Protecting Earth-Exploration Satellite Services at 10 GHz - WRC-23 Agenda Item 1.2

CTU Spectrum Management Workshop

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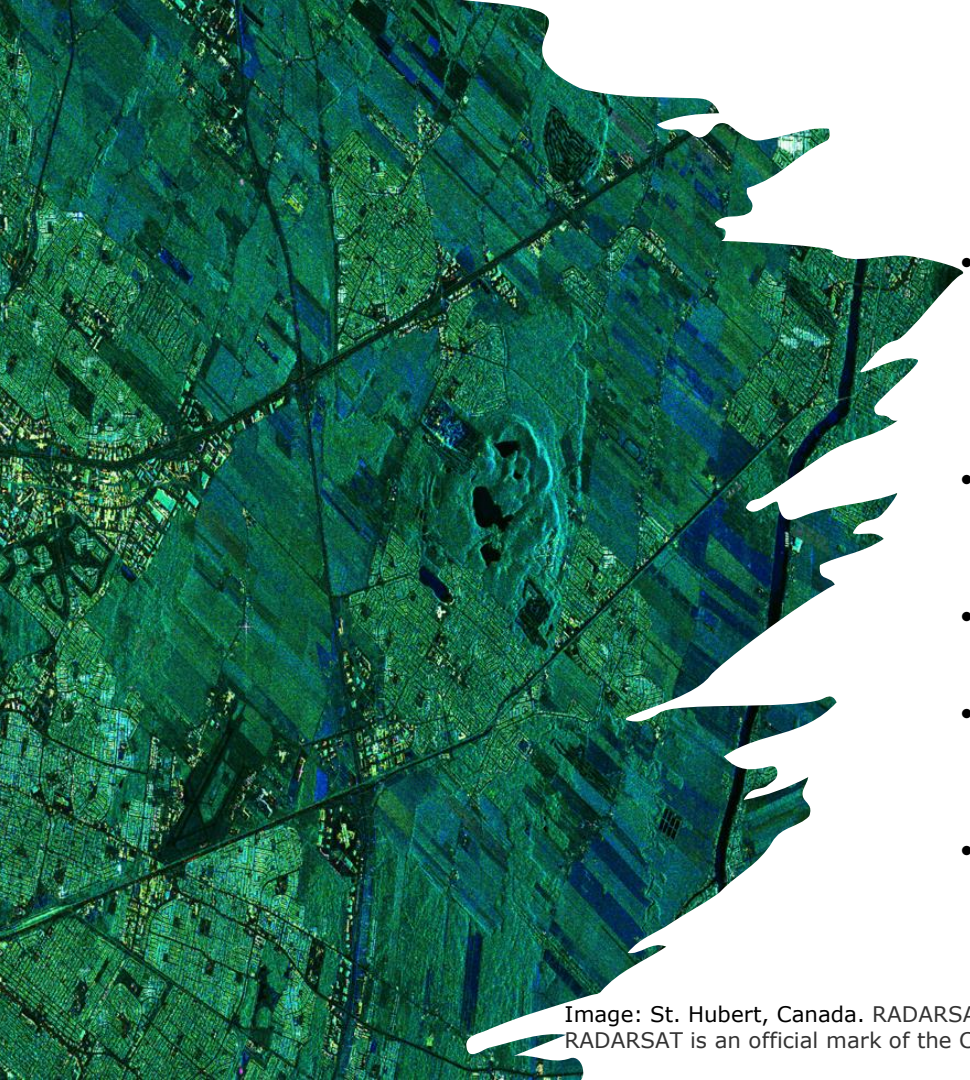
Canada



Background and Issue

- WRC-15 allocated extra spectrum to allow for Hi-Resolution Synthetic Aperture Radars (SARs) (25 cm imaging capability) to operate in the X-band Earth-Exploration Satellite Service allocation (9.2 – 10.4 GHz).
- Synthetic Aperture Radars: all weather imaging (during cloud coverage) and at night.
- Optical sensors need clear skies and daylight to image.
- IAP that the spectrum 10-10.5 GHz also be allocated in Region 2 for mobile services with an identification for IMT.
- ITU Compatibility Studies have shown excessive interference into the EESS.

