SPACE FOR PEACE? THE USE OF SPACE TECHNOLOGY TO MONITOR CONFLICT TRENDS AND HUMAN SECURITY IN AFRICA

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Since the publication of the first issue of *Conflict Trends* in 1998, several African governments – most notably Nigeria, South Africa, Algeria, Egypt and Kenya – have increasingly applied space science and technology (S&T) to improve human development in their countries. This was confirmed by, *inter alia*, the Second African Space Leadership Conference hosted by the South African Department of Science and Technology in Pretoria in 2007.

Space S&T is no longer the domain of a small clique of so-called space-faring nations such as the United States (US), France, India and Brazil. Increasingly, commercial actors are operating in the space industry, which makes satellite images, for example, available to its clients. Google Earth[1], is also freely available, but it is predominantly a US-driven system, and is sometimes barred in countries with poor human rights records. Whereas satellite imagery has traditionally been applied by states for military and strategic purposes (not discussed here), it is increasingly being used by the United Nations (UN) and international humanitarian groups such as Amnesty International (AI) and Human Rights Watch (HRW) to track human security in Africa, the Middle East and Asia. The notion that 'a picture is worth a thousand words' is particularly significant in cases where governments have either denied human rights abuses, or denied access to international humanitarian groups.

This article discusses how space S&T can be applied to determine conflict trends such as environmental and human insecurity, report on human rights abuses in inaccessible areas, and track criminal activities such as piracy off the Somali coast, and how space S&T can be applied in post-conflict reconstruction.

The Application of Space Science and Technology

The application of space S&T such as Earth Observation (EO), geographic information systems (GIS), global position systems (GPS) and remote sensing can assist the continent's decision-makers to determine and assess conflict trends, human security and states' compliance with international agreements.[2] For decades, illegal logging in the Democratic Republic of the Congo (DRC) has been conducted to support conflicts. Most of these areas have been inaccessible, but recent satellite imagery reveals the extent of these activities. Figure 1 shows deforestation in the Nord-Ubangi and Mongala provinces of Zaire (now the DRC) in 1975. Here, deforestation occurs along roads, as indicated by the loops of light green through the dense rain forest.

Figure 1: The Nord-Ubangi and Mongala Provinces of the Democratic Republic of the Congo (DRC) in 1975[3]

Figure 2: The Nord-Ubangi and Mongala Provinces of the Democratic Republic of the Congo (DRC) in 2003[4]

03 Feb 2003

Figure 3: The Zambezi River in January 2008 (top) and December 2007 (bottom)[5]
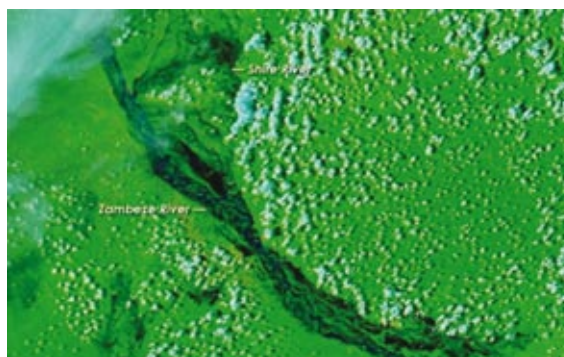

15 January 2008

26 December 2007

In 2003, after years of conflict in the DRC, the deforested corridors have widened to such an extent that they almost merge, as Figure 2 indicates.

Images such as these can form the basis for international efforts similar to the Kimberley Process Verification Scheme, which aims to prevent and curb the trade in so-called 'blood diamonds'.

Figure 3 depicts two images of the Zambezi River in Mozambique. The top image was taken on 15 January 2008, and the bottom image on 26 December 2007. These images show the Zambezi River downstream from the Cahora Bassa lake, close to the borders of the Sofala, Tete and Zambézia provinces. Here the water is dark blue or black in the images, and the surrounding plant-covered land is bright green. Scattered clouds are pale blue and white. The flooding that occurred in January 2008 rivalled the flooding that occurred in 2000-2001, which killed almost 700 people and displaced 500 000 people.

