SCM-10
Atmospheric Motion Vectors (AMVs) and Clear/All Sky Radiances (CSRs/ASRs) from historical meteorological satellites in geostationary and polar orbit

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Leader

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Partners

JMA (MSC, CPD)

EUMETSAT (CF)

NOAA (NCDC, NESDIS)

University of Wisconsin/CIMSS

ECMWF

Objective (1/2)

- The major objective of this project is to provide Atmospheric Motion Vectors (AMVs), Clear Sky Radiances (CSRs) and All Sky Radiances (ASRs) for the use in global and potentially regional Numerical Weather Prediction (NWP) model-based reanalysis.

Objective (2/2)

- Furthermore, AMVs data provided on regular grids may also be utilised in the analysis of dynamical systems in relation to water vapour transport or monsoon studies.

(e.g. SCM-04: Utility of Satellite derived winds for Monsoon and Cyclone studies over Indian region)

Geophysical parameters (AMVs)

- The AMVs products are derived by tracking clouds and water vapour features, computing the displacement vector and assigning a height to the resulting vector according to the temperature of the tracked element/structure.
- AMV height assignment is the major source of uncertainty in the AMV products.

Velden, C.S., and K.M. Bedka, 2008: Identifying the Uncertainty in Determining Satellite-Derived Atmospheric Motion Vector Height Assignments. *J. Appl. Meteor.*, **48**, 450-463, DOI: 10.1175/2008JAMC1957.1.

Geophysical parameters (CSRs)

- The CSR products provides radiances and brightness temperatures averaged over cloud-free/all pixels on a specific processing segment, e.g., 16 x 16 pixels. It is derived from images in all thermal (e.g. infrared and water-vapor) channels.
- In addition to clear sky radiances and brightness temperatures such products often contain cloud coverage information, statistical information, latitude/longitude of the clear pixels, satellite zenith and solar zenith angle of the clear pixels and land/sea flag.

Picon, L., R. Roca, S. Serrar, J. L. Monge, and M. Desbois (2003), A new Meteosat ‘‘water vapor’’ archive for climate studies, J. Geophys. Res.,108(D10), 4301, doi:10.1029/2002JD002640.

Satellite Sensor Record for geostationary imagers

Satellite System	Position Longitude	Period	Image rate for AMV derivation	Comments
GOES-E	75° W	1980 – today	Variable	
GOES-W	135° W	1980 – today	Variable	
Meteosat (2 - 10)	0°	1982 – 2004 2004 - today	30 min 15 min	
Meteosat (5 and 7)	63° E 57° E	1997 – 2005 2005 - today	30 min 30 min	Called Indian Ocean Data Coverage (IODC)
Meteosat 3	70° W 75° W	1991 – 1993 1993 – 1995	30 min 30 min	Called Atlantic Data Coverage (ADC) Called eXtended ADC (XADC)
GMS (GOES-9)	140° E 155° E	1978 – 2003 2003 – 2005	30 min 30 min	GOES-9 was put at the Western Pacific Region
MTSAT	140° E 145° E	2005 – 2010 2010 – today	15 min, 30 min, 60 min	

Satellite Sensor Record for polar orbiting imagers

- AMVs can also be derived from instruments on board polar orbiting satellites providing measurements in infrared window and water vapour absorption channels. Instruments utilised by NOAA, CIMSS and EUMETSAT are AVHHR (IR-window) and MODIS (IR window and water vapour). AVHRR data coverage reaches back to 1979 and MODIS data coverage starts in 2000.

http://noaasis.noaa.gov/NOAASIS/ml/avhrr.html (NOAA/NESDIS)

http://www.eumetsat.int/Home/Main/Satellites/Metop/Instruments/SP_2010053153142514 (EUMETSAT)

http://modis.gsfc.nasa.gov/ (NASA)

Algorithms and Processing chains (1/5)

- The overarching objective would be an AMV processing system that could be applicable to all historical geostationary satellites.
- The existing processing systems at EUMETSAT and JMA do not have this capability, but could be extended.
- The CIMSS AMV derivation algorithm is capable of reprocessing all historical MODIS, AVHRR, GOES, Meteosat and GMS/MTSAT images.
- The existing algorithms differ between AMV processing agencies, and a first step towards a more unified algorithm would be the analysis of the differences.

