

## **VIRTUAL LABORATORY AND RELATED MATTERS**

In response to CGMS action 36.04

The paper reports on training activities within the Virtual Laboratory for training and education in satellite meteorology (VL) along with future plans and directions. Important developments have taken place since CGMS-36, including the CBS approval of the five-year VL strategy, the recognition of new Centres of Excellence (CoEs) in Pretoria, South Africa and in Moscow, Russian Federation and the appointment of the VL Technical Support Officer (TSO). The TSO has efficiently supported the activity and advanced the objectives of the VL along the lines of the new five-year strategy, but its position needs to be further funded.

A summary is given of the annual reports from the CoEs and sponsoring satellite operating agencies for the period from September 2008 to April 2009.

A proposal is presented to initiate training activities towards the research community in developing countries, following initial suggestions from NASA.

CGMS is invited to note the important achievements of the VL, to provide comments, and to consider the actions below.

### Action/Recommendation proposed:

- VL Co-chairs to discuss with VL sponsoring agencies the funding of the Technical Support Officer (TSO) position from November 2009 onwards.
- VL Co-chairs and WMO to convene the fifth Virtual Laboratory Management Group (VLMG-5) during the first half of 2010.
- WMO to continue dialogue with ISRO regarding the establishment of a CoE and the co-sponsoring of the CoE in Oman.
- VL Co-chairs to seek an agreement between CGMS, COMET, and WMO with a view of using ESRC as a resource library for the VL.
- The Co-chairs, in consultation with the WMO Space Programme and other relevant WMO Departments, to prepare a roadmap towards widening the scope of VL activities to serve the needs of emerging scientific communities in the developing countries. This roadmap will be reviewed by VLMG and presented to CGMS-38 for approval.

## **VIRTUAL LABORATORY AND RELATED MATTERS**

### **1 INTRODUCTION**

This report briefly describes the latest activities / achievements of the Virtual Laboratory for training and education in satellite meteorology (VL) since September 2008. Besides the various activities which took place in the Centres of Excellence (CoEs) the major achievements are the approval by CBS of the five-year VL strategy, the new CoEs in Pretoria, South Africa and in Moscow, Russian Federation and the appointment of the VL Technical Support Officer (TSO).

Section two provides a summary and analysis of the annual reports received from the CoEs and satellite operating agencies. In Section three, the activities of the Virtual Laboratory since CGMS-36 are highlighted. Section 4 gives an outline of the planned activities and projects for the near future and presents the tasks and ongoing activities of the TSO. Finally, Section 5 introduces a proposed development of the VL towards the scientific research community in developing countries, following preliminary contacts established between NASA and WMO.

### **2 SUMMARY OF ANNUAL REPORTS FOR THE PERIOD FROM SEPTEMBER 2008 TO APRIL 2009**

Satellite operators and CoEs reported on their training activities for the period from September 2008 to April 2009 by completing a standard format report. Highlights are given below. Complete reports can be obtained from the WMO VL web site.

The CoEs devoted a lot of efforts in providing both online and classroom courses. A total of 53 courses were offered by Virtual Laboratories in a variety of topics depending on the expertise and needs of each CoE. A list of course topics offered can be seen in Appendix II. Information from the reports received indicates that about 700 people took part in the courses offered during the reporting period. Adding to that figure, there are also online courses that can be taken at any time, providing ongoing accessible training (e.g. VISIT Teletraining and COMET modules).

Regional Focus Group (RFG) events, like online weather briefings and product discussions were also mentioned in the reports. Regional daily weather briefings are the most common. The most popular RFG event within the CoEs is the monthly discussion group run by NOAA and CIRA. This is a bilingual group (English and Spanish), which holds live weather briefings online using VISITview to show many GOES and POES products across the western hemisphere plus some special products (MJO, SST anomalies, soundings, etc.). Guest lecturers are also invited and this RFG event has frequent participants from Barbados, Costa Rica, Argentina and Brazil. A similar RFG is now planned by Brazil for the Portuguese-speaking countries. INPE is organizing its first session and already has a list of participants from seven of the nine Portuguese-speaking countries in the world.

RFG and course participants were from various regions around the world. Appendix III provides a summary of the training courses and the number and countries of origin of trained participants.

The internet connection is still not very stable in some CoEs and has to be improved significantly to allow optimum and smooth use for online training courses.