Despite regular flooding, the Zambezi floodplain is fertile and mostly inhabited by subsistence farmers. In January 2008, the Mozambican government and humanitarian organisations such as Doctors Without Borders and Save the Children evacuated more than 62 000 people from the floodplain.

More recently, satellite imagery, as Figure 4 indicates, has been used to track the recent activities of pirates off the Somali coast.

Figure 4: Satellite Images of Pirate Activities Off the Somali Coast[6]
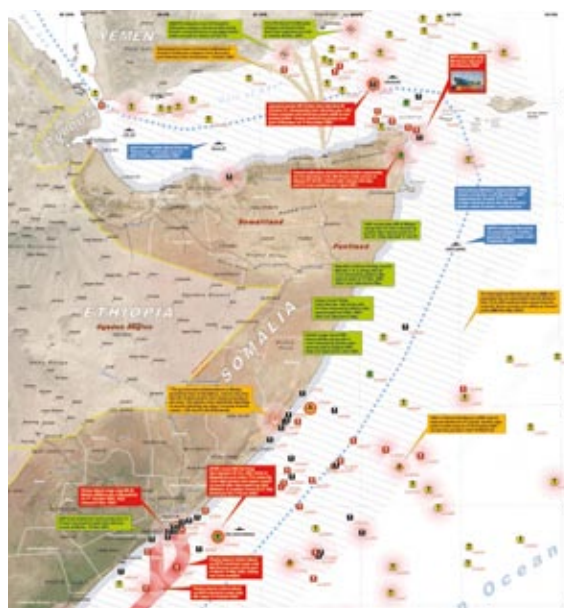
Somalia has been described as one of Africa's total collapsed states. For several years, pirates have used its geo-strategic location to hijack ships. By September 2008, Somali pirates held as many as 10 ships, demanding millions of dollars' ransom, and threatening regional stability as well as preventing urgent humanitarian assistance to Somalis.[7] The United Nations World Food Programme (WFP) is relying on the Dutch, French, Danish and Canadian navies to escort WFP ships delivering food to almost three million Somalis facing starvation.[8] If the Djibouti Agreement between the Transitional Federal Government (TFG) and the Alliance for the Re-Liberation of Somalia (ARS), which was signed on 19 August 2008, is not properly implemented and proper state structures restored, there is little hope that piracy will end. In this case, satellite images will continue to be used to protect humanitarian and cargo ships.

The Somalia piracy example illustrates the complex threats to human security in Africa. Satellite imagery can be a cost-effective 'force multiplier' (an added resource) for decision-makers to alleviate human and natural disasters.[9]

United Nations' Use of Space Science and Technology in Africa

UNOSAT is the UN Institute for Training and Research (UNITAR) Operational Satellite Applications Programme, which is implemented in cooperation with the European Organisation of High Energy Physics (CERN). Since 1963, UNOSAT has delivered satellite images to relief and development organisations. These images assist decision-makers to track and resolve humanitarian crises.[10]

Since 2004, the United Nations High Commissioner for Refugees (UNHCR) has been using satellite data to identify underground water resources for almost 200 000 Sudanese refugees in nine UNCHR refugee camps in eastern Chad. Figure 5 is an example of satellite data that identified underground water for these camps.[1]
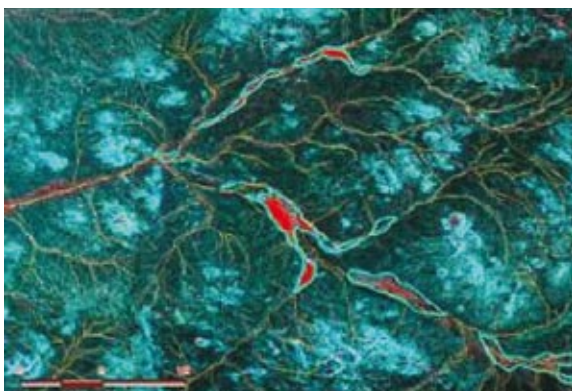
Figure 5: Satellite Image of Underground Water for Refugee Camps in Eastern Chad[12]