Algorithms and Processing chains (2/5)

- **The project would seek close interaction with the CGMS International Winds Working Group (IWWG)** to benefit from ongoing comparison activities that might need to be enhanced to cover the temporal dimension of the AMVs long term records.
- It is also expected to analyze the differences in AMV product definition, algorithms and processing chains and develop a plan for a globally coherent product.

Algorithms and Processing chains (3/5)

- **The project would also seek close interaction with SCOPE-CM/SCM-06: Inter-calibration of imager observations from time-series of geostationary satellites (IOGEO) through the experience from Global Space-based Inter-calibration System (GSICS)** for reprocessing AMVs and CSRs/ASRs long term records.
- GSICS provides bias corrections through the inter-calibration of satellite sensors with respect to selected references that can be applied to generate reprocessed CSR and ASR products as Fundamental Climate Data Records (FCDRs) and related Thematic Climate Data Records (TCDRs).

Algorithms and Processing chains (4/5)

- The reprocessing of AMV requires the background fields of NWP, which are crucial for its height assignment.
- The periods of the exsisting reanalyses fully cover the operation periods of historical meteorological satellites. Thus, the updated reanalysis fields are expected to be used in the AMVs reprocessing with the quality information of the reanalysis fields.

Algorithms and Processing chains (5/5)

- **The project would exchange information with reanalysis communities** on their calculation plans and the quality. The best forum identified for discussion of data issues is **the WCRP Data Advisory Council** that has representation from reanalysis centres.
- The project will encourage reanalysis centres to give feedback and support AMVs, CSRs and ASRs validation exercises by involving observation feedback archives and associated tools such as developed at ECMWF.

Historical overview of related reanalysis activities (1/2)

- The first reanalysis was the 15-year ECMWF Reanalysis (ERA-15). ERA-15 collected and used historical AMV data generated operationally. Such reanalysis activity was extended to other NWP centres such as NCEP/NWS/NOAA, JMA and NASA, and some of them performed reanalysis calculation repeatedly extending period and upgrading NWP and data assimilation system.
- As the extension of reanalysis, accurate observation data were requested. To meet the requirement, EUMETSAT reprocessed AMVs for past Meteosat satellites. It reprocessed Meteosat-2 to 7 AMVs and provided them to ECMWF for ERA-40 and ERA-Interim.
- The first reprocessing by JMA/MSC was performed to provide reprocessed GMS-3 to -5 AMVs to the Japanese 25-year Reanalysis (JRA-25).