Image: St. Hubert, Canada.

ITU Studies Between ESSS and IMT

The excessive interference from IMT/5G was assessed to be up to 11 dB, hampering future use of earth observation imaging. (Table source is Conference Preparatory Meeting Report for WRC-23*)

Study	Exceedance of protection criteria		
	Static aggregate interference		Dynamic interference (dynamic look angle)
	look angle fixed to 18°	look angle fixed to 50°	
Study A	5.31 dB	11.5 dB	N/A
Study B	N/A	11.22 dB	10.55 dB
Study C	0.96 dB	8.15 dB	N/A
Study D	2.56 dB	8.03 dB	5.29 dB
Study E	5 dB	11 dB	8.6 dB

* https://www.itu.int/md/R19-CPM23.2-R-0001/en

CITEL Proposals

- DIAP for "No Change" supported by Bahamas, Canada, USA.
- The IAP is based on a theoretical and unproven significant side lobe suppression technique.
  - This unproven technique was used in studies to achieve the results that allow for sharing and compatibility with the EESS (active).
- CPM text (pg 91) reports that the theoretical sidelobe suppression used in the sharing study is not achievable in practice.

International Charter 'Space and Major Disasters'

- Created by space agencies over 20 years ago.
- EESS spectrum/data is a fundamental element of supporting the international Charter.
- Any country can have access to free satellite images of areas that are impacted by a major disaster.
- Charter uses its network of 270+ satellites to image the impacted area as soon as possible.

https://disasterscharter.org

Image: © *Airbus DS 2022*

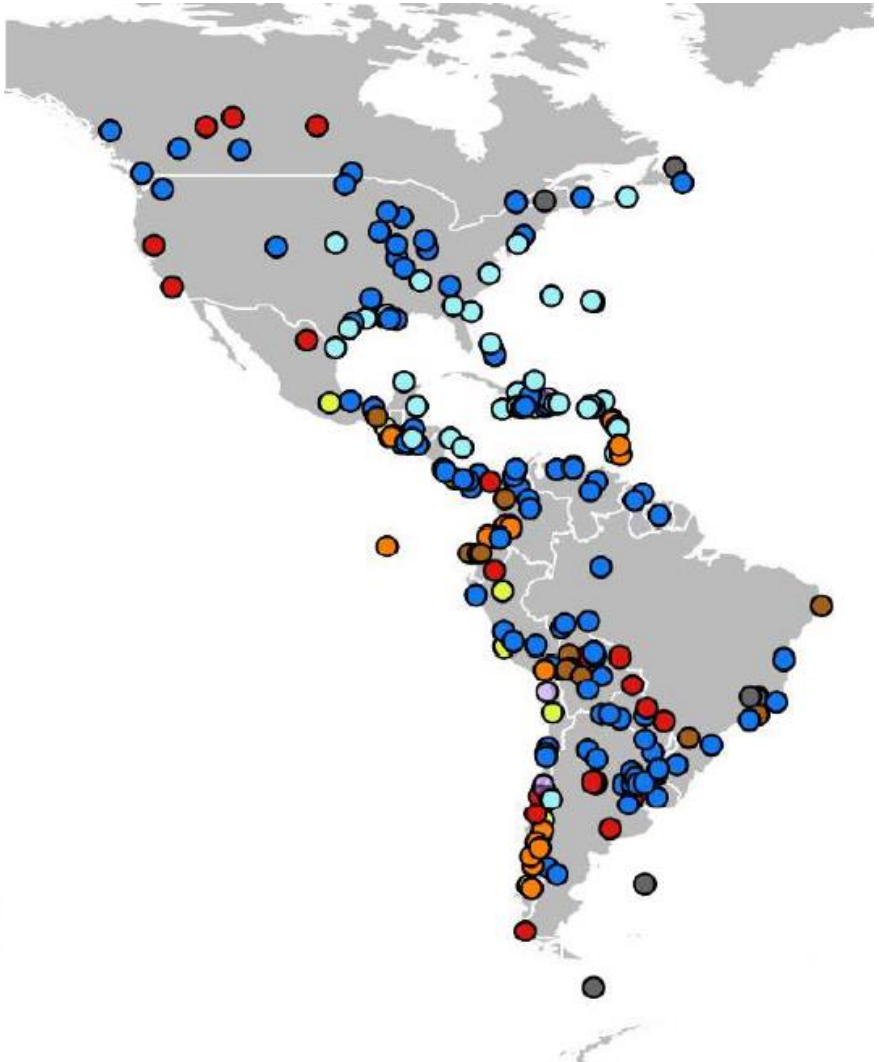
International Charter 'Space and Major Disasters'