More recently, the UN Development Programme (UNDP) released *Africa. Atlas of Our Changing Environment,* which predominantly includes space S&T such as EO and remote sensing to highlight environmental insecurity on the continent, and to help improve decision-making in this regard. Apart from environmental analyses, the Atlas also includes images of the transboundary movement of people and refugees in conflict areas such as the Parrot's Beak region in Guinea and Darfur.[13]

Human Rights Watch in the Ogaden Region of Ethiopia

In the case of the conflict in Ethiopia's Ogaden region, international humanitarian organisations use satellite images to prove incidences of village burnings and destruction by the army, which is usually denied by the Ethiopian government. In this case, HRW applied images collected by the Science and Human Rights Project of the American Association for the Advancement of Science (AAAS), which developed a system to assist human rights groups to access high-resolution satellite images and monitor the activity of military groups. The images obtained for this project indicated the removal and burning of numerous structures and complete villages, as well as the forced relocation of people. It also reported on the destruction of new structures. In its reports on the activities of the Ethiopian government and army through *Collective Punishment*[14], HRW, drawing on this project's satellite images, concludes that these actions amount to 'crimes against humanity'.[15]

Darfur, Sudan

Since 2005, the AAAS has also provided satellite images of 12 villages in Darfur to AI to monitor attacks, and the movement and activities of rebel groups and the Arab militia group, the Janjaweed. AI's 'Eyes on Darfur' project makes specific use of satellite imagery to highlight conflict trends in Darfur and the rest of Sudan. Figures 6 and 7 include satellite images of the destruction of villages in Darfur.[16]

These images show the destruction of homes and other structures. It is also possible to determine how, when and where this destruction took place, using the images. This can assist humanitarian organisations in their advocacy and relief work. For organisations such as AI and Save the Children, this type of monitoring has become essential, as the Sudanese government continues to deny entry permits into Darfur.

Figure 6: Satellite Image of the Destruction of a Village in Darfur[17]

Figure 7: A Portion of the Town of Donkey Dereis in Darfur Before its Recent Destruction (Top), and After (Bottom)[18]
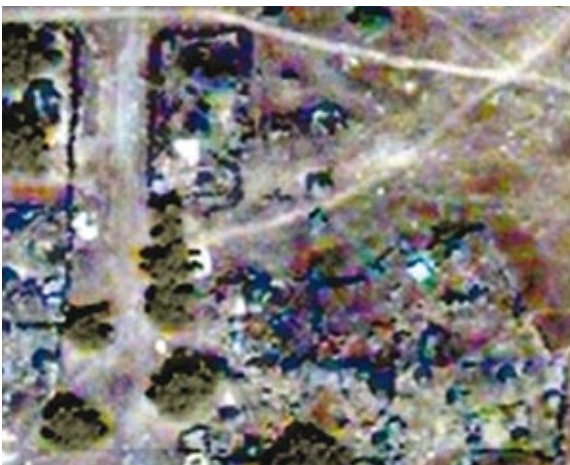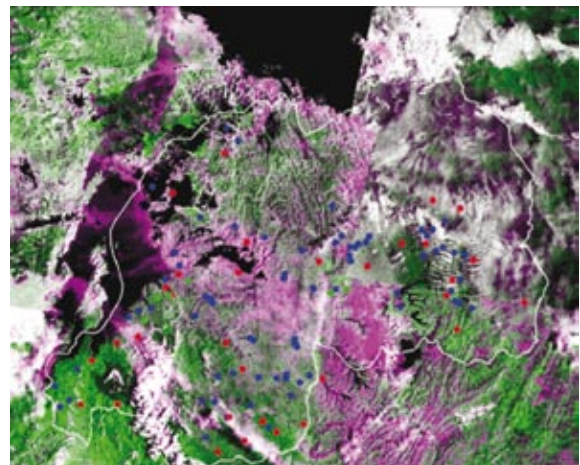

Rwanda

The case of Rwanda illustrates the role that space S&T can play in post-conflict reconstruction. For example, satellite imagery was used to search for mass graves. Figure 8 contains a Landsat Thematic Mapper (TM) image of Rwanda from 1990. Rwanda's borders are shown in white. The image also includes the dense forest areas surrounding the Parc National des Volcans and the Foret de Nyungwe, which appears green in the image. These forest areas are situated north and south of Lake Kivu, respectively.[19]

