Open access to Italian Earth Observation satellites data: the ASI Open Call initiative"

Agenda Item 7: Remote sensing

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Scientific and Technical Subcommittee

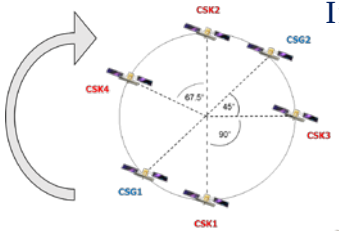
www.asi.it

CONTEXT

In the last decades Italian Space Agency (ASI) invested a significant effort in the Earth Observation (EO) field.

Today, thanks this vision, Italy is playing a leading role in remote sensing of the Earth by satellite both at European level, where Italy is the third largest contributor to the European Space Agency, and worldwide.

In this context, the Italian system COSMO-SkyMed, represents the state-of-the-art of SAR technology



Cosmo 1
June 8, 2007
2:34 GMT

Cosmo 2
December 9, 2007
2:31 GMT

Cosmo 3
October 25, 2008
2:28 GMT

Cosmo 4
November 6, 2010
2:20 GMT

CSG 1
December 18, 2019
9:17 GMT

CSG 2 January 31, 2022 23: 11 GMT
Credit Space X

- ✓ The first constellation (CSK) is fully operational since 2011
- ✓ The first satellite of second generation (CSG) has been launched on December 2019 (CSG data available starting form January 2021)
- ✓ All satellites are placed on the same sun-synchronous 16-days orbit.

Agenzia Spaziale Italiana

This launch signs a new milestone for Italy in the field of Earth Observation

SOME KEY ELEMENTS

In the last decades the scientific community has increasingly used space technology, such as satellite optical or Synthetic Aperture Radar (SAR) data, to improve the understanding of geophysics phenomena in many fields.

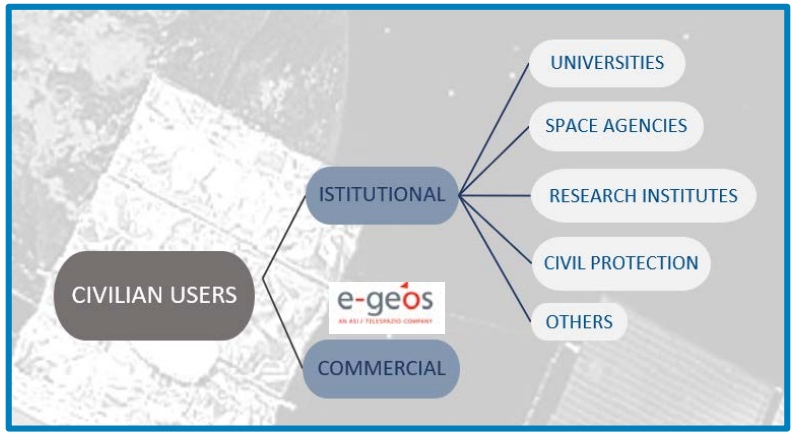
SAR technology and interferometry based techniques offer several advantages such as high spatial coverage, high resolution and the possibility of measuring ground surface displacements with sub-centimetric accuracy (by exploiting large datasets of images), representing a cost-effective alternative to traditional in situ monitoring techniques of single structures and infrastructures.

In this framework, thanks to its capabilities, the Italian constellation is able to offer a relevant contribution in the disaster management and in the DRR (Disaster Risk Reduction) strategies definition.

It is worth of remembering that COSMO-SkyMed is also a Contributing Mission of the European Programme Copernicus, where, it is one of the most exploited mission for emergency management.

The new capabilities of the second generation sensors (products in several operative sensor mode both in narrow field with ultrafine resolution and wide field) will significantly amplify the CSG's potential applications for disaster risk prevention and management, climate change, infrastructure and cultural heritage monitoring and management of natural resources

COSMO-SkyMed data access is regulated by means of an appropriate and well-defined Data Policy



As the owner of the system, ASI can activate different typologies of projects aiming at the exploitation of CSK/CSG data/products by the Institutional Users, at both National and International levels, which can be summarized as follows:

- ✓ **Foreground Mission** (Map Italy project);
- ✓ **Background Mission**, which includes different acquisition handbooks;
- ✓ **Joint and/or Open Call initiatives**
- ✓ **On demand projects**