- SAR sensors can image during cloudy weather 24/7.
- Optical satellites cannot image during a hurricane and need daylight to take photos.
- The X-band SAR is the sole band available for hi-res (better, clearer) imaging.

Image: © *DLR e.V. 2020, Distribution Airbus Defence and Space GmbH; Image Enhancement performed by Radian Software (DLR e.V.)*

Charter Requests (by distribution)

- Hurricanes/Cyclones
- Earthquake
- Fire
- Flood
- Landslide
- Ocean wave
- Oil Spill
- Other
- Snow and Ice
- Volcano



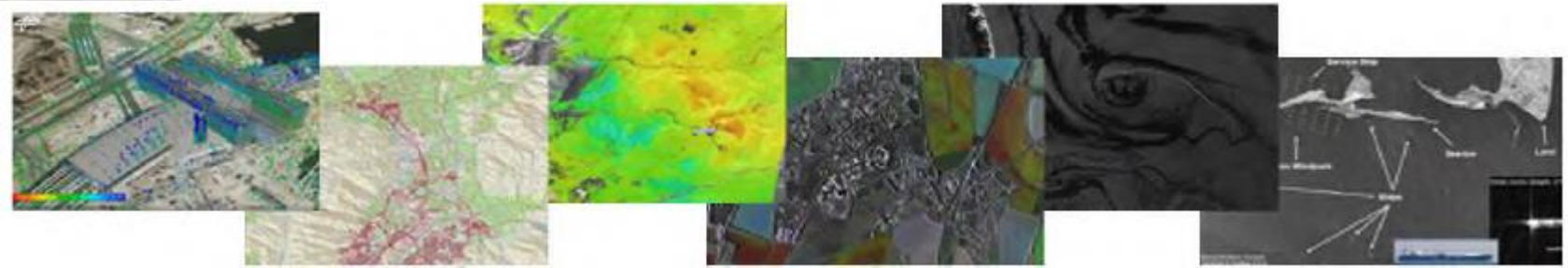
Source: International Charter 'Space and Major Disasters', 2023

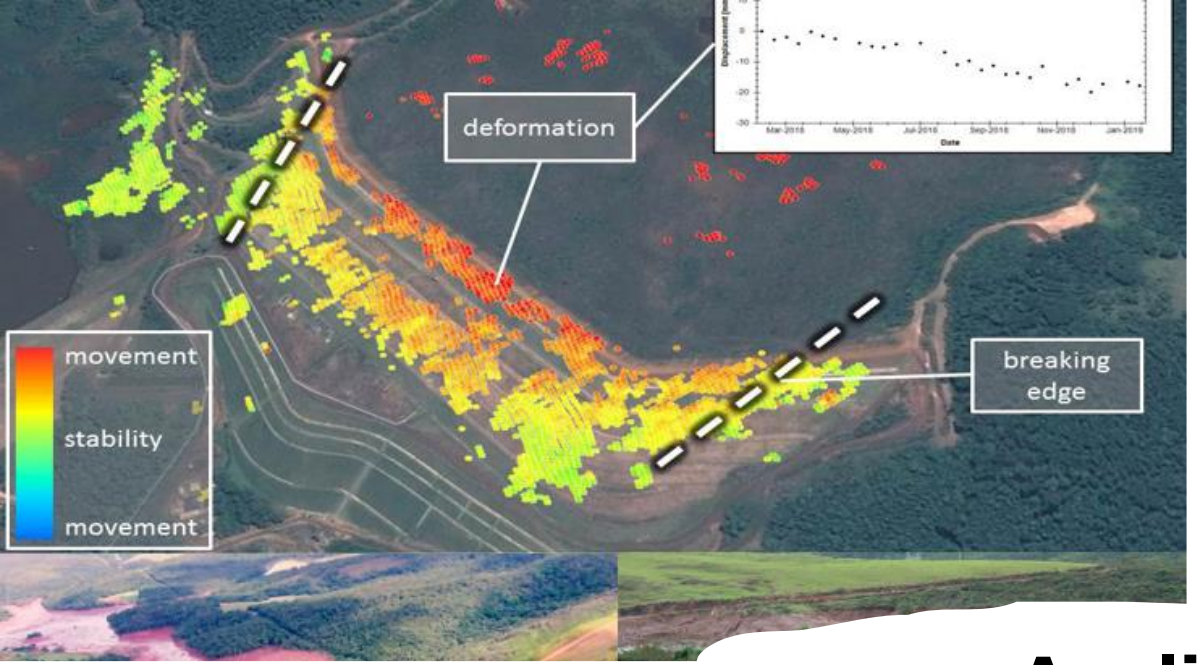
EESS Satellites Operating or planning to operate in the X-band

