Developing Standards for Earth Observation Data Products

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ABSTRACT: Earth Observation data, as one element of the rapidly expanding world of Big Data, holds the potential to assist in addressing many of the societal and environmental problems facing humanity. Standards, especially community-developed open standards, are an important part of the solution. This paper describes the activities of the IEEE GRSS Standards for Earth Observations Technical Committee in developing standards to improve accessibility and interpretability of data from several kinds of remote sensing technologies.

1. Introduction
A flood of new systems and sensors providing Earth Observations is transforming the way information on all aspects of the environment and human activity is being acquired and monitored. The rapid development and deployment of new sensors, the autonomous networking of numerous independent sensors and advances in the capacity to access and process data from these sensors are all driving the need for standards to support communication, analysis and quality assessment of data from these sources. Standards support the rapid implementation of new technologies, helping to ensure compatibility and interoperability.

As data becomes the world’s most valuable resource, it becomes ever more important that the digital ecosystem for planetary data be designed and managed in a way that ensures sufficient public access, transparency, accountability and quality assurance [1]. Standards play an important role here as well.

2. The Need for Global Standards
Historically, standards have enabled technology to advance and for civilizations to flourish. Economic, social and environmental conditions are now driving the need for collaborative development of global standards.

2.1. The UN’s Sustainable Development Goals
Economic, social and environmental conditions are all driving the need for global standards. It has been recognized that fulfilling the goals of the UN’s 2030 Agenda for Sustainable Development and other landmark agreements of the United Nations – including the Paris Agreement on Climate Change, the Sendai Framework for Disaster Risk Reduction, and the New Urban Agenda – all rely on the adoption of voluntary open standards [2]. Standards are seen as a tool for reducing technical barriers to trade, promoting increased resilience to disasters, and fostering innovation and good governance. The International Organization for Standardization (ISO) has identified applicable standards for each of the 17 sustainable development goals (SDGs) identified in the 2030 Agenda [3] (Fig. 1).

2.2. Standards and Ethical Technology
Standards are needed to ensure that the tools and techniques being developed in private, government and public sectors become beneficial for people and the planet. Technology companies are increasingly becoming digital sovereigns that unilaterally establish accepted practice and terms of service [4]. IEEE is working to ensure that autonomous and intelligent systems are created to best utilize science and technology for tangible social progress. The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems seeks to ensure that every stakeholder involved in the design and development of autonomous and intelligent systems is educated, trained, and empowered to prioritize ethical considerations so that these technologies are advanced for the benefit of humanity [5].
3. Open Science
Open standards are one aspect of what is being called Open Science, which emphasizes making the primary outputs of publicly funded research results, i.e. the data, methods and resulting publications, publicly accessible in digital format with no or minimal restriction. Open science embodies open access, open data, open source, and open standards, all of which are important to the unfettered dissemination of scientific discourse [6]. The IEEE standards development process is rooted in consensus, due process, openness, right to appeal and balance.

4. The GRSS Standards for Earth Observations Technical Committee
In 2017 the IEEE Geoscience and Remote Sensing Society (GRSS) convened a Technical Committee (TC) to define and promote standards that can improve the generation, distribution and utilization of interoperable data products from remote sensing systems. The GRSS Standards for Earth Observations TC has sponsored IEEE Standards Association projects that are working on standards for Hyperspectral Imagers (P4001), Synthetic Aperture Radar (P4002), GNSS Reflectometry (P4003), Calibration of Microwave Radiometers (P4004), and Protocols for Measuring Soil Spectroscopy (P4005). The P4001 Project has three subgroups working on Terminology, Testing and Characterization, and Data Structures. P4002 is working on a common data model for SAR data and P4003 is working on metadata and encoding of GNSS-R data products. P4004 is working on a standard describing calibration procedures for microwave radiometers used in geoscience remote sensing applications. The most recently initiated project, P4005, seeks to define protocols for creating, comparing and utilizing soil spectral libraries derived from hyperspectral data, which will contribute to enhanced monitoring and mapping soils worldwide. In addition, the Frequency Allocation in Remote Sensing (FARS) TC is developing guidelines for Earth observing satellite missions to follow in assessing, mitigating and reporting Radio Frequency Interference (RFI) in bands dedicated to remote sensing.

All these projects are supported by experts from remote sensing companies, instrument manufacturers, research institutions and national standards institutes, and are developed through a transparent, consensus-based process that relies on volunteer efforts. Individuals are willing to dedicate their time and expertise to developing standards for many reasons – the desire to shape the direction of an emerging technology, to stay informed, to network with others working on a particular problem. There is, however, a common, overarching motivation, which is to advance the utilization of Earth Observation data for the betterment of humanity by making those data more consistent, accessible and applicable to all those who can benefit from their use.

5. References
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