## **2.1 VL Reporting Template**

The reporting template was created in order to facilitate progress tracking at the CoEs and the satellite operating agencies. The overall feedback concerning the reporting template was generally positive, with VL members finding it easy to use.

## **3 ACTIVITIES IN THE VIRTUAL LABORATORY SINCE CGMS-36**

The five-year VL training strategy, approved by CGMS-36, has been officially endorsed by the Commission for Basic Systems at its fourteenth session (CBS-XIV) in March-April 2009, and has been further noted by the WMO Executive Council in June 2009. The new strategy constitutes an important step for the future development of the VL.

The VL has grown, training and outreach activities have taken place within the various CoEs, and the scope of VL activities has widened. The VL performed at an exceptional level of activity since CGMS-36. This was made possible, to a large extent, by the employment of a VL Technical Support Officer (TSO).

### **3.1 New Centre of Excellence: South African Weather Service (SAWS)**

After endorsement by CBS-XIV, the South African Weather Service (SAWS) has become an official VL CoE for training in satellite meteorology and related environmental remote sensing within the Southern African sub-region. SAWS' commitment to regional satellite training will certainly be a valuable contribution to the VL and will strengthen the development of satellite meteorology and remote sensing data applications in Africa.

### **3.2 New Centre of Excellence in the Russian Federation**

Also during CBS-XIV the proposal of the Russian Federation to participate in the VL as a sponsoring agency as well as establishing its own Centre of Excellence was welcomed. The CoE will be at the Regional Training Centre in Moscow and the sponsoring satellite agencies will be ROSHYDROMET and ROSCOSMOS.

### **3.3 Regional Focus Groups**

The VL Focus Group of the Americas, which carries out regular online weather briefings in Costa Rica and Barbados, has proved to be successful in training and expanding the use of satellite data. This demonstrates the importance of Regional Focus Groups (RFG) within the VL. It is strongly recommended that all Centres of

Excellence conduct regular such RFG discussions, which are a key element of the VL strategy.

### **3.4 VL Newsletter**

The first VL Newsletter was issued in April 2009 and was well received by VLMG members. It serves as an important tool to inform the VLMG members and other interested parties about the activities of the VL. The next edition of the VL Newsletter is planned for November/December 2009.

### **3.5 The new VL Technical Support Officer (TSO)**

In response to CGMS action 36.04, a vacancy notice was prepared among the VL Co-chairs and WMO for a VL Technical Support Officer (TSO). INPE proposed Mrs Luciane Veeck for this new post and made funds available to sponsor this position for a period of six months starting from 1 May until the end of October 2009. An online interview was conducted with Mrs Veeck and the interview board was convinced of her background experience and capabilities and agreed that she was the suitable candidate for the post.

Mrs Veeck has a background in environmental science, a MSc in Environmental Geochemistry and a BSc in Oceanography. She has experience with distance learning and teaching, gained by working at The Open University in England. Mrs Veeck started to work for the WMO VL in May and was based in INPE, Brazil until mid August. She is now back in England and working from Southampton.

The appointed TSO has been working to support CoEs in many ways:

- Receiving and evaluating reports from the CoEs;
- Assisting in the setting up of the Moodle server at INPE in Brazil;
- Liaising with trainers to collect materials and set up a Moodle site for the blended course to take place in Maputo (beginning of November 2009);
- Assisting in the issuing of the VL Newsletter;
- Initiating the organization of the regional training event weeks by collecting suggestions of topics;
- Designing an initial logo suggestion for the Virtual Laboratory;
- Assisting in the establishment of a RFG for the Portuguese speaking countries;
- Assisting in the organization of the VLMG web meetings (July 2009) and also the follow-up actions;
- Assisting the task team to create a centralized WMO VL web site;
- Submitting training resources available to the Environmental Satellite Resource Center (ESRC).

Mrs Veeck visited NOAA and CIRA in June. She learned about the support provided by NOAA and CIRA to many international satellite training activities and participated in two RFG sessions. She also gained knowledge of the ESRC, which is of great use for the VL. EUMETSAT has also hosted the TSO on two occasions in July and September.

In July she had the opportunity to meet and work with the EUMETSAT team, learning a great deal more about the VL current status, goals and strategic objectives. In September she attended the Moodle Workshop for Advanced Learners.

