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STRATEGY FOR THE VIRTUAL LABORATORY FOR EDUCATION AND TRAINING IN SATELLITE METEOROLOGY 2024–2027

Scope and Definition

The WMO-CGMS Virtual Laboratory for Education and Training in Satellite Meteorology (VLab) is an activity of the WMO Space Programme, based on a global network of specialized training centres, named Centres of Excellence (CoEs), that are supported by one or more Coordination Groups for Meteorological Satellites (CGMS) Satellite Operators (SatOps) (see http://vlab.wmo.int).

The CoEs are established in the various WMO Regions to address user needs for increased skills and knowledge in using satellite data within their region. They are often co-located with WMO Regional Training Centres (RTCs).

VLab activities are implemented by CoEs in cooperation with CGMS SatOps.

Mission of VLab

To improve weather, water, climate and related environmental services by enabling WMO Members to utilize satellite data.

Upholding WMO Core Values and Key Drivers

(1) Accountability for results and transparency;

(2) Collaboration and partnership;

(3) Inclusiveness and diversity.

Long-term Goals of VLab

1. Continuously improve the utilization of data from the space-based component of the WMO Integrated Global Observing System (WIGOS) for services that are increasingly reliant on satellite data;

2. Globally share knowledge, experience, methods, and tools related to access and usage of satellite data, especially in support of WMO Members that have limited resources.

Strategic Objectives that VLab Seeks to Support

Recognizing

The goal declared by the UN Secretary-General at the World Meteorological Day on 23 May 2022: "Within the next five years, everyone on Earth should be protected by early warning systems against increasingly extreme weather and climate change."

And

The need to address societal challenges and global development agendas put forth under the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction 2015–2030, and the Paris Climate Agreement.

The VLab Strategy seeks to encourage members and partners to plan and deliver training that enhances the ability to:

- Objective 1.1 Improve the availability of Earth observation data to support operational service delivery in line with the expected growth of the space-based observing system component as outlined in the *Vision for the WMO Integrated Global Observing System in 2040* (WMO-No. 1243).

- Objective 1.2 Provide support to achieve readiness for the next generation of satellites, instruments, data and product dissemination systems, and processing hardware and software.

- Objective 1.3 Continue to support primary and "backup" data delivery for emergency preparedness and for WMO Members that have limited resources.

- Objective 2.1 Transfer the improved scientific understanding and technological advances that can lead to enhanced National Meteorological and Hydrological Services (NMHSs), and the evolution of the services they provide.

- Objective 2.2 Promote the uptake of satellite data in research and institutions.

- Objective 2.3 Respond to new and emerging service demands for weather, water and climate. These include impact-based decision support services (IDSS) and the application of the Global Framework for Climate Services (GFCS) in support of marine and land applications.

- Objective 2.4 Increase the diversity and quality of services offered by WMO Members in line with the WMO Earth System approach and efforts to enhance the quality of these services.

- Objective 2.5 Achieve the competence, quality control requirements, and professionalism within WMO Services, particularly noting the human resource management challenges facing many NMHSs.

- Objective 2.6 Work with WMO Education and Training Programme (ETR) to maintain and increase content and usage of the calendar of events and the library of satellite training resources, which will enable extending the reach and users to efficiently find and repurpose these resources.

- Objective 2.7 Grow social community projects to increase public user trust and confidence while also contributing to verification of remotely sensed observations (for example surface-based precipitation measurements confirming derived remotely sensed precipitation measurements).

Challenges and areas of improvement

During the past few years, members report shortages of both trainers and operational staff due to retirement, leaving for other employment, or lack of funding. VLab Trainer interaction with the Regional Satellite Data Requirements Groups and User Conferences further revealed limited available resources for organizing and participating in capacity development activities, lack of expertise in various satellite focus areas, and language barriers. Many members expressed a training need for discovery, utilization and visualization of various satellite data sets for local applications.

Translation of communications, documents, and real-time translation during meetings and events continues to be an issue for VLab progress. New technologies, including artificial intelligence translators, will continue to be explored and evaluated to improve in this area.

The pandemic forced all of us into a predominantly virtual mode. Many members reported challenges due to low Internet bandwidth of both instructors and trainees, limited access to learning management systems to deliver training materials and track participants, and challenges with trainers learning and adapting to online teaching and the software used.

Where the training was offered successfully, there was overwhelming participation that required a larger number of facilitators. Many organizations require certificates from employees who attend virtual trainings and, in a few cases, due to the challenges of increased participation and no digital certificates, the certificates were delayed.

