road in the street. The third satellite image shows hundreds of damaged buildings and impact craters following the week-long government shelling of a neighborhood in the Syrian city of Homs. This satellite image is overlaid with red circles to show destroyed or damaged buildings and yellow circles to highlight craters in open areas such as fields or roads. Human Rights Watch found that 640 buildings had been damaged and at least 950 craters pocked the area.

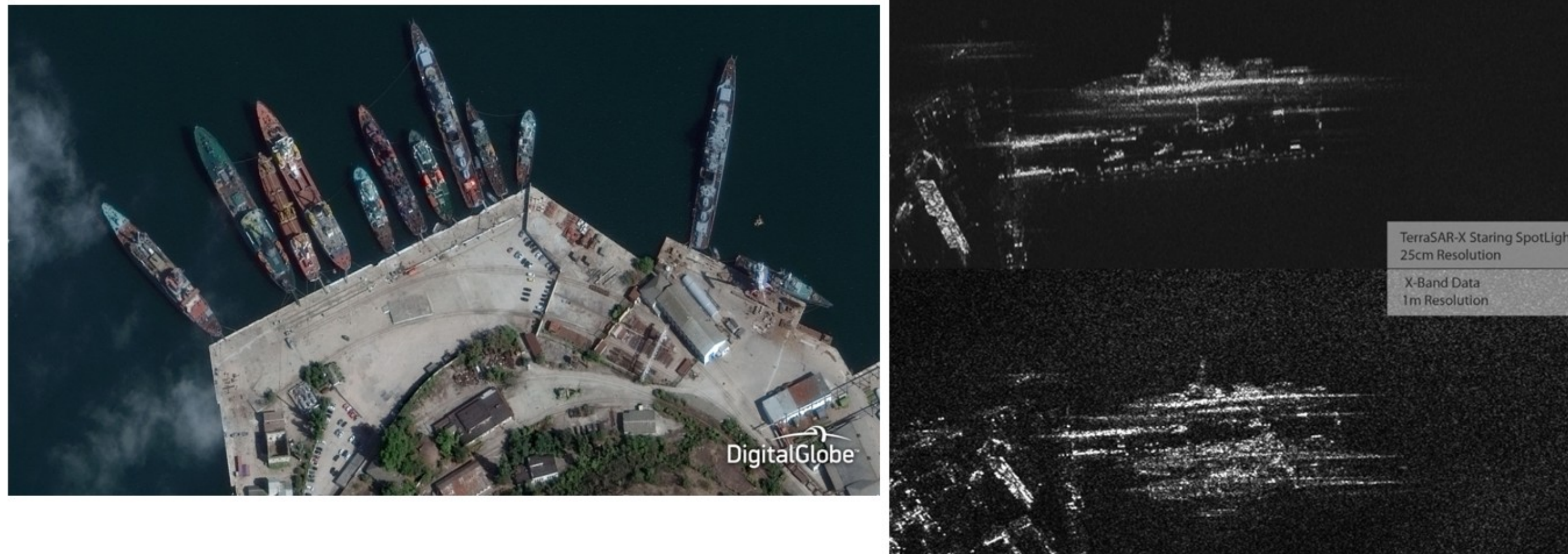


Figure 1 WorldView 3 (left) example in operation at an expected altitude of 617 km. WorldView3 provides 31 cm panchromatic resolution, 1.24 m multispectral resolution, and 3.7 m shortwave infrared resolution. WorldView3 has an average revisit time of less than 1 day and is capable of collecting up to 680,000 km² per day. Example of SAR (Right) TerraSAR-X Spotlight Staring image (up per picture, 25 cm spatial resolution) and 1 m (bottom).