In order to bring the started projects to fruition, it is crucial to further employ a TSO. Therefore a letter was sent by the Director of the WMO Space Programme to all CGMS satellite operators seeking their commitment to continue financially supporting the VL TSO post in the future.

### **3.6 VLMG Web Meetings**

A face-to-face meeting of the Virtual Laboratory Management Group (VLMG) was initially planned for September 2009. Due to limited travel funds and time constraints, it was agreed that in 2009 only online meetings could be conducted. It was furthermore agreed to conduct two of these online meetings and to hold each meeting in two separate sessions for the western and eastern hemisphere respectively.

On 20 July 2009, the first online meeting for the western hemisphere was attended by 17 participants on four continents. The web meeting for the eastern hemisphere took place on 23 July 2009 and included 13 attendees. EUMETSAT hosted both online meetings using Centra - a web conferencing tool provided by Saba. The organization of these meetings was very successful and the model, again using Centra will be used for the upcoming online VLMG meetings in November. The next face-to-face VLMG meeting will be postponed to the first half of 2010. Preliminary discussions are ongoing about the potential hosting of the VLMG-5 meeting by CMA in Beijing.

### **3.7 A logo for the VL**

In order to better promote the identity of the WMO Virtual Laboratory, a new logo has been designed by the TSO. Two suggestions for the VL logo were presented during the web meetings on 20 and 23 July 09. All members were asked to provide feedback on the designs and submit additional proposals. The most popular design is shown in Appendix I.

### **3.8 Harmonized VL web sites and domain name registration**

During VLMG-4, a small task force was nominated to work on the harmonization of VL web sites. Since the TSO has started to work for the VL, this project has progressed well. As a result there are currently seven VL web sites (BoM, CIRA, EUMETSAT, INPE, JMA, ROSHYDROMET and WMO). All VL web sites will be coordinated via the central WMO VL web page hosted on a server provided by WMO in Geneva.

The importance of a dedicated domain name registration for the VL web site was discussed during the VLMG web meetings. The name "vlab.wmo.int." was selected. As of 23 September 2009, WMO has made the CGMS-WMO Virtual Laboratory web pages directly accessible through the address: [vlab.wmo.int](http://vlab.wmo.int) (or: <http://vlab.wmo.int>).

### **3.9 Virtual Resources Library**

The possibility of using COMET's new Environmental Satellite Resource Center (ESRC) as a resource library of the WMO VL is under investigation. The ESRC is intended to be a community site where organizations and individuals around the globe can easily submit their resources via online forms by providing a small set of metadata.

The COMET Program maintains the site and, through dedicated points of contacts for each topic, provides the necessary quality assurance and monitoring to ensure that all resources are appropriate and well described before being made available. The VL TSO would assure that relevant VL materials are submitted to ESRC and kept up-to-date.

It is recommended to further investigate this possibility and, if relevant, to seek an agreement between CGMS, COMET, and WMO to use the ESRC as a resource library for the VL.

### **3.10 VL Moodle web site**

A dedicated VL Moodle web site has been created on the EUMETSAT Moodle server. VLMG members have received their login and password for the web site. This site contains materials such as presentations, recordings of VL meetings and relevant documents. Additionally the Moodle web site can be used by the VLMG members as a forum to discuss topics of interest.

### **3.11 KMA to become a new VL member**

Recently KMA showed a strong interest in the activities of the VL and contacted the WMO Space Programme for information. WMO and the KMA have started a dialogue on this topic. KMA participated in the most recent online VL meeting in order to become familiar with the different projects within the VL.

### **3.12 Discussions with WMO Directorates of Research, Education and Training, and the Space Programme**

Following initial contacts by NASA with the WMO Department of Research at the beginning of 2009, the potential was investigated of making use of the WMO VL assets and infrastructure for training of researchers and scientists. Initial discussions took place on this subject in Geneva, on 9 and 10 July 2009, within WMO with the Research Department, the Education and Training Office, and the Space Programme. This subject is further developed in Section 5 below.

## **4 OUTLOOK**

### **4.1 Planned activities:**

- More regular and continuous RFG discussions (e.g. Costa Rica and Barbados) to be conducted by all CoEs;

- Initial SATRep online from Pretoria to be further developed;
- Specific focus should be put on the creation and delivery of blended learning courses.
  
