GEWEX water vapor assessment plan

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1 Purpose of document

The assessment plan recalls the GEWEX Water Vapor Assessment (G-VAP) scope and states the GEWEX needs on water vapour data records. The main part of the plan comprises of scientific questions and of scientific and technical activities which are needed to answer these questions and to characterise the data records and their utility for the user community. The plan provides an overview of available resources and assigns responsible persons to each activity. Finally, it provides a time line and tables of candidate data records.
It does not intent to be a fully developed project plan to ensure the necessary flexibility to cope with changing funding situations, with changing personnel and with interim results.

We strongly encourage the community to contribute to G-VAP. Please contact the co-chairs and activity leaders when you want to contribute with your data record, to one of the listed activities or when you want to contribute with a new activity!

History:

V1.0	M. Schröder (DWD)	Distributed to G-VAP list	05 June 2013
V1.1	M. Schröder (DWD)	Feedback implemented	17 July 2013

2 G-VAP scope

The need for quality assessments of Essential Climate Variables (ECVs) Climate Data Records (CDRs) is part of the GCOS guidelines for the generation of data products. The assessement process shall give an overview of available data records and enable users to judge the quality and fitness for purpose of CDRs by informing them about the strengths and weaknesses of existing and readily available records. This is achieved by inter-comparison and evaluation, also to, if possible, provide reasons for differences and limitations. Assessments of data records related to the global energy and water cycles became an integral part of GEWEX activities over the last decades.

The GEWEX Radiation Panel (GRP, recently renamed to GEWEX Data and Assessments Panel - GDAP) has initiated a Water Vapor Assessment in 2011, further on referred to as G-VAP. The major purpose of G-VAP is to[1]:

- Quantify the current state of the art in water vapour products being constructed for climate applications, and by this;
- Support the selection process of suitable water vapour products by GDAP for its production of globally consistent water and energy cycle products.

The optimum GEWEX needs on satellite based temperature and humidity products are[2]:

[1] http://www.gewex.org/gewexnews/May2011.pdf
[2] http://due.esrin.esa.int/meetings/meetings247PRE.php

- Global coverage,
- 3 hourly temporal resolution,
- 10 km spatial resolution,
- Availability from 1979 to present,
- Verified high quality (uncertainty and in particular temporal stability).

While the requirements on resolution are similar between GCOS-154 and the GEWEX needs, G-VAP will consider the GCOS requirements on accuracy and stability as baseline guidance.
The assessment of atmospheric profiles (specific humidity preferred) is of highest interest to GDAP as such profiles are the input to the GEWEX products (see www.gewex.org for an overview). The usage of the products within GDAP activities essentially implies to study long-term data records.

G-VAP activities started in 2011. Since then two workshops have been conducted – the first workshop was hosted in March 2011 by the European Space Agency's European Space Research Institute (ESA-ESRIN) with support from the ESA DUE GlobVapour[3] project and the second workshop was hosted in September 2012 by Deutscher Wetterdienst (DWD) and the Satellite Application Facility on Climate Monitoring (CM SAF)[4].

The results of these workshops together with feedback from the GDAP meeting held in Paris in October 2012 led to the following refinement of the scope of G-VAP:

- All three products defined by GCOS to represent the Essential Climate Variable (ECV) water vapour are considered (see e.g. GCOS-154):
  - Total column water vapour (TCWV), ECV Product A.5.1
  - Tropospheric and lower-stratospheric profiles of water vapour (WV), ECV Product A.5.2, and their related temperature products, ECV Product A.5.2,
  - Upper tropospheric humidity (UTH), ECV Product A.5.3.

  G-VAP does not include sea-/land-surface temperature or 2m temperature/humidity unless these are integral parts of the water vapour profile;
- G-VAP considers all data records "long-term" that are longer than approximately ten years. Thus, the assessment will consider data records that may not be used as input for GEWEX water and energy cycle data sets but which are important to establish a deeper understanding of atmospheric water vapour observations. This will considerably increase the number of data records that can be analysed;
- The assessment considers data records that are provided by assessment participants and that are readily available and well documented;
- The assessment focuses on overall characteristics of participating satellite data records and reanalysis as determined from inter-comparisons and comparisons against in situ observations and ground-based products;
- The consistency of TCWV and UTH with the profile data is studied as well;
- Long-term Level-3 (gridded products) products are analysed on different time and space scales in order to get an overview of issues in Level-3 products. These issues can then be