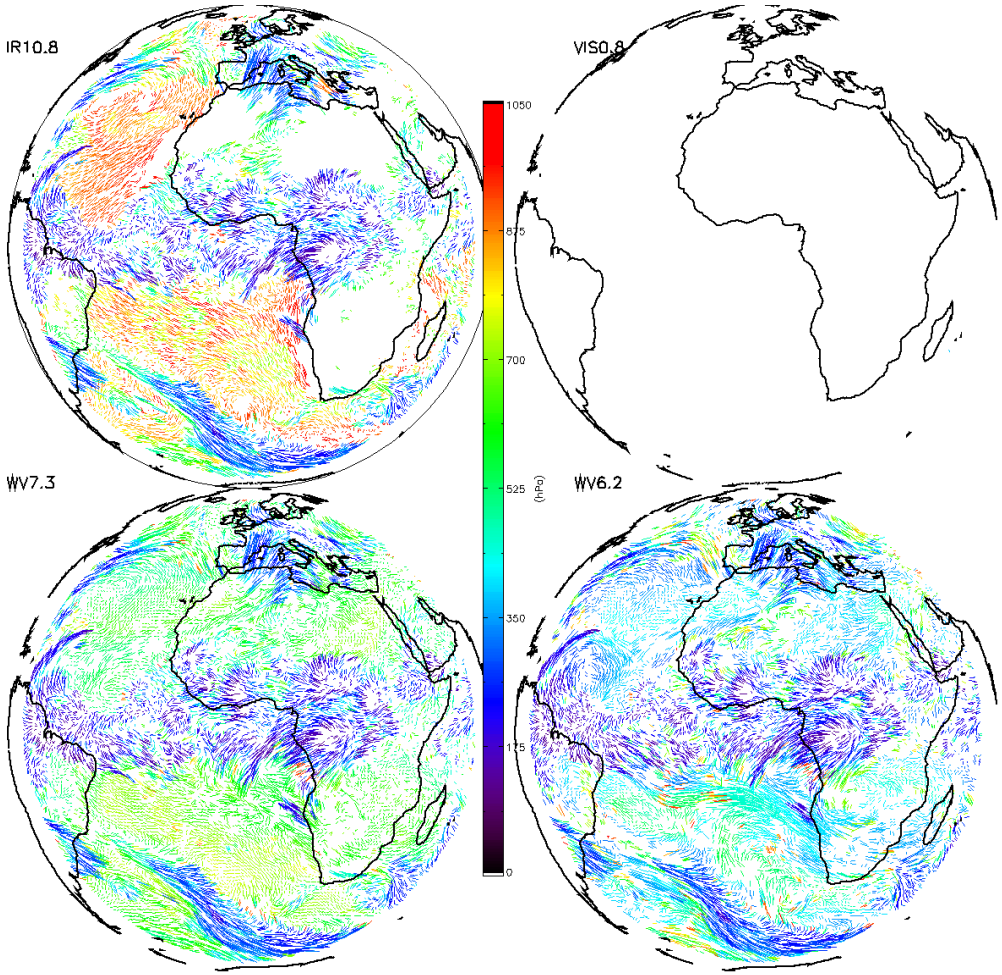
Historical overview of related reanalysis activities (2/2)

- Currently, EUMETSAT is performing the reprocessing of AMVs, CSRs and ASRs for Meteosat-8 and 9 data within the ERA-CLIM project. This activity will continue in ERA-CLIM2 and also include METEOSAT-2 to 7.
- JMA/MSC has completed the reprocessing of AMVs for GMS-1,3,4,5, GOES-9 and MTSAT-1R data within the JRA-55 project. JMA/MSC also has completed CSRs reprocessing for GMS-5, GOES-9 and MTSAT-1R .
- University of Wisconsin/CIMSS has completed the re-processing of 18-19 years of GOES AMVs, and now starting a post-processing/QC stage of all the datasets.

ERA-CLIM

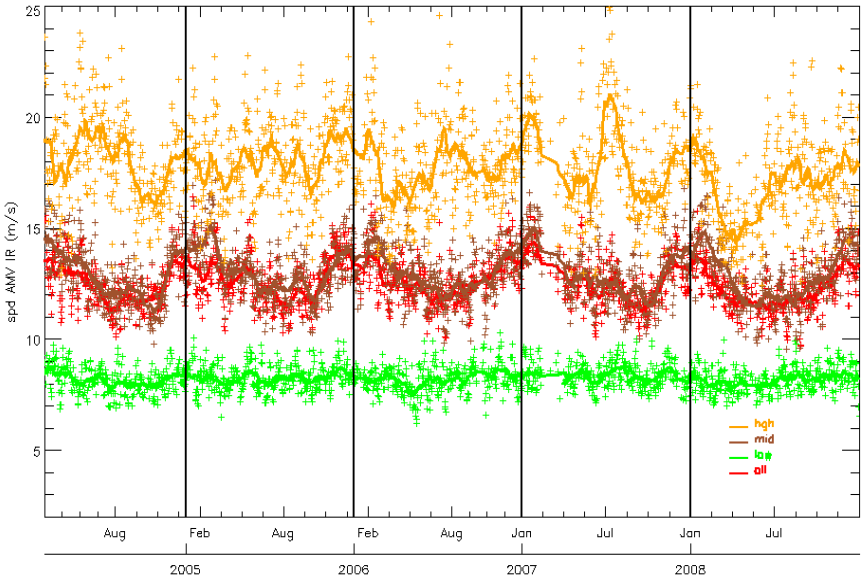
- ERA-CLIM: 2011 – 2013
  - CSR and ASR from MSG for 2004 – 2011 (ongoing)
  - AMV from MSG for 2004 – 2011 (ongoing)
  - AMV from METOP-A for 2007 – 2012 (completed for two algorithms (EUMETSAT & CIMSS))
- ERA-CLIM2: 2014 – 2016
  - AVHRR AMVs from 1982 to present
  - AMV from MFG and MSG 1982 to present