Many VLab CoE and SatOp members are willing to share the lessons learned from the challenges and successes and collaborate on training. Two main areas identified include:

(1) Training material: Continue to identify and connect resources in formats that can be readily accessed by others to facilitate translations, as well as modifications and updates of training resources. The VLab Strategy seeks to enable VLab to continue to collaborate with WMO ETR to leverage their training resources library, learning management system, software advice, and techniques;

(2) Training personnel: Encourage interaction among the trainer operational and technical communities to participate actively in training events of other CoEs or SatOps. Promote members to invite speakers and lecturers from other CoEs and SatOps for specialized subjects.

VLab Strategy for the period from 2024 to 2027

The VLab Strategy describes the priorities for the WMO-CGMS VLab. It takes into account the drivers articulated in:

(1) WMO Strategic Plan;

(2) Capacity Development Strategy;

(3) The Statement of the 14th Symposium on Education and Training;

(4) Coordination Group for Meteorological Satellites (CGMS) High Level Priority Plan.

VLab will work towards its objectives by:

- Identifying regional training needs and prioritizing the organization of VLab training events.

- Developing, reusing, coordinating, and implementing training that links the enabling satellite skills to the competencies and qualification frameworks where they exist.

- Encouraging evaluation of the impact of the training on the use of satellite data and products to demonstrate the long-term benefits of training.
- Encouraging the availability of training materials in the official UN languages and other native languages.
- Encouraging exchange of information and enhanced communication between researchers, trainers, and operational users in developing new products from current and planned satellite missions that can lead to improved meteorological, hydrological, and environmental services.
- Promoting the benefits of using current and new satellite-based products and providing technical and training support, where possible, to make them available to users.
- Engaging directly with and reporting to its co-sponsors, which currently include the WMO Expert Team on Space Systems and Utilization (ET-SSU) and the Coordination Group for Meteorological Satellites (CGMS), and partner organizations.
- Engaging the next generation of students and early career researchers to utilize satellite data in applied research.
- Increasing efforts to engage interdisciplinary early career professionals by creating opportunities for them to participate in and contribute to WMO activities.
- Promoting mentoring and peer-to-peer learning opportunities for both students and instructors.

VLab will implement its overall strategy by:

- Developing and delivering training on user identified needs for access, display, and applications in the form of virtual, blended, and face-to-face events, Regional Focus Group discussions, and self-study resources.
- Supporting regional and cross-regional satellite user conferences and associated training workshops.
- Contributing to the regional satellite data requirement dialogues, and providing briefings on the regional data access to NMHSs to ensure they have the appropriate staff to support access, processing, visualization and application of satellite data.
- Providing feedback to satellite operators on the use of the available data, products, systems and services as well as the challenges associated with their full exploitation.
- Raising awareness on the available in-person/online training and distance-learning resources provided by WMO-CGMS VLab CoEs, Satellite Operators and other WMO Members in various regions.
- Advertising training events in the VLab Calendar of Training Events and WMO Global Campus Events Calendar.
- Encouraging VLab Members to add linkages to their training resources to the WMO Global Campus E-Library.
- Providing support via the VLab Trust Fund to promising and early career personnel to attend training events, conferences, or conduct scientific activities that contribute towards satellite product development, evaluation, and implementation.

In the period 2024 to 2027, VLab will pay particular attention to:

- Big data and cloud-computing platforms: noting that their utilization in data dissemination and online processing will increase, it will contribute towards improvements in data sharing and resource exchange and facilitate training efforts.

- Impact-based forecasting and IDSS: encourage NMHS personnel to continuously work with core partners, such as emergency personnel, public safety officials, and social scientists, on the production and dissemination of accurate and consistent forecast information for weather, water, climate, and other relevant areas of application that have a high impact.

- Technical capacity development: supporting the technical staff involved in primary and backup satellite data reception and processing, through training, provision of up-to-date information, and potentially a skills framework.

- Earth systems approach: Establishing interdisciplinary connections to ensure data interoperability and knowledge sharing for satellite-based application areas linking meteorology, climatology, hydrology, agrometeorology, oceanography, atmospheric composition, geology, and many other fields.

- Virtual Reality applications: explore utilization of Virtual Reality technologies to enhance the learning process and provide alternative satellite training delivery and learning tools in virtual spaces.

- Space weather: noting the growth in interest for space weather services around the world, VLab will engage and cooperate with relevant partners, including the Committee on Space Research (COSPAR), the International Space Environment Service (ISES), and the WMO Expert Team on Space Weather (ET-SWx), seeking to enhance the implementation of space weather services.

The delivery of training will rely on:

- Use of digital technology where appropriate, recognizing that in certain situations, the solutions may rely on simple technology and human intervention based on expertise.

