

International Coordination of Future SAR Missions – An Overview

Dr. Maurice Borgeaud – ESA

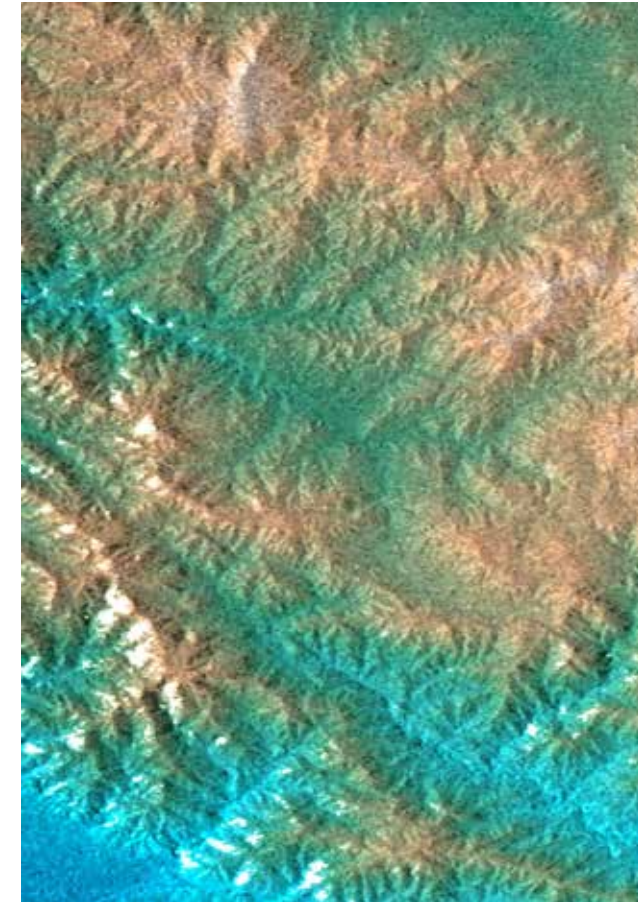
Prof. Charles Elachi – Caltech

IGARSS'21

Online meeting, 16 July 2021

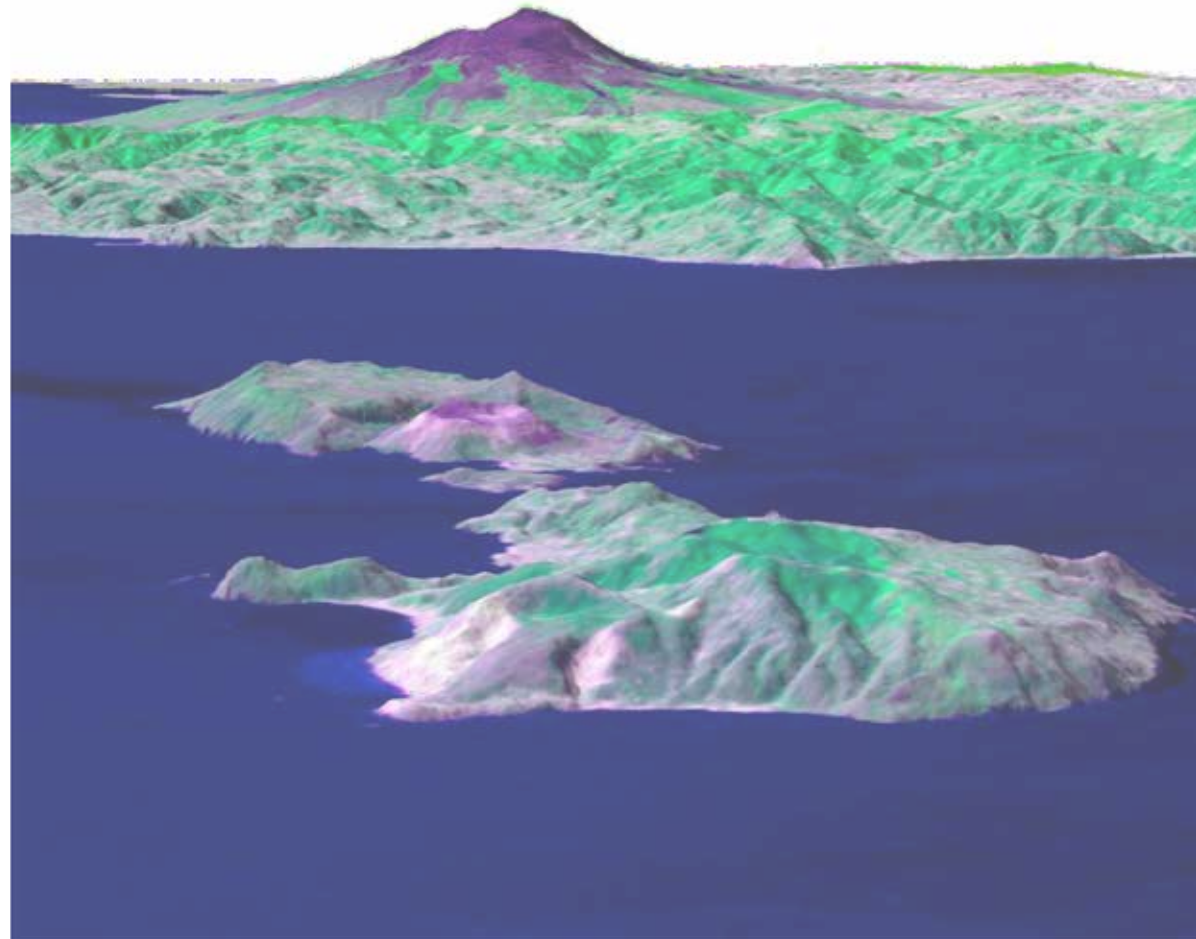
International Coordination for Spaceborne Synthetic Aperture Radar Data Acquisition, Processing and Analysis for Earth Science and Applications