Atmospheric Motion Vectors (AMVs) from GEO



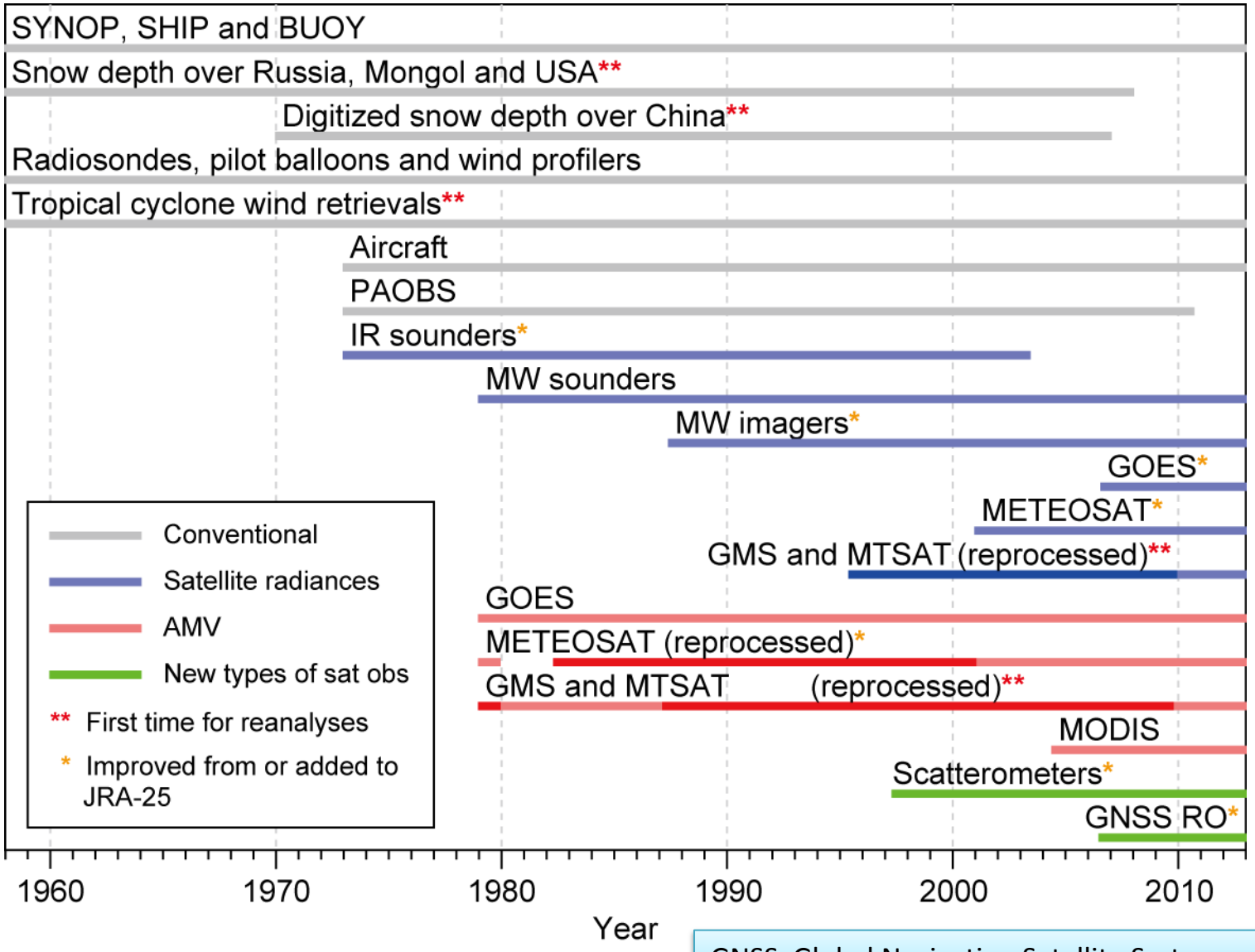
MSG 2004 – 2011

- 3-hourly winds
- IR 10.8 µm
- VIS 0.8 µm
- WV 7.3 µm & 6.2 µm



Speed AMV IR, all, high, mid, low altitudes

Observational Data available for JRA-55

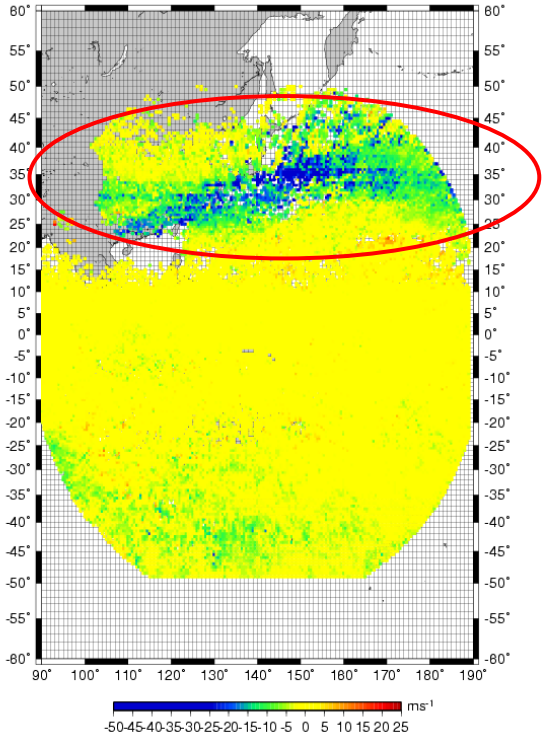


GNSS: Global Navigation Satellite System

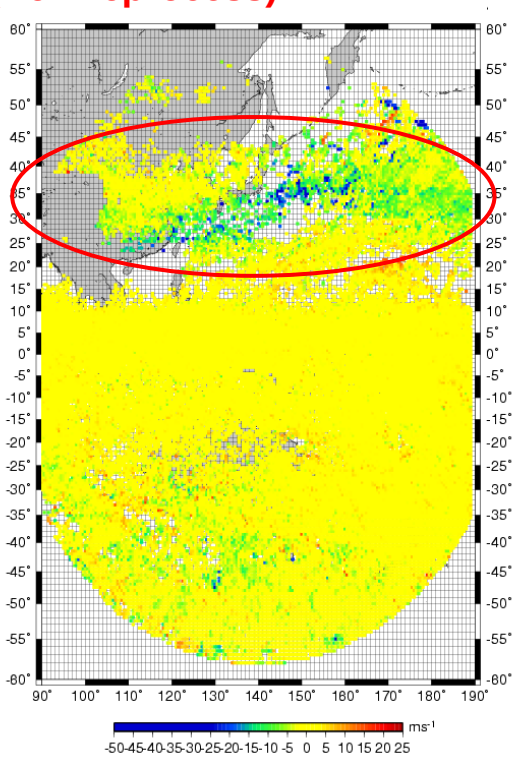
2nd reprocess by MSC for JRA-55

MSC/JMA has been computing AMVs from the past satellites (**GMS, GOES-9 and MTSAT-1R** between 1979 and 2009) using the latest AMV derivation algorithms. The data set of AMVs is provided for **JRA-55** and **SCOPE-CM.**

for JRA-25
(Previous reprocess)



for JRA-55
(New reprocess)



Wind speed bias (QI>0.85) of high-level IR-AMVs to JRA-25 analysis fields (Jan.1990, GMS-4)

Main quality difference between the previous reprocess (for JRA-25) and the new reprocess (for JRA-55).