COSMO-SkyMed Mission Data Exploitation: OPEN CALL INITIATIVEs

https://www.asi.it/bandi_e_concorsi/open-call-for-science-data-utilization-of-the-cosmo-skymed-mission-first-and-second-generation-english-version/

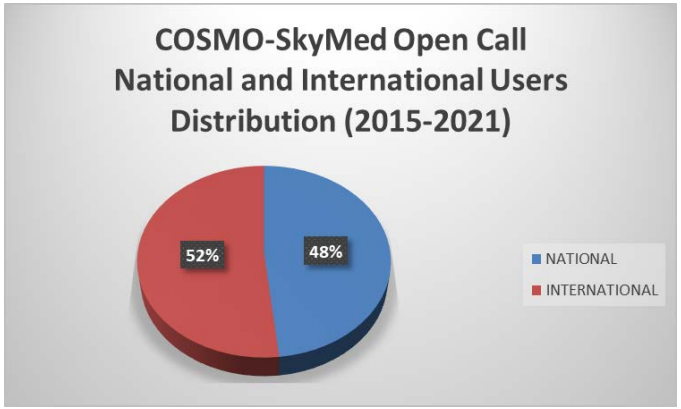
PERMANENTLY OPEN

Only for National users

First Issue: Febraury 2015 >>first generation
Second Issue: March 2021>> the text of the call was updated in order to guarantee the continuity also for COSMO-SkyMed Second Generation data

- These calls are addressed to basic and applied R&D in view of scientific and toward operational utilization of the products/services developed.
- Commercial or operational activities are not supported.
- Access is based on peer-review evaluation, with scientific relevance and feasibility as criteria and granted on the basis of the access policy adopted by the Mission.

COSMO-SkyMed observed trend and applications in the framework of the Open Call initiative



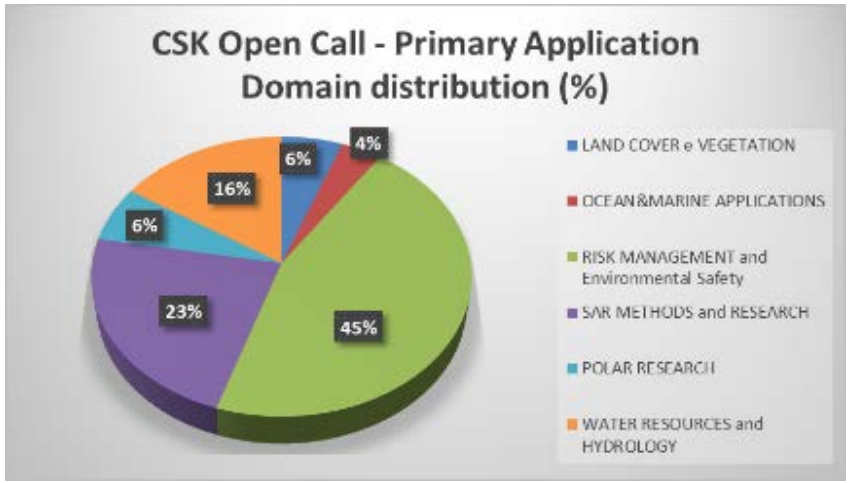
Around 2000 products/year are delivered

More than 200 submitted proposals in 7 years

In this context, the COSMO-SkyMed constellation is particularly regarded by the users as a source of high spatial resolution X-band SAR data complementing other SAR sensors, above all the medium resolution Copernicus Sentinel-1 C-band SAR datasets

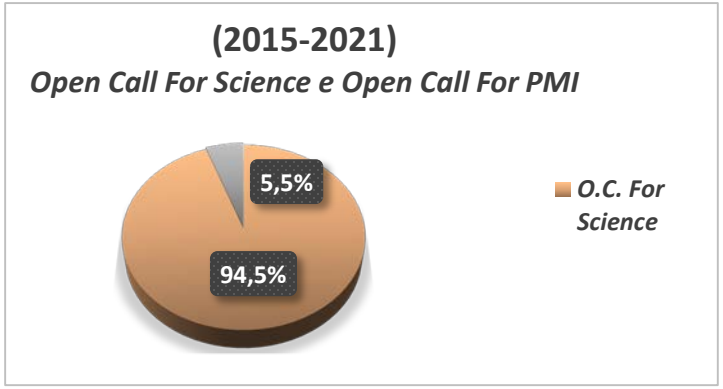
- Primary Applications Domain distribution shows "**Risk Management and Environmental Safety"** as the main field of application, with 45%.