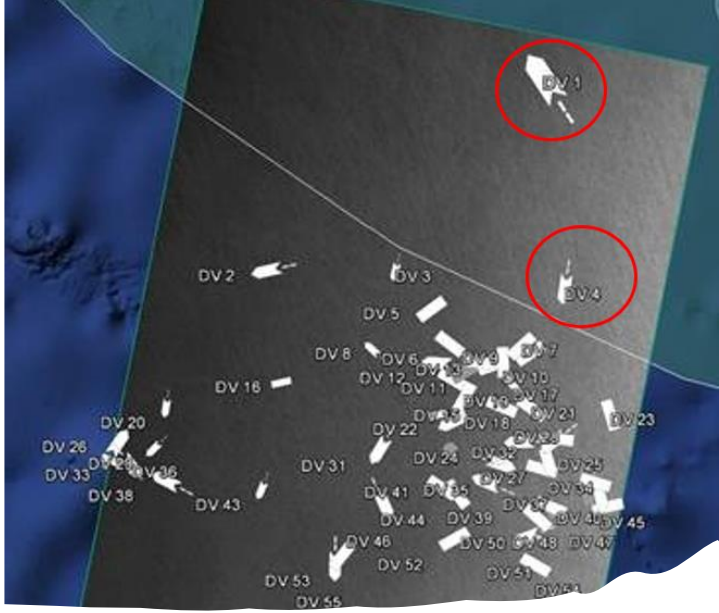
Existing satellites operating in the X-band	Existing satellites using the full allocation	Satellites planning to use the full allocation
• CHORUS-X • iQPS • KOMPSAT-5 • KOMPSAT-6 • NimBUS SAR • PAZ • TanDem-X • TerraSAR-X	• COSMO-SkyMed2 • ICEYE-X2, X3, X4, X5, X6, X7 • TecSAR • UMBRA	• Capella Space • PAZ-2 • PLATiNO • Synspective

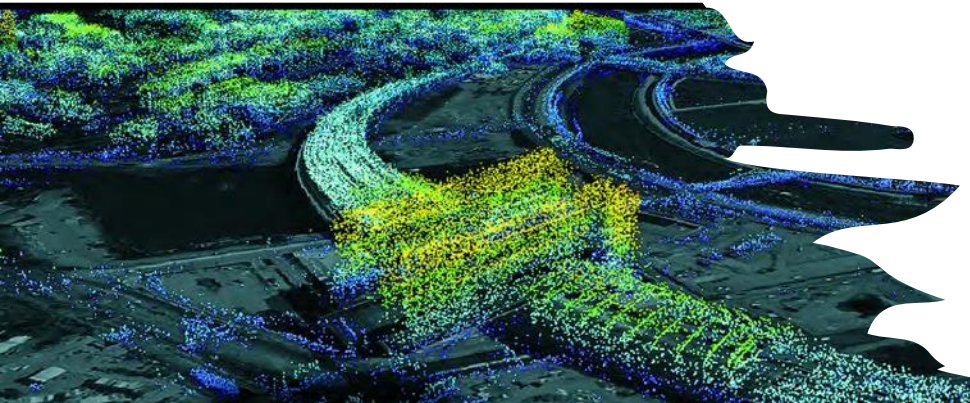
The Negative Impact of IMT interference on EESS data

