Workshops

Sunday, October 6th, 8:30 am – 12:30 pm – Room Laurel A-B

Big Datacubes in a Nutshell: Concepts, Standards, Tools

Peter Baumann, Jacobs University, Bremen, Germany

In the quest for managing and understanding Big Earth Data, datacubes have emerged as a paradigm for function-rich services on spatio-temporally aligned, homogenized raster data assets. Generally speaking, datacubes encompass spatio-temporal sensor, image (time series), simulation, and statistics data. For example, in Earth sciences we find 1-D sensor time series, 2-D satellite imagery, 3-D x/y/t image time series and x/y/z voxel data, as well as 4-D x/y/z/t climate and ocean model output. Typically, datacubes are rather large - today, we talk about multi-Terabyte to multi-Petabyte sizes.

It can be observed that datacube engines are emerging in increasing numbers, with a wide variety of access interfaces - from simple Web requests (such as REST) over procedural code (such as python) to declarative datacube analytics languages. Hence, clients have to accommodate completely new interfaces when switching from one service to another - there is a lack of interoperability.

Fortunately, mature standards are in place for achieving datacube interoperability. In ISO we find the domain-neutral SQL array extension, MDA ("Multi-Dimensional Arrays"). In the field of Earth data the OGC Coverage concept defines space/time aware datacubes, with the Coverage Implementation as data model, the Web Coverage Service (WCS) as access and extraction service model, and Web Coverage Processing Service (WCPS) as Earth datacube analytics language. OGC CIS has been adopted by ISO TC211 and also by the European legal framework for a common SDI, INSPIRE. These standards are proven on multi-Petabyte datacube services, massively parallelizing engines, and supported by a large, increasing number of open-source and proprietary implementations.

We introduce to the OGC datacube data and service model, present its current status of standardization in OGC, ISO, and INSPIRE, and illustrate it through operational large-scale services, although learning goals are independent from any particular tool. Hands-on examples, which utilize such services, can be repeated and modified by participants.

The author is datacube standards editor and Working Group chair in OGC and ISO and has long-standing experience in architecting datacube systems. He is co-author of a comprehensive datacube engine overview published by Research Data Alliance in 2018.

Sunday, October 6th, 8:30 am – 12:30 pm – Room Essex A-C

Earth Observation with SAR and InSAR Technology and Multiple-temporal SAR Datasets

Yong Wang, East Carolina University

Synthetic aperture radar (SAR) and interferometric SAR (InSAR) techniques and multiple-temporal SAR datasets have been widely and successfully used in Earth observation to study the ever-change environments. Examples include the global/national land use and land cover, national land survey, agriculture, forestry, fishery, resource exploitation, environmental protection and monitoring, disaster prevention and mitigation, and national security. Therefore, the objectives of the workshop are to overview the state of the Earth observation using SAR with the focus on the development of SAR hardware and data analysis software, and eye-opening applications using time-series InSAR (TSInSAR) techniques and datasets. It is 2-hour long. The outline is

- Radar, synthetic aperture radar (SAR), interferometric SAR (InSAR) (0.5 hour),
- Airborne and spaceborne SARs (0.5 hour),
- Time-series InSAR (TSInSAR) techniques and datasets (0.5 hour), and
- Surface deformation assessed by TSInSAR (0.5 hour).

The level is intermediate.

Sunday, October 6th, 9:30 am – 11:30 am – Room Kent A-C

Introduction to Synthetic Aperture Radar Applications

Batu Osmanoglu, NASA Goddard Space Flight Center / Franz J. Meyer, Alaska Satellite Facility University of Alaska Fairbanks

Synthetic Aperture Radar (SAR) is an imaging sensor that uses radio frequency waves. Similar to optical imagers, it can be used to map land use/cover and changes on the Earth surface. Main advantage of SAR over optical sensors is that it can acquire data independent of sun-light, under almost all weather conditions, penetrating clouds, and it can measure displacement in the satellite look direction very precisely. In the last decade, several radar imaging satellites have been launched, e.g. TERRASAR-X and TanDEM-X by Germany, COSMO-SKYMED by Italy, RADARSAT-2 and Radarsat Constellation Mission by Canada, ALOS-2 by Japan, and SENTINEL-1A/B by Europe. These satellites aid in applications such as natural resources monitoring (water, vegetation, agriculture and forest), and natural hazard mapping (landslide, earthquake, flooding etc.). Even though SAR systems have some advantages over optical sensors, their non-nadir imaging geometry, and radar specific imaging characteristics often confuse new users.

In this lecture, we will provide fundamentals of SAR systems, basics of imaging geometry, characteristics and impacts of resolution, wavelength and polarization. We will talk about SAR applications, and the impacts of target parameters such as dielectric constant, topography, penetration, and surface roughness. We will also cover the basics of pre-processing steps such as calibration, multilooking, speckle noise filtering, terrain correction and geocoding. We will highlight the operational SAR systems and their imaging parameters. Time series analysis of SAR data, and examples on damage mapping (change detection) as well as displacement mapping (interferometry) will be presented. The example data sets will be processed by a new cloud SAR processing environment called OpenSARLab, developed by ASF/UAF.