- A number of projects are closely connected with Disaster Risk Reduction (DRR) in order to reduce natural disasters impact, with a focus over European territories. Investing in prevention and preparedness is a cost effective approach: on average, every euro spent on DRR activities saves between four and seven euros that would be spent to respond to the impact of disasters.



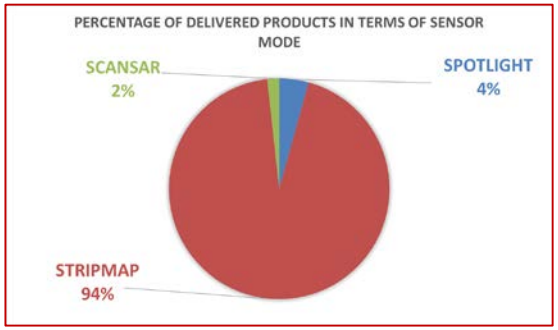
M.L. Battagliere et al. / Procedia Computer Science 181 (2021) 1041–1048 , available online at www.sciencedirect.com

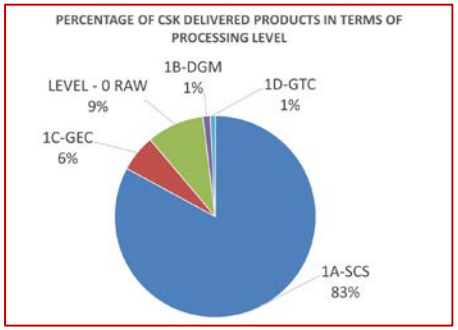
COSMO-SkyMed observed trend and applications in the framework of the Open Call initiative

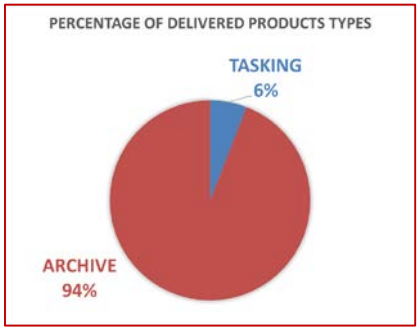


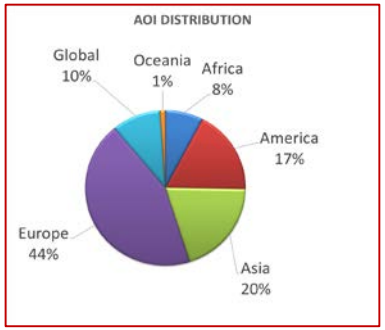
- More than 90% of projects have been activated in the framework of "Open Call for Science" that has a large number of potential users.
- It is worth noting that InSAR applications are increasingly moving towards

- integration of multi-sensor and multi-band SAR
- data geological modelling
- digital elevation model generation
- combination of different viewing geometries, to better constrain the 3D deformation field of environmental and human-induced hazard processes.