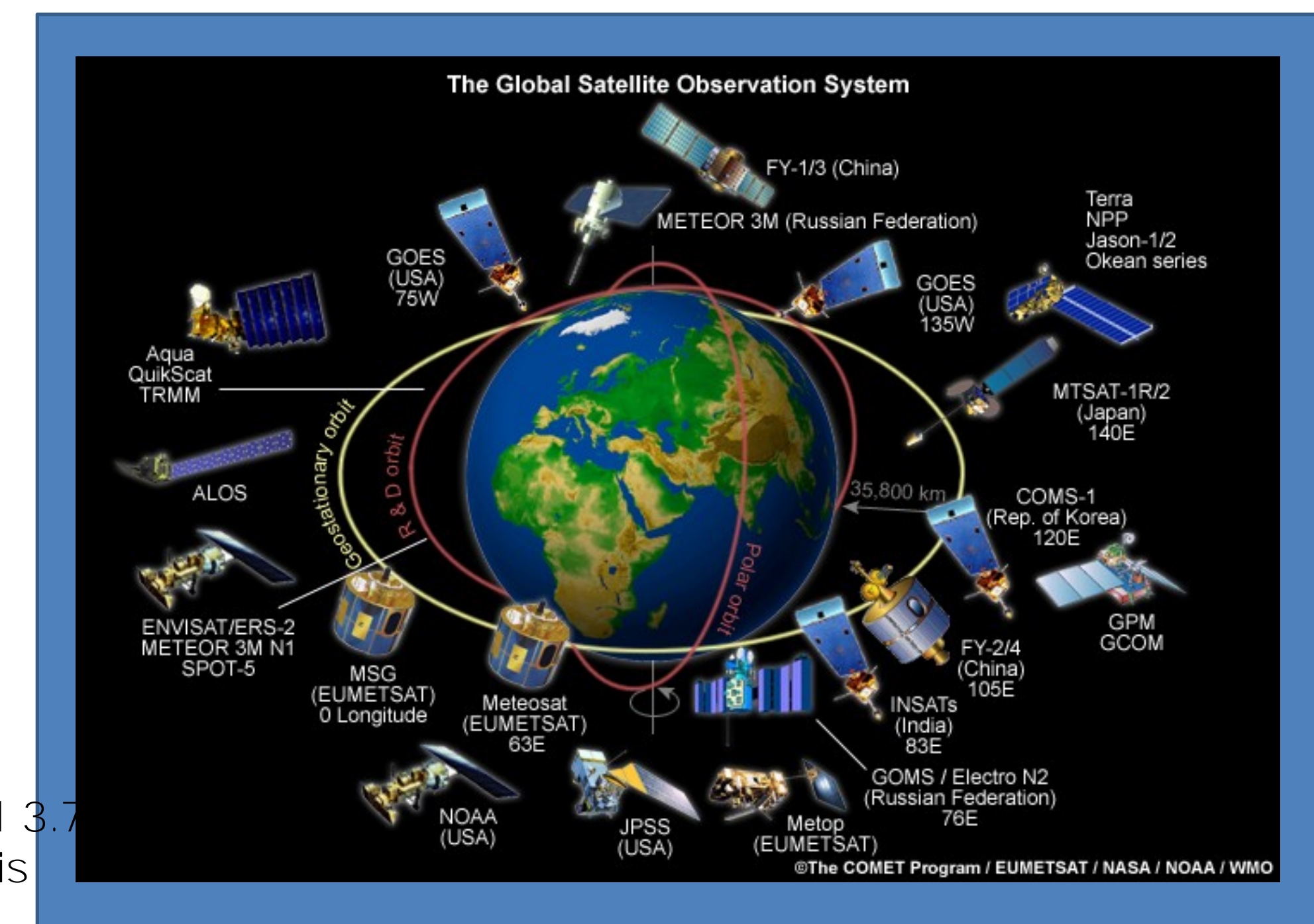


Figure 2 example of commercial Earth Observation satellite missions.

Intelligence and object detection

Several examples of military/intelligence use of satellite images can be simply found. Target recognition, the eastern analysis supporting ongoing activities are applications widely diffused in modern conflicts. Recently, SAR images have been used to detect and measure an underground nuclear test in North Korea not officially declared (Carluccio et al., 2012) (see Figure 6). Such results can be a feature of the ban of nuclear tests.