Sunday, October 6th, 9:30 am – 11:30 am – Room Dover A-C

Demonstration and Application of the LCMAP Product Suite

Kristi Sayler, U.S. Geological Survey

The U.S. Geological Survey's Earth Resources Observation and Science Center implemented a new capability titled LCMAP (Land Change Monitoring, Assessment, and Projection). This capability couples novel methodologies with all cloud free Landsat data from the 1980s forward to produce annual land-cover and land-change products readily available to the research community. The version 1 products are bundled into a suite of five land-cover products and five land-cover change products. The land-cover products are primary land cover, secondary land cover, primary land-cover confidence, secondary land-cover confidence, and annual land-cover change. The land-cover change products are time of spectral change, change magnitude, time since last change, spectral stability, and model quality. The workshop objectives include a brief introduction to LCMAP, a detailed description of each product in the suite, and a demonstration of product applications followed by an opportunity for participants to explore and interact with the products. The product sample for the workshop is the entire suite for an area in central California (500 km x 500 km; 1985-2017). This workshop provides an environment for participants to interact and engage with others, including LCMAP scientists who can answer questions pertaining to data characteristics, format, and applicable uses. Participants will benefit by gaining familiarity with the data and how LCMAP products can be applied in their research. LCMAP scientists encourage participants to share insight and provide feedback. Incorporating user experience benefits the broader research community by enhancing future product and tool development.

Participants are required to have a laptop (minimum 5 GB storage) with image viewing and processing software installed (ERDAS Imagine, ArcGIS, QGIS). It is recommended that participants download the LCMAP published sample data from the website below prior to the workshop. The data is available at:
https://www.usgs.gov/land-resources/eros/lcmap/lcmap-sample-products

This workshop is limited to 30 participants.

Sunday, October 6th, 1:00 pm – 5:00 pm – Room Kent A-C

Google Earth Engine for Teaching, Research and Outreach

JB Sharma, University of North Georgia and Ge Pu, Syracuse University

Cloud-based image processing platforms bring unprecedented possibilities for remote sensing education, research and outreach. This workshop will have two parts; the first part will provide an interactive exploration of Google Earth Engine (GEE) capabilities with examples of projects demonstrating the use of GEE in education, undergraduate research and outreach. This will be followed by hands on activities including data exploration, supervised classification, and a hands-on activity. The second part will include more advanced topics of GEE that includes image processing, widget use and app building using an API based coding environment. Each participant will get at 4 GEE activities for classroom use and several GEE API scripts that the participants can modify for their own use.

Sunday, October 6th, 1:00 pm – 5:00 pm – Room Laurel A-B

Research Data Management for Today, Tomorrow, and Beyond: an Introduction to Core Principles, Practices, and Required Skills

Karl Benedict, University of New Mexico and Nancy Hoebelheinrich, Knowledge Motifs LLC

Earth and environmental sciences are more collaborative and increasingly depend upon diverse and growing collections of remote sensing, ground observation, and modeled data products in addressing research, decision-support, and public communication needs. This increasingly complex data environment, both in terms of the data that are being used and produced, when combined with requirements for more effective documentation and communication based on those data, requires that Earth scientists explicitly plan for and execute effective data management through the both the research and data lifecycle. This workshop will provide an introduction, grounded in Earth science, of the work that must be done to first plan for effective data management, analysis, documentation, preservation, and sharing; and second translate that plan into high-impact research and data products that will maintain that impact well beyond the life of a specific research project. Throughout the workshop connections to additional training materials within the Earth Science Information Partners Data Management Training Clearinghouse will be highlighted, providing an opportunity for workshop participants to continue their learning well beyond the workshop session presented at the ISRSE meeting.

Sunday, October 6th, 1:00 pm – 5:00 pm – Room Dover A-C

Preparation for ASPRS Certification - General Knowledge

Robert Burch, Ferris State University

This workshop covers the common knowledge areas comprising a large portion of exam content for ASPRS Certification. It is valuable preparation for those who have never taken an ASPRS exam, as well as for those who have expertise in a particular specialty, such as lidar or UAS, but feel less prepared for the general knowledge component of the exam. This workshop will also explain the certification application process and the importance of certification in career development.

Sunday, October 6th, 1:00 pm – 5:00 pm – Room Essex A-C

Machine and Deep Learning Image classification using ArcGIS Pro Image Analyst Extension

Amr Abd-Elrahman, University of Florida

This workshop teaches participants how to (1) utilize the ArcGIS Pro Image Analyst extension to conduct pixel- and object-based image classification using traditional (Support Vector Machine and Random Forests) machine learning algorithms; (2) build models for data preparation and experiment with different classification parameters; (3) Use the deeplab deep learning architecture for image segmentation (classification). Participants will be briefly introduced to necessary theoretical background information as well as practical implementation. Real world examples of wetland land cover classification will be used in the demonstration.
Outlines:

1. Introduction to image classification concepts and machine learning algorithms
2. Object-based image segmentation and data preparation
3. Machine learning algorithm training, classification, and validation
4. Creating models for comparing classification results
5. Preparing training and validation datasets for deep learning
6. Transfer training using the tensorflow deeplab architecture
7. Classifiy images using trained deep learning network