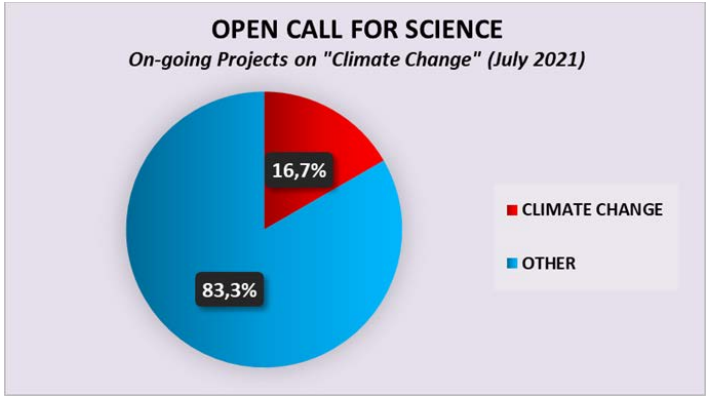


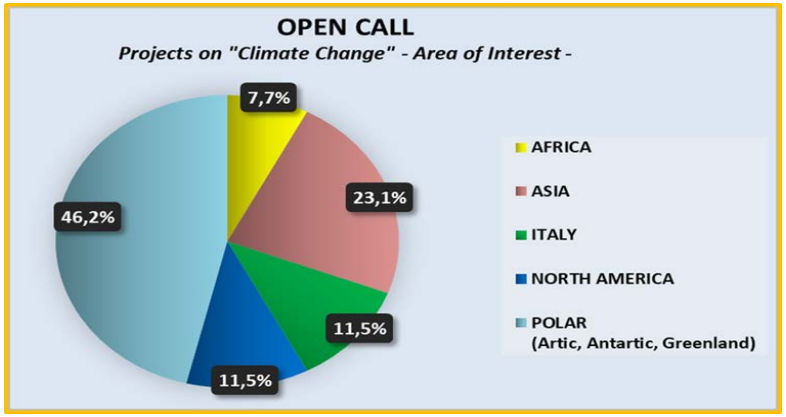


By focusing on the SAR data processing approaches, there is a significant methodological push for state-of-the-art multi-temporal differential InSAR (DInSAR) techniques, either Small Baseline Subset (SBAS) or Persistent Scatterer Interferometry (PSI), to further enhance their performances.

Climate change: is one of the biggest challenges facing the world and it is a global challenge.

- It is also recognized as one of the challenges in which the use of space technology can make a difference.
- Efforts to reduce disaster risk and at the same time adapt to a changing climate have become a global and European priority.
- Projects focused on Climate Change represented about the 12% of the total number in the last 6 years (2015-2021), with a step forward in the last year (2021) when they represents about the 17% of the on-going projects

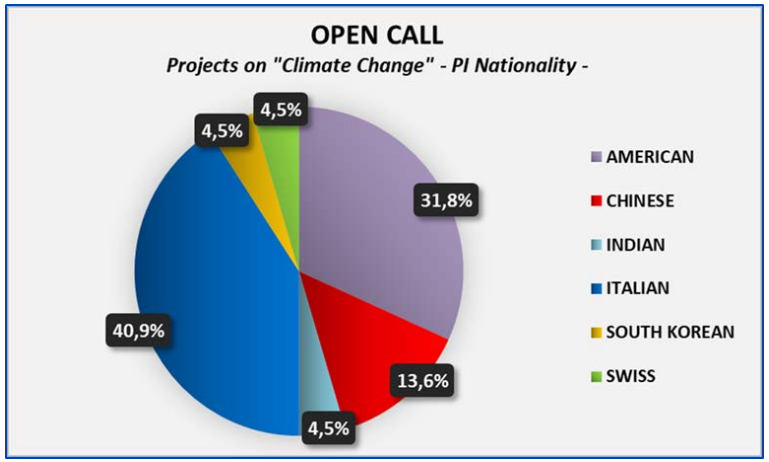




Considering Climate Change, **it is worth mentioning a strong interest from the Italian scientific community,** probably because the Mediterranean area is an “hot spot” and it is estimated that in the coming decades the southern Europe (including Italy) will be subject to the most significant impacts of climate change.

Regarding the areas of interest in this framework, of course **the polar areas are the main target,** owing to their important impact on climate, weather and the functioning of the entire ecosystem, but it has been observed a growing interest also with reference to African territories

COSMO-SkyMed Open Call initiative: observed trend for developing countries



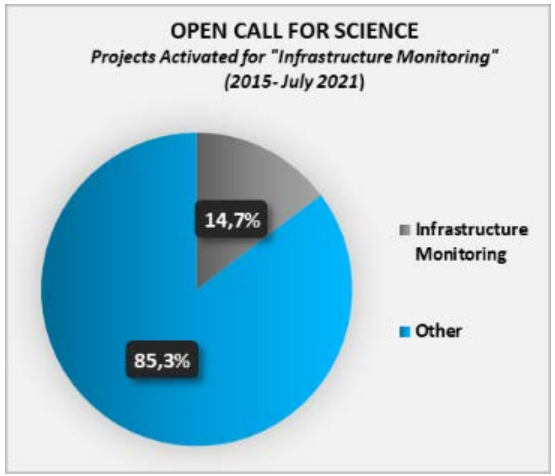
Globally, considering the geographic areas of interest of the projects and applications for developing countries, they represent the 5% of the global scientific purposes.