- Original idea proposed by Charles Elachi
- First workshop held on 30 May – 1 June 2018 at Caltech, USA
- Explore the interest in and value of a more coordinated approach among the different organizations flying or planning spaceborne SAR missions to achieve higher value for the science and application user community
- Workshop was attended by 60 scientists and engineers from almost all the agencies/countries flying spaceborne SAR's and from the commercial sector



2018 Workshop Organizing Committee

Charles Elachi	Caltech, <i>Chair</i>
Maurice Borgeaud	ESA
Maria Battagliere	ASI
Gerald Bawden	NASA
Laura Frulla	CONAE
Guennadi Kroupnik	CSA
Tapan Misra	ISRO
Alberto Moreira	DLR
Sobue Shinichi	JAXA



2018 Workshop Attendees



Recommendation 1: Archival, present and future data should be easily and electronically accessible with a standard and common format, at little or no cost.

- All agencies flying spaceborne SAR systems either provide all of the data free of cost, or subsets of data for specific purposes and to support interagency agreements.
- While a single format may not be suitable for all SAR data, there is a strong consensus that a good degree of harmonization is warranted and possible, through the clear and common definition of metadata quantities, and creation of standard lookup tables to serve as Rosetta Stones translating among legacy formats.



Recommendation 2: Develop a mechanism to coordinate future data acquisition and coverage by present and planned systems, as well as ground reception and processing approaches for mutual benefit.

- Coordination among systems has led to significant benefit, particularly for polar ice studies (Polar Space Task Group) and rapid characterization of natural hazards (International Disaster Charter and Sentinel Asia). Expanded coordination will greatly benefit applications that rely on expanded coverage, shorter repeat time, long term monitoring and multiple frequency/polarized observations.
- Information on acquisition plans for each mission should be available to all to facilitate better coordinated between the agencies.



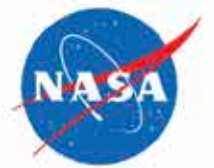
Recommendation 3: Take an optimized systems approach to the overall constellation of planned and proposed missions to explore the possible mutual benefit of the total constellation coverage and capabilities.

- Each organization, *understandably*, optimizes its system for its needs within its limitations. By evaluating the global constellation of missions as a coordinated system, there are opportunities for enhanced or new capabilities, while meeting individual agency requirements. Some examples:
 - Better filling of gaps and higher repeat coverage by slight adjustment of orbit, node crossings or local crossing time.
 - Quick response for time critical applications.
 - Better continuity of observations over a long period of time (multi decadal).
 - Enable new multiple system capabilities such as bistatic observations and multi interferometric observations.
 - Left / right imaging coordination to overcome shadowing



Recommendation 4: Coordinate and share common test sites and sites for calibration and validation.

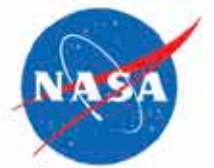
- Calibration and validation sites are essential to be able to use the radar data for most applications. Each mission team establishes such sites to serve individual systems, with a few cases of common site utilization.
- Mutually agreed on common test sites and “Supersites” for calibration and validation of all currently flying and planned systems would provide great value. *This would significantly enhance the value of the data from multiple systems, save significant financial resources and encourage international collaboration.*
- Given the large number of SAR missions and the diversity of mission architectures (e.g. frequency, antenna, pattern, resolution, polarization, etc...), there is a recognized benefit to calibrating/validating all SAR missions over a number of “Super-Sites”.
- Public availability of data from all missions and associated ground based observations would facilitate inter-mission comparisons and fusion. These sites should be defined, developed, and supported by international teams, under multi-agency agreements.
- The validation and thematic sites should involve relevant user agencies, so that validated data are easily understood and used, and that data products can be widely applied by non-experts.