[3] http://www.globvapour.info/
[4] http://www.gewex.org/gewexnews/Nov2012.pdf

studied in more detail using Level-2 and/or Level-1 data and by dedicated Level-2 data comparisons employing high quality satellite and ground-based observations;
- No quality ranking of the assessed data records is attempted. Rather, the specific application areas and requirements of each individual data record will be documented;
- G-VAP will build up a database including collocated products and "reference" data of sufficient quality, in particular long-term stability, which serves as main repository for the current assessment and which will be also useful for the development of improved products.
- G-VAP pursues information exchange with the SPARC water vapour activity, with SPARC focusing on the stratosphere and G-VAP focusing on the troposphere.

3 Main questions for satellite data record evaluation

Following presentations and discussions at the first GDAP meeting in October 2012 key questions for the evaluation of data records have been formulated. The questions below determine the metric to identify strengths and limitations, to analyse differences and to find reasons for distinct differences and limitations.
The *science* questions are:

Q1)
a) How large are the differences in observed temporal changes in long-term satellite data records of water vapour on global and regional scales?
b) Are the observed temporal changes and anomalies, on global and regional scale, in line with theoretical expectations?
c) Are the differences in observed temporal changes within uncertainty limits?
d) What is the degree of homogeneity (breakpoints) and stability of each long-term satellite data record?
e) How can we enhance value and usability of the satellite data records (e.g., through analysis of consistency in climate related features such as position and strength of dry zones, regional annual cycles, and El Nino response)?

Q2) What is the degree of consistency among the products, e.g., can we observe systematic differences between, e.g., TCWV from MERIS or SSM/I and TCWV integrated from sounders such as HIRS or ATOVS?

Q3)
a) Do the satellite data records exhibit areas of distinct quality and how can the distinct differences and limitations be explained?
b) What is the quality of long-term satellite WV products in the lowermost part of the atmosphere and in the upper troposphere?
c) What is the quality of long-term satellite TCWV and WV products over ocean where ground-based and in-situ observations are rarely available?

Q4) What are the differences in quality between satellite products and products from reanalysis and are the observed differences significant?

The *technical* question is:

Q5) How easily can the satellite data records be downloaded, read and understood?

4 Technical implementation

The technical implementation is outlined in

Table 1. These activities are needed for management and organisation and to set up scientific activities (next section).

Table 1: Overview of technical activities together with responsible person and contributing partners. D: dependency on technical activity; Q: related question.

Activity	D	Q	ECV	Lead	Partner
a) Compile satellite and "reference" data record specifications through collection of data fact sheets (DFS). This will include the record specific application areas and requirements.		5	TCWV WV UTH	F. Fell (Inf), M. Lockhoff (DWD), M. Schröder (DWD)	PIs
b) Comment data access and data record documentation based on DFS and experience made during use in G-VAP.	a	5	TCWV WV UTH	M. Lockhoff (DWD)	
c) Implement and maintain ftp server for data exchange.				M. Lockhoff (DWD)	
d) Build and maintain a "reference" data base including ground-based and in-situ observations with high quality and long-term stability.	c		TCWV WV	M. Lockhoff (DWD)	PIs, M. Schröder (DWD)
e) Collect long-term satellite data records with an initial focus on Level-3 (gridded) data records. Include reanalysis products.	c		TCWV WV UTH	M. Lockhoff (DWD)	PIs, M Schröder (DWD), V. John (UKMO)
f) Develop/implement central processing tools using Level-3 (gridded) data records for satellite data record inter-comparison and comparison to other data records. The tools encompass reading, reformatting, re-gridding and plotting modules.	e		TCWV WV	A. Walther (UW), M. Lockhoff (DWD)	M Schröder (DWD)
			UTH	L. Shi (NOAA)	V. John (UKMO), M. Schröder (DWD)
g) Collect Level-2 satellite data records and reference data when not done in d).	d	3	TCWV WV UTH	M. Lockhoff (DWD)	PIs
		3, 3, 4	WV	A. Reale (NOAA)	PIs, T. Trent (U Leicester)

h) Develop/implement central Level-2 processing tools for satellite data record evaluation. The tools encompass reading, reformatting, collocation and plotting modules.	g		WV, TCWV UTH	M. Lockhoff (DWD) L. Shi (NOAA)	
i) Implement and maintain G-VAP web page.				Co-chairs, F. Fell (Inf)	
j) Establish and maintain communication links, also to SPARC.				Co-chairs	
k) Organise and carry out annual workshops.				Co-chairs	Local host, Activity leaders
l) Report to GDAP and summarise final G-VAP results in WCRP report.				Co-chairs	Activity leaders

5 Scientific activities

Table 2 provides an overview of scientific activities which are carried out in order to address the G-VAP scope, to find answers to the G-VAP questions (section 3), to reveal agreements/strengths and differences/limitations among/of the data records. Finally, the objective is to find explanations for the observed differences/limiations. Leaders and contributing partners are listed for each activity.