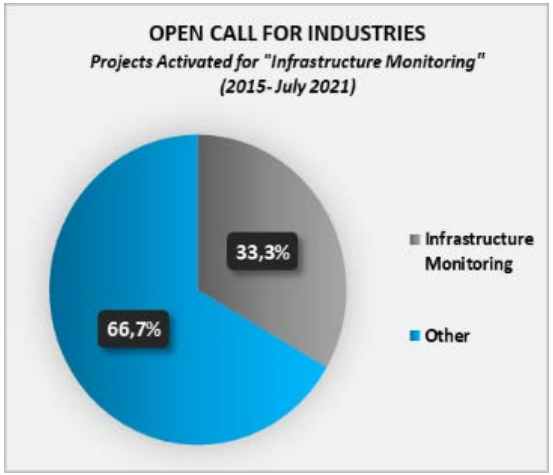
However, the same trend is not found if we consider the geographical distribution of Principal Investigator (PI)'s nationality, pointing out the necessity to further disseminate and promote this initiative in the appropriate contexts, in order to reduce inequalities (as per the SDG#10).

Sustainable Development Goals

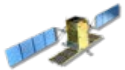
COSMO-SkyMed observed trend in the framework of the Open Call initiative: focus on infrastructure monitoring

The observed primary applications domain distribution further corroborates the impact of X-band SAR data exploitation towards the reduction and prevention of natural and human-made catastrophic events, showing that, among others, the infrastructure monitoring is effective and strategic to identify critical issues at an early stage, reducing maintenance costs and preventing collapses and disastrous events.

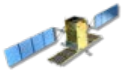




M.L. Battagliere et al., "High resolution X-band SAR sensors: applications and trends for infrastructure monitoring in the framework of ASI's initiatives", Proc. SPIE 11863, Earth Resources and Environmental Remote Sensing/GIS Applications XII, 118630J (12 September 2021); https://doi.org/10.1117/12.2598907.



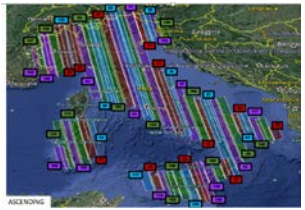
The interest in infrastructure monitoring, as well as the exploitation of satellite SAR data for this purpose, have been growing in the last decade.



This trend is easily detectable in the context of "COSMO-SkyMed Open Call initiatives", especially in the last 3 years (2019-2021), when an increase of about 25% was observed compared to the period 2016-2018.

COSMO-SkyMed observed trend in the framework of the Open Call initiative: focus on infrastructure monitoring

Accounting for the projects supported in the context of the COSMO-SkyMed Open Call initiatives, it comes out that **Interferometric SAR (InSAR) represents the main family of techniques by means of which COSMO-SkyMed data are commonly processed for purposes of infrastructure monitoring.**



From a technical point of view, the majority of the studies and experimental research rely on:

- ✓ long stacks of COSMO-SkyMed images collected in interferometric mode;
- ✓ characterized by the highest temporal revisit allowed by the constellation and/or specific mission observation scenarios (e.g. Map Italy project, Background Mission);
- ✓ along both the ascending and descending geometries to overcome constraints to Line-of-sight (LOS) visibility and achieve 3D reconstruction of the detected motions.

This observed trend has been taken into account in the selection of the topics for the first thematic call of the I4DP National Initiative

The I4DP Initiative has been proposed with the aim of developing a "progressive" ASI roadmap within the downstream, to stimulate the innovation process, economic growth and scientific and technological development as a preparatory stage for national operational and value-added services.

*TOTAL BUDGET for the first call: **7 M€***

- *3 M€ for Market:*

up to 1 M€ for projects with TRL>8 and up to 500 k€ for project with TRL in the range 6-8

- *1,5 M€ for Science with a max co-fund 250 k€/proposal*
- *2,5 M€ for Science with a max co-fund 500 k€/proposal*

COSMO-SkyMed OPEN CALL ACHIEVEMENTS FOR SUSTAINABLE DEVELOPMENT GOALS

FOCUS:
Results and case studies addressing the impact on SDGs targets of the downstream applications based on COSMO-SkyMed data exploitation in the context of the Open Calls initiatives

I.65: Remote Sensing for the Sustainable Development Goals: the contribution of the COSMO-SkyMed Italian Mission in the framework of the ASI's Open Call initiative (Part 1)

I.66: Remote Sensing for the Sustainable Development Goals: the contribution of the COSMO-SkyMed Italian Mission in the framework of the ASI's Open Call initiative (Part 2)

Thank you for your attention

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