- **Expansion of derivation area** (from 50S-50N to 60S-60N).
- **Mitigation of slow wind speed bias in the winter hemisphere,** owing to the improvement of height assignment scheme and resizing target box size.

Meteorological Satellite Center Technical Note, No. 54

Information website: http://mscweb.kishou.go.jp/product/reprocess/index.htm Oyama(2010)

Current and targeted Maturity Level

- The software used to create AMVs, CSRs and ASRs products is in operational use and can be considered mature. However, as one objective of this project is to present the products in a more coherent way by potentially using a common software.

	Software Readiness	Meta Data	Documentation	Validation	Public Access	Utility
Current Maturity level	3	3	3	2	4	5
Targeted Maturity level	5	5	5	5	5	6

Summary of proposed project

The major points to work on to reach the goal of this project are:

- Analysis of differences in AMVs, CSRs and ASRs product definition, algorithms and processing chains for instruments in geostationary and polar orbit;
- **Development of a plan for a more coherent product suite for all instruments;**
- Enhancement of AMVs algorithms with a quantitative uncertainty estimate;
- Establishment of a validation framework for AMVs by agreeing on a metric, certain quality analysed non-satellite observations and by utilising means from reanalysis centres;
- Enhancement of the documentation towards a coherent description of the products

Duration of the project and schedule
(5 years from 1 Jan 2014)

– Review on the use of AMV and CSR in past reanalysis; – Analyze requirement for future reanalysis; – Analyze the differences in AMV product definition, algorithms and processing chains and develop a plan for a globally coherent product; – Perform feasibility analysis of GOES AMV processing with respect to satellite observation schedule and forward analysis result to reanalysis centres – Encourage other space agencies operating geostationary instruments to join the project; – Open a project portal site	2014	All All JMA, EUM, NOAA, NOAA JMA, EUM, NOAA JMA
– Build common validation framework following agreed metric involving radiosonde observations and tools provided by reanalysis centres; – Perform processing of geostationary products;	2015	EUM, JMA, NOAA EUM, JMA, NOAA
– Perform processing of polar orbit data; – Perform processing of geostationary products (continue); – Validate products from geostationary satellites; – Analyze feedback on early phase products from reanalysis centers	2016	EUM EUM, JMA, NOAA All
– Update the documentation of all products in coherent style; – Validate products from polar orbiting satellites;	2017	EUM , JMA, NOAA
– Analyze feedback on products from reanalysis centres and other applications and develop a plan for SCOPE-CM phase 3	2018	All

Schedule in 2014

– Review on the use of AMV and CSR in past reanalysis;	2014	All
– Analyze requirement for future reanalysis;		All
– Analyze the differences in AMV product definition, algorithms and processing chains and develop a plan for a globally coherent product;		JMA,EUM, NOAA, NOAA
– Perform feasibility analysis of GOES AMV processing with respect to satellite observation schedule and forward analysis result to reanalysis centres		JMA, EUM,NOAA
– Encourage other space agencies operating geostationary instruments to join the project;		JMA
– Open a project portal site		

Status and Progress

- GOES AMV Reprocessing (Point 4)
- AMV workshop at ECMWF (Point 3)
- Project Portal Site (Point 6)
- Review on the use of AMVs and CSRs in past reanalysis (Point 1)

Status of GOES AMV Reprocessing

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University of Wisconsin-Madison
U.S.A