We strongly encourage the community to contribute to G-VAP. Please contact the co-chairs and activity leaders when you want to contribute with your data records, to one of the listed activities or when you want to contribute with a new activity!

On the G-VAP webpage we provide an overview of activities which are not pursued at present and which complement and extend running activities.

Table 2: Overview of scientific activities together with responsible person and contributing partners. D: dependency on technical or scientific activity; Q: related Question.

Activity	D	Q	ECV	Lead	Partner
1) Analyse temporal averages of long-term satellite data records on original grid basis and Hovmoeller diagrams in absolute and relative space on full temporal coverage using monthly means.	f	1	TCWV WV UTH	M. Lockhoff (DWD)	A. Walther (UW), R. Bennartz (UW), M. Schröder (DWD)
2) Inter-comparison of long-term satellite data records. Analyse bias and standard deviation relative to ensemble monthly mean of long term	f	1, 3	TCWV WV	M. Lockhoff (DWD)	A. Walther (UW), M. Schröder (DWD)

satellite data records and differences in 10 year averages.			UTH	L. Shi (NOAA)	V. John (UKMO), M. Schröder (DWD)
3) Analyse degree of homogeneity of long-term satellite data records, e.g., following Wang et al. (2007) and Wang (2008) in anomaly space (e.g., PMF method, anomaly with respect to data record average).	f, 2	1	TCWV WV UTH	M. Lockhoff (DWD)	
4) Assess degree of stability of long-term satellite data records on common grid. Several potential references will be considered – candidates are stable long-term, multi-station ground-based data records or the ensemble satellite data record mean (common grid). For UTH, radiative transfer simulations need to be employed.	f, 2	1	TCWV WV	M. Lockhoff (DWD)	M. Schröder (DWD)
			UTH	M. Schröder (DWD)	V. John (UKMO), N. Scott (LMD/IPSL), L. Shi (NOAA)
5) Determine temporal changes in long-term satellite TCWV and WV records following Weatherhead et al. (1998) by utilising data records on common grid and common temporal coverage. The analysis also considers "trend" uncertainties and uncertainties in "trend" differences. For UTH the change of extremes will be analysed following Roca et al. (2012).	f, 2	1, 3	TCWV WV UTH	M. Schröder (DWD)	M. Lockhoff (DWD)
6) Compare observed changes and anomalies relative to expectations from theory using SST data and climate indices such as PDO, NAO, and JMA SST index on ENSO using data on common grid and period.	f, 2 5	1, 3	TCWV	R. Bennartz (UW), F. Fell (Inf), M. Schröder (DWD)	
			WV	M. Schröder (DWD)	
			UTH	L. Shi (NOAA)	
7) Assess consistency in satellite long-term data records among the three product classes (TCWV, UTH and WV).	F	2	TCWV WV UTH	L. Shi (NOAA)	
8) Areas and periods of distinct differences or limitations observed in activities 1)-7) will be analysed in more detail to find reasons for them.	h, 1-6	1, 3	TCWV WV	M. Lockhoff (DWD)	M. Schröder (DWD)
			UTH	L. Shi (NOAA)	V. John (UKMO), M. Schröder (DWD)
9) Assess quality of satellite data records at near		3	WV	A. Reale	A.