- **The Use of Satellite Data for Land-Surface Monitoring**  
The first blended learning course for Portuguese speaking countries took place from 1-5 December 2008 in Brasilia, Brazil. In total there were around 30 participants and it can be summarized that it was a very successful course. A similar course will take place from 2-6 November 2009 in Maputo, Mozambique. The course is a simultaneous face-to-face and online training event based on VISITview and Moodle. This regional online course includes three WMO Regions (I Africa, III South America and VI Europe).
  
- **The organization of compatible time zone training event weeks**  
These training events should be a continuation of the HPTE training event with the difference of repeating the same lectures in another geographical area. It is planned to start with dust and volcanic ash in November 2009. For further training events of this type the following topics are considered:
  - Fire and smoke
  - Floods
  - Tropical convection
  - INPE suggested nowcasting
  - JMA suggested:
    - The tropical cyclone analysis
    - The introduction of satellite products
  
- Widening the Scope of the WMO/CGMS Virtual Laboratory to cater for the education and training needs of emerging scientific communities in developing countries. This topic is presented in Section 5.
  
- ISRO confirmed informally their commitment to co-sponsor the CoE in Oman (and to establish a CoE in India) at VLGM-4. Dialogue needs to be pursued with ISRO to implement this sponsorship.

## 4.2 Ongoing and future tasks of the TSO

As mentioned above, further employing a TSO is crucial to keep the progress of the activities initiated by the TSO from May 2009. A good example of that is the submission of resources to the ESRC. The links of working VL web sites were already submitted to ESRC, as were the training materials made available by JMA.

At the moment, training resources from the Brazilian VL web site (40 courses available) are steadily being submitted. The same should be done with the resources available from each CoE. New training materials prepared should also be submitted so as to keep the virtual resources library up-to-date.

As for future activities, some specific tasks are listed below:

- Assist in the establishment of more Regional Focus Groups (RFG) and the building up of user communities;
- Assist the existing RFGs and coordinate activities between them;
- Assist technically in the set up and use of tools such as MOODLE, Visitview, CENTRA, web-casts;
- Keep continually updated regarding evolving training technologies;
- Prepare regular VL newsletters;
- Establish constant communication with people involved;
- Assist the RFG coordinator with the distance sessions;
- Maintain the centralized web page;
- Maintain the training and RFG discussion groups schedules;
- Assist the VLMG Co-chairs monitoring activities;
- Produce relevant reports for use by CGMS, ET-SUP, VLMG;
- Help in the organization of training events in coordination with WMO;
- Produce assessments based on the annual reports of the CoEs;
- Help in the analysis of the personnel (the training component);
- Ensure that training events have a virtual component for people who want to participate and cannot travel;
- Carry out and report on the evaluation of training events;
- Provide advice on future VL developments.

## **5 WIDENING THE SCOPE OF THE VL TO SERVE TRAINING NEEDS OF EMERGING SCIENTIFIC COMMUNITIES IN DEVELOPING COUNTRIES**

### **5.1 Background**

In a recent exchange of correspondence with WMO and the CGMS Secretariat, Dr Richard Kleidman, from NASA, has highlighted the need for a more organized effort to provide remote sensing education and training to science communities in less developed countries. In many of these countries students frequently endeavour to pursue their research without access to satellite data because of the daunting task of learning how to understand, acquire and make proper use of the data. He realized that the best way forward would be to provide isolated researchers new to the field of satellite data applications with access to well trained individuals who could play the role of local experts.

As a first response to this need, Dr Kleidman has developed a series of NASA supported training workshops, initially primarily focused on MODIS atmosphere products, and geared towards graduate students, undergraduates and researchers new to remote sensing. To date, workshops have been held in Brazil, India, Israel, Mexico and the USA. Occasionally they are held in conjunction with training on the use of ocean products. Recently the scope of the workshops has gradually widened to include atmospheric chemistry/aerosol products and information on new land product applications using data from other EO satellite sensors.



## 5.2 Implementation

The acquisition by researchers of greater expertise in the use of remote sensing products can be achieved through regional training centres that would provide short courses and dedicated lectures (classroom or online) addressing particular aspects of remote sensing and which cater to more specific needs of the local scientific communities, providing information in the appropriate language.

It seems logical to make use of the capabilities of the existing WMO/CGMS Virtual Laboratory for Satellite Education and Training (VL) to achieve this goal. This would fit with VL longer term strategic planning and would be a synergistic use of existing global infrastructure and pools of expertise.