20 February 2014

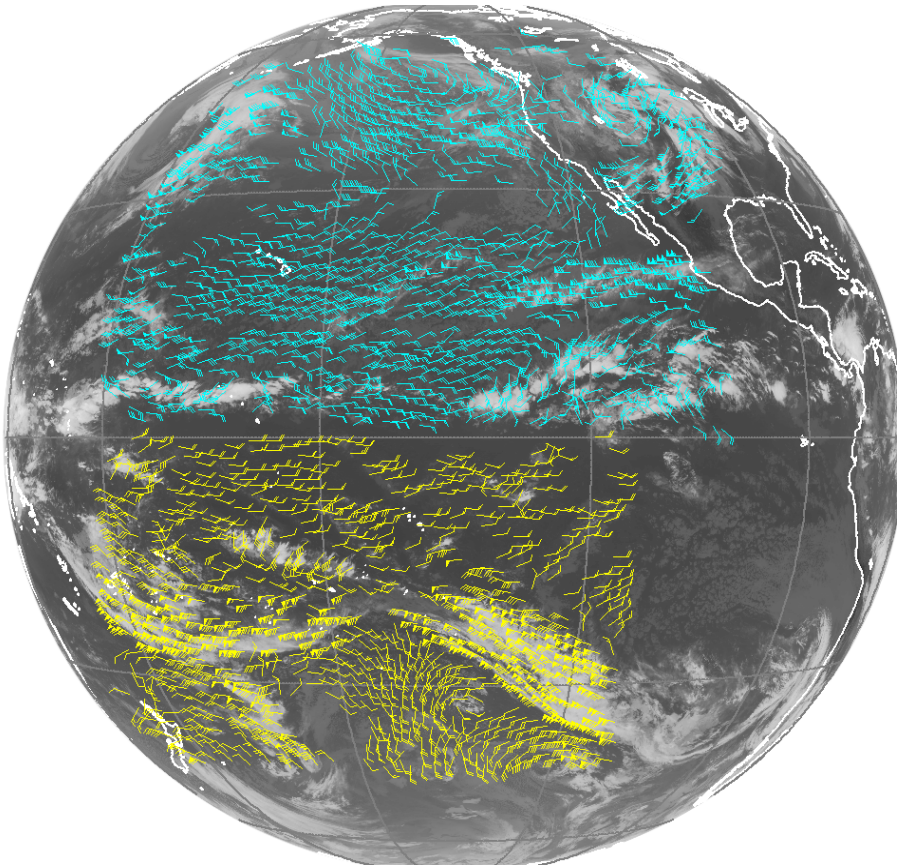
GOES AMV Reprocessing: Phase 1a

- Derive hourly AMV datasets from each of the two GOES operational satellites (East and West) from 1995 to present.
  - GVAR satellite series (GOES-8 to -15); entire data archive on-line at UW-SSEC
  - Mostly stable calibration and geolocation throughout time period
  - Utilize full-resolution image triplets from longwave IR (window), shortwave IR, and water vapor channels, and the visible channel at ½ spatial resolution
  - Only GOES Imager, no Sounder data used
  - Divide processing into two sectors per satellite: Northern and Southern Hemisphere
- Employ the current NOAA operational AMV processing algorithm
- ERA-Interim analyses used for first guess and in AMV height determination
- AMV datasets processed on a cluster computer system to reduce reprocessing time -- about a 3-month (dedicated) effort