surface layers and in the upper troposphere using high quality ground-based and in-situ observations such as GRUAN or ARM and new, high quality satellite data (each as Level 2). The activity will be based on existing processing and analysis tools. *Other activities will contribute to answer Q3, in particular 3, 5 and 8.*				(NOAA), M. Lockhoff (DWD)	Gambacorta (NOAA), J. Remedios (U Leicester), M. Schröder (DWD), T. Trent (U. Leicester)
10) Assess over ocean quality of satellite data records using e.g., satellite based GPS-RO data and new, high quality satellite data (each as Level 2). The activity will be based on existing processing and analysis tools. *Other activities will contribute to answer Q3, in particular 3, 5 and 8.*		3	WV	A. Reale (NOAA), M. Lockhoff (DWD)	A. Gambacorta (NOAA), M. Schröder (DWD)
11) Analyse differences and their significance observed between satellite data records and products from reanalysis. *Other activities will contribute to answer Q4, in particular 3, 5 and 8-10.* *Activities 9-11 will be based on two approaches: inter-comparions to 1) conventional observations and 2) reference observations/dedicated experiment data.*		4	WV	A. Reale (NOAA)	A. Gambacorta (NOAA),), M. Lockhoff (DWD), J. Remedios (U Leicester, T. Trent (U. Leicester)

6 Common approaches

The analysis will be carried out in SI units for TCWV (kg/m^2), specific humidity (kg/kg) and UTH (%). Spatial averaging within G-VAP avoids intermediate totals. When collocated to "reference" data records, nearest neighbours within certain collocation critera are searched to allow for a collocation impact analysis.

The assessment will inter-compare the satellite data records and compare such reco rds with in-situ and ground-based observations in order to assess their quality (uncertainty, homogeneity (breakspoints) and long-term stability). The quality assessment will be carried out in terms of bias, root mean square difference, standard deviation, each in absolute and relative units, correlation, probability density function comparison and change in bias over time. Because sampling differences among the various satellite data records will impact the result, the analysis will be refined using bins such as day/night, time such as annual cycle, latitude, land/ocean, tropics/midlatitudes and clear sky/all sky.

In case the satellite data record and the "reference" data record contain uncertainty estimates, the comparison will be carried out following Immler et al. (2010).

7 Roles, resources and priorities

GEWEX nominated the following co-chairs:

- Marc Schröder, DWD,
- Lei Shi, NOAA/NESDIS/NCDC.

The co-chairs have institutional support and accepted the nomination.

Roles within G-VAP:

- M. Schröder:
  Organise the hosting, processing and the analysis of gridded long-term satellite and "reference" data records and identification of reasons for observed differences/limitations. The associated activities will largely been carried out by DWD.
- L. Shi:
  Organise the hosting, processing and analysis of the consistency of long-term data records and of UTH products using Level-2 data and carry out associated analysis.

The following resources are available:

- Support from EUMETSAT's CM SAF with focus on long-term data record analysis (funding for ~1/3 position for 4-5 years).
- Support from NRPOVS team and NPP cal/val (NOAA) with focus on Level-2 profile evaluation (unfunded).
- Support from University of Leicester with focus on Level-2 profile evaluation (unfunded).
- Potential support from ICARE on data hosting and processing.

A timely accomplishment of G-VAP is needed to cope with the rate at which satellite water vapour products are modified or newly generated. Following GDAP needs[5]: a time frame of 5 years is anticipated. This together with constrains on funding give reason to assign priorities to the data records and activities. These priorities are deduced from the G-VAP scope, itself based on results from the first and second G-VAP workshops and on feedback received during the first GDAP meeting:

- Characterisation of satellite data records with temporal coverage of approximately more than ten years through inter-comparison and comparison to ground-based and in-situ observations with focus on stability (Question 1d, Question 2),
- Identification of physical reasons for observed inconsistencies (Question 3a),
- Information of users on G-VAP results.

Therefore, activities a)-h), 1)-8) and i)+l) have high priority.
High priorities are assigned to satellite data records with long-term temporal coverage and which include water vapour profiles. Activities 6), 9)-11) consider satellite profile data records with temporal coverage of 20 years or more (6): all water vapour ECVs). Satellite data records with verified high quality and (short term) stability can be well used as "reference".
Concerning ground-based and in-situ data records which can be used for evaluation, high priorities are assigned to data records with long-term temporal coverage and documented quality, in particular long-term stability and which also include both profiles and total columns.

[5] http://due.esrin.esa.int/meetings/meetings247PRE.php

8 Expected outcome

The main output from G-VAP will be

- Report on assessment results with focus on guidance for GEWEX and information for the user community, in particular the climate analysis and application community.
- "Reference" data base and collocated data.
- Information data base on data records considered within G-VAP.
- Feedback to data record PIs and agencies.

Depending on results, outcomes of G-VAP will be submitted to peer-reviewed journals.

9 Time line

In Table 3 the assessment time line is given.

Table 3: Time line of activities.