- In-person and distance-learning delivery of training that uses a mixture of formal, semi-formal, and informal learning methods where appropriate.

Quality Control and Evaluation

To ensure quality of services provided by VLab, internal quality evaluations will be conducted. These include undertaking evaluations of the training impact, as well as establishing procedures to ensure that VLab expectations are met. Annual reviews of achievements will be carried out to ensure focus is kept on the provision of training in the main priority areas established in the VLab Strategy.

Collaboration

Enhance the regional and global coordination and collaboration between CoEs, SatOps, WMO RTCs, and other partners in order to maximize the efficiency of effort.

Maximize the discoverability and usability of resources. Foster the co-development of learning events and materials utilizing existing and emerging platforms, including social.

Promote good practice in the VLab training community and encourage collaboration with the WMO Global Campus network. Grow cross disciplinary relationships with other Earth observation training communities to explore opportunities to collaborate and to share tools and knowledge for the delivery of the VLab objectives. Encourage the other communities to use the WMO competency frameworks.

The development and delivery of training, with particular emphasis on national and regional specific demands and requirements, relies on the strong collaboration between VLab CoEs and SatOps. An unexpected positive impact of the COVID pandemic was the strong collaboration and support between CoEs, RTCs and partner SatOps. It is the VLab belief that these collaborative activities have and will continue to contribute to the social and economic benefits of the large investments in the space-based observing system.

The continuation of VLab collaboration with other training and education programmes is essential for further success. VLab will continue to explore partnerships with the WMO Training and Education Programme, the Community for the Advancement of Learning in Meteorology and related disciplines (CALMET), the Earth Observation Training, Education, and Capacity Development Network (EOTEC DevNet) and with other programmes in areas of common or complementary interest.

Resources

VLab is an entity sustained by contributing CoEs and SatOps. The technical support function is critical for VLab coordination. Currently, VLab provides a broad support to CoEs activities with its central website (http://vlab.wmo.int) serving as a platform for collaboration and networking. The work of a dedicated Technical Support Officer (TSO) is mission-critical in this regard. VLab seeks to expand its reach by providing support via the VLab Trust Fund to promising and early career personnel to attend training events and conferences, or conduct scientific activities. Both of these activities require a long-term collaborative funding effort from CGMS Satellite Operators via the designated WMO VLab Trust Fund, as per section 7.2.3 of CGMS HLPP 2022–2026.

ANNEX

STATUS AND ACHIEVEMENTS OF VLAB

In its more than 20 years of existence, VLab has demonstrated its capability to deliver local, regional, and global scale training events in satellite meteorology and related fields. All VLab activities support the objectives of the WMO Global Campus.

During the past 3 years (2019–2021), VLab conducted the following activities as reported by members (link to VLab reports: https://wmo-sat.info/vlab/documents/):

(1) Training activities:

(a) Annually delivered more than 25 Regional Focus Group discussions (RFGs) and more than 100 training courses in seven languages, that reached approximately 4 500 participants per year. During the pandemic in 2020, there was a dramatic decrease in the number of events (45%) and in the number of participants (66%) over 2019. The recovery in 2021 with virtual resources was tremendous with an increase in the number of events (88%) and number of participants (77%) almost back to pre-pandemic levels (compared to 2019);

(b) Supported achieving user readiness for the new satellite systems and facilitated a seamless transition to its operational utilization globally;

(c) Developed training materials based on training needs analyses that focused on access, processing, visualization and utilization of satellite data and products for various application areas;

(d) Collaborated on translation efforts to reach larger audiences in their native languages. In 2019, 2020, and 2021, 66%, 48%, and 51% respectively of training events were offered in English. The increase in training sessions offered in languages other than English is encouraging.

(2) Collaboration and sharing:

(a) Utilized WMO SP-12 Guidelines on Satellite Skills and Knowledge for Operational Meteorologists to inform training development, implementation, and assess impacts;

(b) Participated and contributed to WMO Global Campus activities and collaboration mechanisms;

(c) Maintained partnerships with the WMO Training and Education Programme, the Community for the Advancement of Learning in Meteorology and related disciplines (CALMET), the COMET Program, the Applied Remote Sensing Training Program (ARSET), the Earth Observation Training, Education, and Capacity Development Network (EOTEC DevNet), and others.

(3) Management and oversight:

(a) Held VLab Management Group (VLMG) quarterly online meetings to plan and oversee VLab activities. Due to the pandemic, no in-person meeting occurred;

(b) Maintained good communication between training centres and satellite data providers around the globe, bringing research products into operations and feedback from operations to enhance research via user conferences and surveys.

Accelerated implementation of new products in operations and the development of short reference guides.

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