- Weather independent Earth Observations
- Landslide and flooding hazard mapping
- Monitoring deforestation and unauthorized fishing in all weather conditions
- Infrastructure and landslide monitoring
- Crop growth and Sustainable palm oil production monitoring

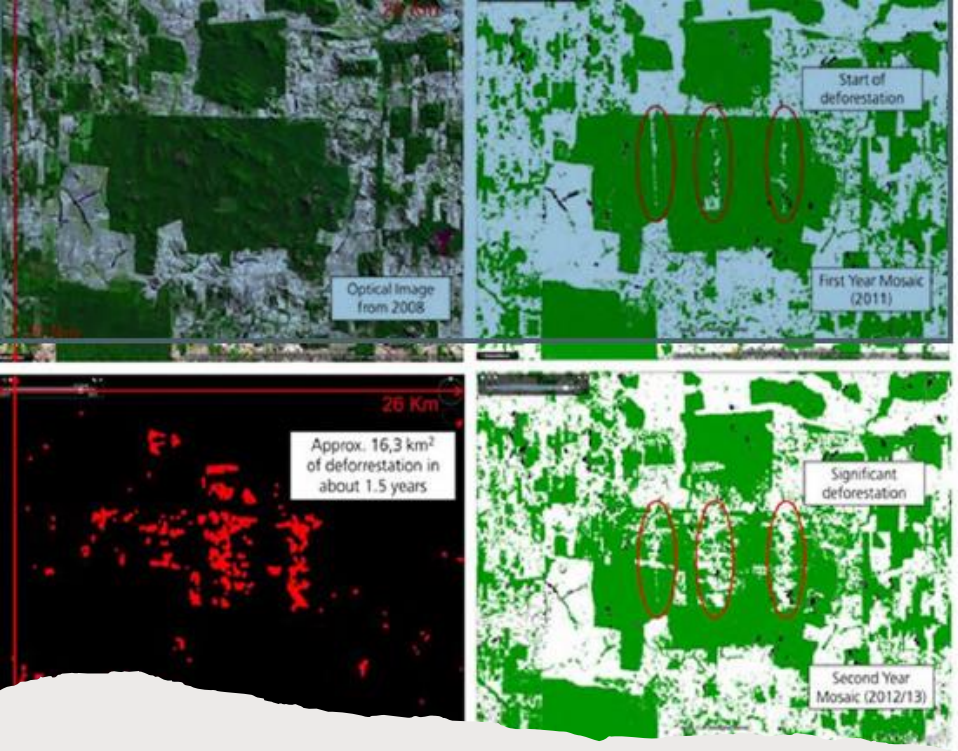




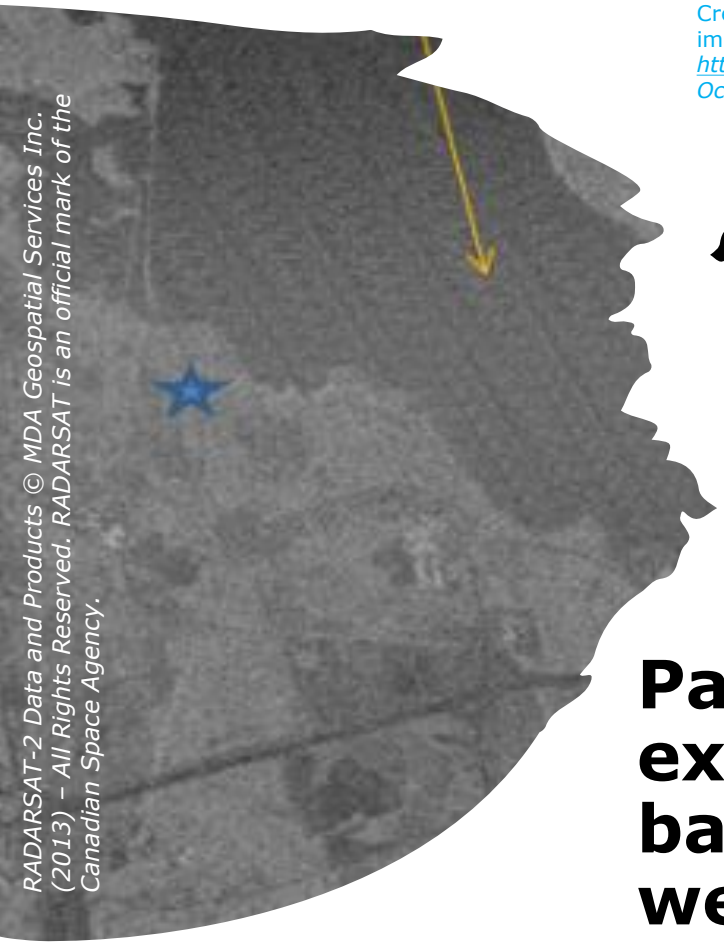


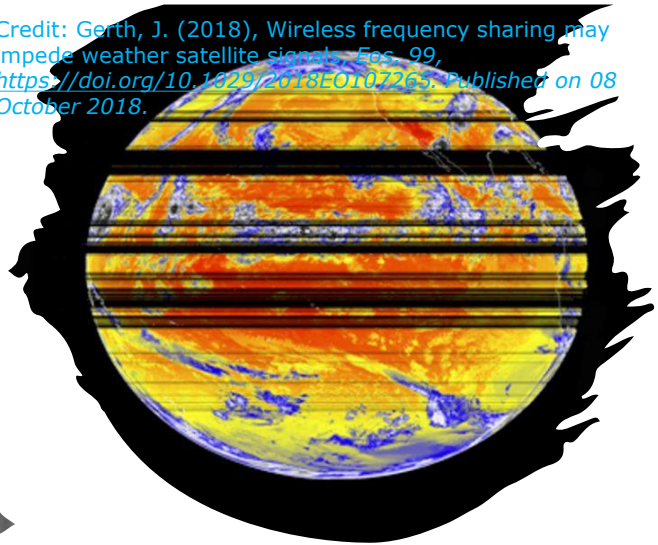


Application of X-band SAR: landslide, unauthorized fishing and infrastructure stability

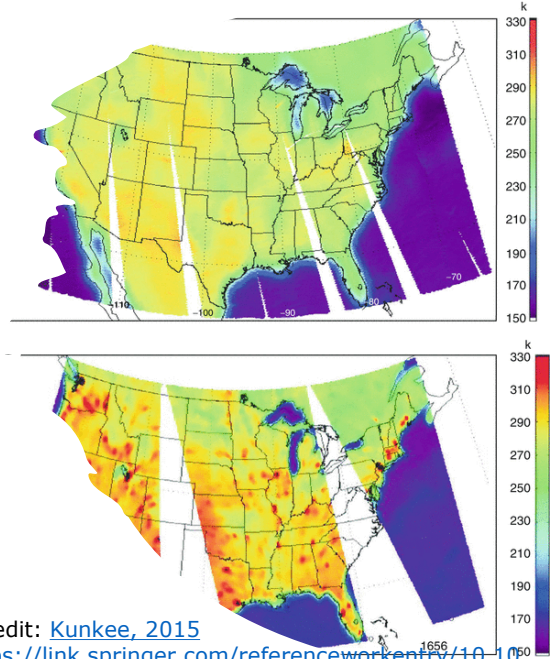


Application of X-band SAR: Deforestation and Flood Mapping





Credit: Gerth, J. (2018), Wireless frequency sharing may impede weather satellite signals, Eos, 99, https://doi.org/10.1029/2018EO107265. Published on 08 October 2018.



(Credit: Kunkee, 2015 https://link.springer.com/referenceworkentry/10.1007/978-0-387-36699-9_153)

Past experience: Impact of excessive interference into a C-band SAR image, a GOES weather satellite and Brightness temperature measurements

Support of the CTU Member States Needed

- Canada is protecting the data that feeds into the International Charter ‘Space and Major Disasters’.
- The “No Change” proposal is the only way to safeguard the services that this Charter provides.
- Canada would appreciate your administration’s support directly to CITEL or during the CITEL meeting in Ottawa.

THANK YOU!


CANADIAN SPACE AGENCY
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