Topic	2013				2014				2015			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
a)-e), g) DFS, data base,...												
f) L3 processing												
h) L2 processing												
i-k) web, workshops,...												
l) Reporting												
1-3) inter-comparison, homogeneity,...												
4) stability												
5-7) trends, consistency,...												
8) areas/periods												
9-10) quality (near surface, UT, ocean)												
11) satellite versus reanalysis												

Major interim results and outputs are expected until:

- Q3 2013: Implementation of ftp server and continuous data upload.

Implementation of G-VAP webpage.
First results from activities 1)-5) to refine activity 8).
Draft activity and assessment reports on basis of assessment plan and first results.

- Q4 2013: Finalise basic Level 3 analysis tool.
- Q3 2014: Latest data record upload for consideration in assessment report.
  Latest acceptance of new activities.Finalise basic Level 2/Level 1 analysis tool.
  "Reference" data base.
  Information data base.
- Q2 2015: Finalise analysis and summarise results in reports.
- Q3 2015: Combine all results and reports into a single assessment report.

It is foreseen to conduct annual G-VAP workshops prior to the GDAP meetings.

10 Governance, communication and participation

The co-chairs are jointly responsible to organise and coordinate the assessment, to define and evaluate the scientific and technical activities, and to summarise results and conclusions/recommendations in reports and the scientific literature. Decision making is the responsibility of the co-chairs but decisions will be based on consensus.
The co-chairs report back to GDAP. Annual workshops are foreseen, preferably a few weeks prior to the GDAP meetings, to discuss recent findings, to further refine the plan and to draft and consolidate the assessment reports.

Communication will be based on email exchange, and the webpage is the main portal to inform the G-VAP community and the public on activities and results. Regular emails will inform the G-VAP community on latest news and results in bullet form. The status of the activities will be presented and discussed at the G-VAP workshops. Reports on (grouped) activity results will be published via the web and will be included in the assessment report. The activity leaders are responsible for drafting the activity reports and need to be send the report to the co-chairs in time for overall assessment report drafting, that is, latest in Q2 2015. It is the responsibility of the activity leaders to inform PIs on report contents.

When the activities exhibit spurious quality for certain data records, the corresponding PIs will be contacted by the activity leaders for clarification. If issues in Level-1 data seem to be present, space agencies will be contacted by activity leaders.

Participation to G-VAP is voluntary - any participant can withdraw their data records partly or entirely from the assessment at any time. In this case, the concerned data will be removed from the databases and not further be used in any respect.

The following support is needed from data record PIs for participation in G-VAP:

- Provision of DFS,
- Agreement on data policy,
- Upload of data record,
- Provision of one or multiple readers,

- Support on data utilisation and interpretation of results.

Prior to any presentation or distribution outside G-VAP or GDAP, the G-VAP results shall be send to the envolved PIs to allow for feedback or kept anonymous.

11 References

GCOS-154: Systematic observation requirements for satellite-based data products for climate, December 2011.

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Weatherhead, E. C., et al., Factors affecting the detection of trends: Statistical considerations and applications to environmental data, Journal of Geophysical Research, 103, 17,149–17,161, 1998.

12 Appendix: Candidate lists

In Table 4 and Table 5 candidate satellite as well as ground-based and in-situ data records are listed.

The term “candidate” indicates that these data records are potentially valuable for consideration in G-VAP. However, not all of them might actually be analysed or utilised for comparison within G-VAP.

Table 4: Candidate satellite data records, including reanalysis and merged data records. Both: to be evaluated/used for evaluation.