Figure 8: Satellite Image of Pre-genocide Rwanda (1990)[20]

Figure 9 is a Landsat TM mosaic of Rwanda after the genocide (1995). Rwanda's borders are shown in white. The satellite image was used to indicate various genocide sites such as mass graves ('*lieus publics*'), which are shown in blue, memorials ('*lieux de culte*') shown in red, and resistance sites ('*collines de résistance*'), which appear in green.[21]

Figure 9: Post-genocide Rwanda (1995) and Various Genocide Sites[22]

Operation Murambatsvina[23] **in Zimbabwe in 2005**

In 2005, while the government of Zimbabwe was still denying that human rights abuses occurred during its Operation Murambatsvina, AI and Zimbabwe Lawyers for Human Rights produced satellite images showing strong evidence of the government's destruction during Operation Murambatsvina as part of the ruling party's political campaign against opponents.[24] These satellite images (see Figure 10) showed the complete destruction and forced relocation of a settlement that once housed almost 10 000 people outside Harare.

An official government operation, Operation Murambatsvina was the government's programme of mass forced eviction and the demolition of homes and informal businesses, aimed at forcibly relocating the urban poor to rural areas, and contributing to rising numbers of internally displaced Zimbabweans.

Figure 10: Satellite Images from 2002 (top) and 2006 (bottom) Showing the Destruction of the Porta Farm Settlement, Harare, Zimbabwe[25]

In Figure 10, the 2002 image (left) shows a large informal settlement with structures and roads. The 2006 image (right) shows empty plots. It is estimated that 850 structures were demolished during Operation Murambatsvina.[26]

Conclusion

Despite its limited use, this article has illustrated that space S&T can be applied to address conflict trends and human security in Africa. However, there continues to be some limitations to the application of space S&T:

• First, satellite imagery can be costly and therefore inaccessible to organisations – for example, most African humanitarian organisations.

• Second, some tribes, clans and ethnic groups in some areas are nomadic and, if these groups are moving into or out of a conflict-ridden area, it may be difficult to determine whether it is a forced displacement or part of the groups' seasonal movement. It is therefore, necessary, that the images that capture these movements be clearly analysed. A humanitarian group may respond to images that reflect movements, only to find that it is part of a seasonal nomadic movement.

• Third, lacking a scientific support base means that satellite imagery cannot be interpreted. This is particularly the case in underdeveloped states, which may have access to these images but do not have the skilled scientists to interpret the images in order for the government to respond to humanitarian crises appropriately and adequately.

• Fourth, weak African states lack the institutional capacity to implement decisions relating to the interpretation of EO, remote sensing and GIS areas relating to the resolution of conflict, or humanitarian assistance.[27]

Notwithstanding these limitations, space S&T has and will increasingly continue to contribute to human security and justice in Africa. Space S&T may assist governments and humanitarian organisations achieve this against the approaching deadlines for the Millennium Development Goals.

The use of satellite imagery to support human rights abuses undertaken by national governments remains controversial. However, the UN Principles Relating to Remote Sensing of the Earth from Space (1986) encourages the use of EO and remote sensing to improve human security.[28]

Access to space S&T is no longer limited only to governments and commercial actors. The 'democratisation' of this type of technology is increasingly assisting humanitarian organisations to 'reach' people in Africa who are severely affected by conflict and violence. It can also assist in bringing individuals to book for crimes against humanity and war crimes, which they may have denied, but are clearly visible and accessible via satellite imagery. ⚑

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Endnotes

1   Google Earth is a desktop computer application that allows users to navigate planet Earth. Google Earth combines satellite images and maps with a search engine, which allows the user to search for a specific location. Available at: <http://google.about.com> Accessed on: 9 October 2008.

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6   (2008) 'Spain Next to Deal with Somali Pirates' in *New York Times*, Available at: <http://thelede.blogs.nytimes.com/2008/04/21/spain-next-to-deal-with-somali-pirates/index.html> Accessed on: 3 October 2008.

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