It is recalled that CGMS R&D satellite operators are fully eligible and welcome to participate in VL activities and support scientific institutes offering education and training to their user communities. Furthermore, at the ninth session of the Consultative Meetings on High-level Policy on Satellite Matters (CM-9), several R&D agencies including NASA and ISRO expressed their willingness to support VL activities through linkages with their own training activities and recommended to further explore these opportunities. The active involvement of CGMS R&D satellite operators within the framework of the VL would establish a broader, networked training programme which would, in turn, benefit the more global scientific user communities.

This widened approach of the VL could leverage resources to support (1) the human resources required to coordinate this wider international network and, (2) travel funds for participating graduate scientists from developing countries to take part in regional training activities.

Furthermore, this would enable expanding the scope of the VL to new areas such as atmospheric chemistry, which is mainly addressed in a research framework but includes related topics that are currently in transition from research to operations, such as air quality and sand and dust warning.

The first task is to create this small cadre of experts from the developing countries who are competent in their fields of EO data applications and who, with help and resources from the VL and the R&D satellite operators, can go back to their countries and conduct their own scientific training programmes. A VL-based scientific training programme could also allow selected trainees to spend time at R&D Organizations such as ESA, ISRO, JAXA and NASA, in addition to the operational CGMS satellite operators, in order to learn and create training resources and develop contacts and networks of expertise.

Bearing in mind that the VL would address different user communities (operational meteorologists, research and academic communities), the types of training and the interactive activities that would be needed by these audiences would be different and some degree of tailoring will be required.

### 5.3 Proposed way forward

It is suggested that the VL Co-chairs continue discussions with the WMO Space Programme and other relevant WMO Departments, with the aim of preparing a roadmap towards widening the scope of VL activities in order to make better use of the training capabilities offered by CGMS R&D satellite operators, in order to cater to the education and training needs of emerging scientific communities in developing countries. This roadmap will be reviewed by the VLMG, and then presented to CGMS-38 for approval.

## 6 CONCLUSION

CGMS is invited to note the important achievements of the VL, to provide comments, and to consider the following actions:

- VL Co-chairs to discuss with VL sponsoring agencies the funding of the Technical Support Officer (TSO) position from November 2009 onwards.
- VL Co-chairs and WMO to convene the fifth Virtual Laboratory Management Group (VLMG-5) during the first half of 2010.
- WMO to continue dialogue with ISRO regarding the establishment of a CoE and the co-sponsoring of the CoE in Oman.
- VL Co-chairs to seek an agreement between CGMS, COMET, and WMO with a view of using ESRC as a resource library for the VL.
- The Co-chairs, in consultation with the WMO Space Programme and other relevant WMO Departments, to prepare a roadmap towards widening the scope of VL activities to serve the needs of emerging scientific communities in developing countries. This roadmap will be reviewed by VLMG and presented to CGMS-38 for approval.