Instrument(s)/Technique	Data set	Parameters	Temporal coverage	Anticipated use in G-VAP
AIRS	NASA NOAA	TCWV, WV TCWV, WV	2002-present	To be evaluated
AIRS, AMSU, CloudSat, MODIS	NASA		2006-2011	To be evaluated
AMSR-E	RSS/NASA JAXA	TCWV TCWV	2002-2011	To be evaluated
AMSR-2	JAXA	TCWV	2012-present	To be evaluated
AMSU-B/MHS	UKMO	TCWV, UTH	1999-2011	To be evaluated
ATMS	NOAA	TCWV, WV	2011-present	To be evaluated
ATOVS	CM SAF	TCWV, WV	1999-2011	To be evaluated
CrIS	NOAA	TCWV, WV	2011-present	both
GPS-RO (COSMIC, GRAS)	ROM SAF UCAR	TCWV, WV	2006-present	both
GOME/SCIAMACHY/GOME-2	DLR/MPI-C U Bremen	TCWV TCWV	1995-present	To be evaluated
HIRS	NOAA NASA	TCWV, UTH, WV WV	1979-2011	To be evaluated
IASI	EUMETSAT NASA NOAA	TCWV, WV	2006-present	both
MERIS+SSM/I	DWD/FUB/ESA	TCWV	2003-2008	To be evaluated
MIRS – AMSU, MHS, SSMIS	NOAA	TCWV, WV	2009 onwards	To be evaluated
MODIS NIR	NASA	TCWV	2000-2013 (TERRA), 2002-2013 (Aqua)	To be evaluated
MVIRI/SEVIRI	CM SAF/CNRS	UTH	1983-2009	To be evaluated
MWR	ESA/DWD/FUB/CNRS	TCWV	1991-2012	To be evaluated
Polder	U Lille	TCWV	2005-2012	To be evaluated
Reanalysis	MERRA ERA Interim	TCWV, WV TCWV, WV	1979-present 1979-present	To be evaluated

	JRA55 NCEP CFSR	TCWV, WV TCWV, WV	1958-2012 1979-2009	
SSM/I, HIRS, IGRA, AIRS (NVAP-M)	LaRC	TCWV, WV	1988-2009	To be evaluated
SSM/I, SSMIS	CM SAF RSS	TCWV TCWV	1987-2008 1987-present	To be evaluated
TES	NASA	TCWV, WV	2004-2010	To be evaluated
TMI	RSS	TCWV	1997-2013	To be evaluated
TOVS Path A	NASA	WV	1978-1994	To be evaluated
TOVS Path B	ARA/LMD/CNRS	WV	1986-1995	To be evaluated

Table 5: Candidate ground-based and in-situ data records. Both: to be evaluated/used for evaluation.

Instruments/Technique	Data set	Parameter	Temporal coverage	Anticipated use in G-VAP
AERI	ARM	TCWV, WV	1994-present	Used for evaluation
Aircraft	AMDAR CARIBIC MOZAIC	TCWV, WV	Since 1986 Since 1997 Since 1994	Used for evaluation
Buoy+ship+synop	SWA+ICOADS, HadCRUH HadCRUT	T, q at surface	1987-2008* 1973-2003 1850-2013	Used for evaluation
Field experiments	AEROSE ConcordIASI MOHAVE IASI cal/val Jaivex WAVES HYMEX Cindy-Dynamo NCAR field (radiosonde, dropsondes)	TCWV, WV	various	Used for evaluation
FPH	CFH NOAA FPH Snow White	TCWV, WV	1980 onwards	Used for evaluation
FTIR	MUSICA/NDACC	TCWV, WV	various	Used for evaluation
Ground-based GNSS	NCAR	TCWV	1995-2011	both
Lidar	NDACC ARM Earlinet	WV	Various	Used for evaluation
Microwave	ARM MWRnet NDACC	TCWV, WV	various	Used for evaluation
Radiosonde	GRUAN IGRA NCAR homogenised (based on IGRA) ARSA	TCWV, WV	Various, mostly since 2011 1969-present 1945-2010 1979-2011	Used for evaluation Both Both Both

Sunphotometer	AERONET	TCWV	1993-2013	Used for evaluation

13 Data policy

All external data records participating to the G-VAP activities (e.g. satellite and non-satellite observations, reanalyses) as well as data products derived within G-VAP (e.g. merged and co-located data products) together with corresponding DFS shall freely be made available to all G-VAP participants under the following conditions (adapted from http://fluxnet.ornl.gov/):

- Users shall inform the appropriate PIs (see data fact sheets) and G-VAP co-chairs of download, anticipated use and publication plans.
- If the PIs feel that they should be acknowledged or offered participation as authors, an agreement on such matters shall be reached prior to publishing and/or use of the data for publication.
- If work of a user directly competes with the PIs analysis, he or she may ask that they have the opportunity to submit a manuscript before PI submits the one that uses their data.
- We encourage users to check with PIs as to the availability of updated data.
- We encourage users to provide information to the PIs and to the G-VAP co-chairs if suspect values are found in the data.

After the end of the G-VAP activities, the data products derived within G-VAP (collocated data, reformatted data, e.g., netCDF files with common meta data for the validation data base) will freely be made available to the public.