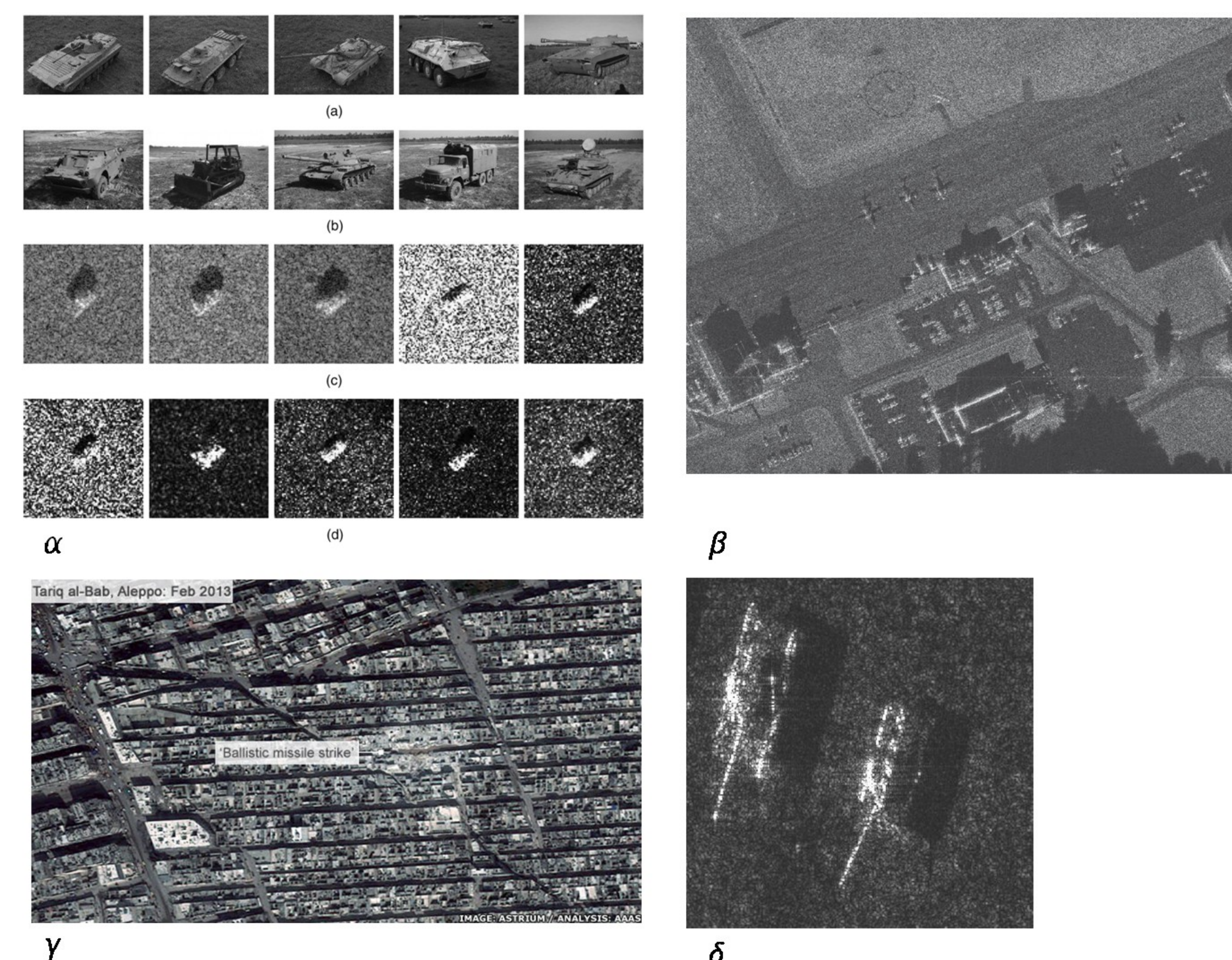


Figure 4 (up) target detection from SAR images and damaged urban areas. (right) effects of underground nuclear tests detected from satellites.

Figure 4 pre and post bombing in Damascus. Six months of destructions are pointed out with yellow and red dots (Imagery Copyright DigitalGlobe Inc.)

Immigration
The dramatic issue of illegal immigration and refugees has requested the support from satellite images. In particular, the maritime authorities are equipped with specific tools for ship identification (see Figure 5)

Figure 5 ship detection tool based on SAR and Optical satellite data

Figure 3 Darfur destructions at different times (Imagery Copyright DigitalGlobe Inc.)