APPENDIX I

**Suggestion for the VL logo**



Proposal received from B. Connell upon a.m. logo suggestion



## APPENDIX II

## Course Topics for the period from September 2008 to April 2009

Name of training event	Date	Location	Number of Participants
Satellite and Radar Meteorology	Sep-08	Nanjing, China	23
Management for Meteorological Administrators	Nov-08	Nanjing, China	43
Applied Meteorology for Forecasters	Mar-09	Nanjing, China	3
Weather Eye - Star Player - Media preparation for weather presentation.	Oct-08	Nairobi	33
Applied Agricultural Meteorology	Dec-08	Nairobi	5
Oceanographic Modeling	Nov-08	Nairobi	20
Satellite Meteorology	Aug-08	Nairobi	20
Applied Statistics	Aug and Sep-08	Nairobi	39
Broadcast Media/TV Weather presentation	Jun-08	Nairobi	3
Media Weather Presentation Skills (MWPS)	Dec-08	Nairobi	1
Training Course on Radar Application and Satellite Data Analysis for Early Warning	Dec-08	Jakarta, Indonesia	24
Basic Satellite Meteorology	Mar-09	Melbourne, Australia	29
Introduction to HYDRA	Feb-09	Melbourne, Australia	12
Introduction to Satellite Meteorology	Apr-09	Melbourne, Australia	12
Convective Development and Evolution using Satellite imagery	Nov-08	Barbados	14
Student lead on-line discussion - Weather and climatic condition in the Caribbean region	Feb-9	Barbados	8
Introduction to the Blended Total Precipitable Water Products	Apr and May-09	Barbados	19
Volcanic ash	May-09	Niger	*
Visitview Presentations	May-09	Niger	*
Regional Training Course on the Use of Environmental Satellite Data in Meteorological Applications for RA III and RA IV	Sep-08	Argentina	30
The use of Satellite Data for Land-Surface Monitoring	Dec-08	Brasília, Brazil	30
Understanding and interpreting satellite imagery	Feb, Mar, Apr and May-09	Pretoria, South Africa	55
SWFDP now-casting workshop	Nov-09	Pretoria, South Africa	20
Methods of short-term, medium-term and long-term weather forecasting	Oct-08	Moscow, Russia	25
Meteorological forecasting for aviation service	Nov-08	Moscow, Russia	30
Exit employment on the cosmodrome of Baikonur and air station Salehard	Jan-09	Moscow, Russia	42
Generation of information resources of Roshydromet using the hydrologist-forecaster workstation	Jan-09	Moscow, Russia	5
Methods of short-term, medium-term and long-term weather forecasting.	Feb-09		8
Processing and use of the satellite data at drawing up the hydro-meteorological forecasts	Feb-09	Moscow, Russia	4
Organization of aviation meteorological service	Mar-09	Moscow, Russia	14
Meteorological forecasting for aviation service	Mar-09	Moscow,	14

Name of training event	Date	Location	Number of Participants
		Russia	
Aviation meteorology, large-scale and meso-scale features of synoptic processes and their influence on activity of aircraft	Mar-09	Moscow, Russia	15
Modeling of floodings	Sep-08	Moscow, Russia	**
Environment pollution	Oct-08	Moscow, Russia	**
Desertification	Nov-08	Moscow, Russia	**
Remote sounding of water steam in atmosphere by means of navigating satellite systems	Dec-08	Moscow, Russia	**
Monitoring of a condition of agricultural crops	Jan-09	Moscow, Russia	**
Monitoring of a condition of wood ecosystems	Jan-09	Moscow, Russia	**
Decoding of space pictures	Feb-09	Moscow, Russia	**
Mezostructural features of overcast	Feb-09	Moscow, Russia	**
Overcast of pressure systems	Feb-09	Moscow, Russia	**
Tests on desertification, wood ecosystems and to cloudy systems	Mar-09	Moscow, Russia	**
Water objects of a land	Apr-09	Moscow, Russia	**
Training course on interpretation of meteorological satellite data in weather analyses and forecast	Feb-09	Beijing, China	61
Training Course on Satellite Meteorology	Oct-08	Beijing, China	36
NPOESS/GOES-R Training Resources Development Workshop	May-09	Boulder, US	40
Satellite Application Course	Mar-09	Muscat, Oman	32
VISIT Teletraining (Live and recorded)	Continuous	Ft. Collins and Madison	***
COMET Modules (English, Spanish and some in French)	Continuous	Boulder, US	****

\* No information available.

\*\* Training material available in the VL web site from the date stated.

\*\*\* VISIT teletraining live may have 10 to 90 participants, depending on the number of sessions. The recorded VISIT and SHyMet Modules have approximately 50 to 100 viewers per month.

\*\*\*\* For the period from April to June 2009, there were 1949 user sessions and 379 completions for 28 modules (English) and 6 Modules (Spanish).

## APPENDIX III

**Countries of origin of RFG and course participants\***

Country	WMO Region
Antigua and Barbuda	IV
Argentina	III
Australia	V
Bahamas	IV
Barbados	IV
Benin	I
Bolivia	III
Brazil	III
Burkina Faso	I
Cayman Islands	IV
Chile	III
Colombia	III
Costa Rica	IV
Dominica	IV
Ecuador	III
El Salvador	IV
Germany	VI
Grenada	IV ( <i>not a WMO Member</i> )
Guatemala	IV
Guyana	III
Honduras	IV
Niger	I
Panama	IV
Peru	III
Portugal	VI
Saint Lucia	IV
Saint Vincent	IV ( <i>not a WMO Member</i> )
Senegal	I
Togo	I
Trinidad and Tobago	III
United States of America	IV
Uruguay	III
Venezuela	III

\* This list is based on the information received from CoEs.