2018-2021 Activities

Since the 2018 First Workshop:

- Session at LPS'19 in Milano (more than 250 attendees)
- Coordination meeting in Milano in May 2019
- Second workshop should have taken place at ESA/ESRIN in May 2020
- Unfortunately, due to COVID-19, it was postponed first to May 2021 then to October 2021
- Several meetings of the Organisation Committee to prepare the Second Workshop
- This session today at IGARSS'21, 16 July 2021
- New date for the Second Workshop: 20-22 October 2021, ESA-ESRIN, Frascati, Italy



Working Groups (WG)

In order to implement the 2018 recommendations, three working teams that include radar systems experts, users, and scientists from all the involved organizations have started their activities:

- WG-1 ... Visibility, access, coverage and coordination working team to address recommendations 1 & 2
- WG-2 ... Constellation system working team to address recommendation 3
- WG-3 ... Calibration & validation working team to address recommendation 4



Thematic Areas (TA)

In the preparation of the Second Workshop, three thematic areas (TA) have been added to further deepen the collaboration across the WG topics and cover the following across-domains:

- **TA-1: Polarimetric and multi-frequency SAR applications** (polarimetric or multi-frequency backscatter intensity and/or polarimetric phase the main measurements. InSAR often useful, but not the main driver). TA-1 covers applications such as Forestry, Agriculture, Wetland and Other Land Uses (i.e. the IPCC “AFOLU” themes), plus such relating to Ocean and Sea Ice.
- **TA-2: Interferometric SAR applications** (interferometric phase the main measurement). TA-2 covers the traditional InSAR driven applications such as Solid Earth (incl. crustal deformation, volcanoes), Glaciers/Ice Caps, Geo-hazards, and PS.
- **TA-3: Programme coordination**



Working Groups (WG)

<p>WG1 Present and future data-Visibility and access (L0-L2)</p>	<p>WG2 Future imaging systems- Goals, plans, challenges and opportunities</p>	<p>WG3 Data exploration-Cal/Val, fusion and assimilation (L3-L4)</p>
<p>Co-Chair's Sobue, Kumar, Bawden</p>	<p>Co-Chair's Suess, Zink, Rosen</p>	<p>Co-Chair's Schmullius, Chapman, McNairn</p>

Thematic Areas (TA)

<p>TA1 Polarimetric and multi-frequency SAR applications</p>	<p>TA2 Interferometric SAR applications</p>	<p>TA3 Program and mission coordination</p>
<p>Co-Chair Rosenqvist</p>	<p>Co-Chair Jones</p>	<p>Co-Chair Bawden</p>



Summary and Way Forward

- With more than 25 spaceborne SAR systems currently flying and an additional 25+ being built or planned, tremendous opportunity to cooperate and coordinate among space agencies and industry actors:
 - Data harmonisation and standard
 - Coordinate future data acquisition and coverage
 - Optimized systems approach to the overall constellation of planned and proposed missions
 - Coordinate and share common test sites and sites for calibration and validation
- WG's and TA' put in place to address these topics
- Strong desire from space agencies to work together in order to offer the best synergy among SAR missions to the users community
- Wish to include commercial SAR data providers in the overall approach
- *Second Workshop on 20-22 October 2021 at ESA/ESRIN*



Second workshop on International Coordination for Spaceborne SAR

20-22 October 2021 | ESA-ESRIN | Frascati (Rome), Italy



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[Thematic Areas](#) [Seed Questions](#)

The workshop will be held on **20-22 October 2021** at **ESA/ESRIN** and it is planned as onsite event. Virtual participation will be possible for the people that are not able to travel to Italy.

Second Workshop on International Coordination for Spaceborne Synthetic Aperture Radar

20-22 October 2021

ESRIN, Italy

Participation based on invitation only

Feel free to contact us if you think you can contribute:

sar.workshop@esa.int

Organising Committee

Maurice Borgeaud (ESA, co-chair)

Charles Elachi (Caltech, co-chair)

Maria Battagliere (ASI)

Gerald Bawden (NASA)

Bruce Chapman (NASA/JPL)

Laura Frulla (CONAE)

Cathleen Jones (NASA/JPL)

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