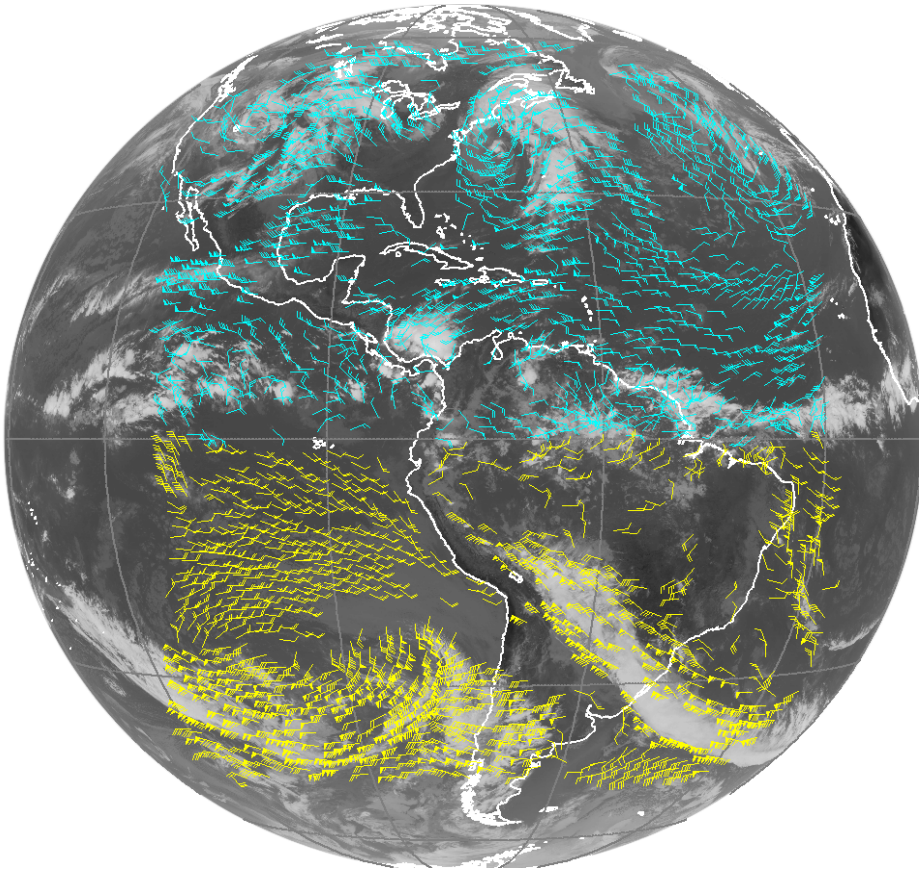
GOES AMV Reprocessing: Coverage

Blue: Northern Hemisphere coverage

Yellow: Southern Hemishpere coverage



GOES-West
07 May 2005
1500 UTC



GOES-East
07 May 2005
1500 UTC

GOES AMV Reprocessing: Status

- **Continuous, hourly AMV datasets have been re-processed for the two GOES operational satellites from 1995 to mid-2013.**
  - **~600,000 AMV datasets generated**
  - **Quality control of the AMVs is underway, both automated and visual**
  - **Output text files will be prepared for community access (April release expected)**
- **This will complete Phase 1a of the reprocessing effort**

- **Future GOES AMV reprocessing plans (currently unfunded):**
  - **Phase 1b: Reprocess the same dataset, but using the GOES-R cluster tracking algorithm (J. Daniels, NOAA/NESDIS) and cloud height algorithm (A. Heidinger, NOAA/NESDIS), both under development**
  - **Phase 2: Extend the reprocessing to earlier U.S. satellites (from 1978 onward), which will require a more substantial effort to:**
    - **Correct sensor calibration and geolocation**
    - **Produce cloud products (heights) for the pre-GVAR satellites**

AMV workshop at ECMWF together with EUMETSAT and CIMSS

- In 2013 a workshop including EUMETSAT and CIMSS was held at ECMWF.
- The differences between the EUMETSAT and CIMSS algorithms were analysed.
- Usability of AMV products at ECMWF discussed.
- Results forwarded to JMA and IWWG.

(the more detailed information in Appendix)

Contents for Project Portal Site

Reprocessing Projects

- JMA's website for reprocessing of Satellite Products for Climate

http://mscweb.kishou.go.jp/product/reprocess/

- EUMETSAT's website on Climate Data Records:

http://www.eumetsat.int/website/home/Data/Products/Climate/index.html

Reanalysis Projects

- JRA-55 website:

http://jra.kishou.go.jp/JRA-55/index_en.html

- ERA-CLIM website: http://era-clim.eu/

Appendix

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs (report from AMV workshop at ECMWF with the addition of JMA's status for Himawari for the review on the use of AMVs and CSRs in past reanalysis (Schedule in 2014; Point 1)

as of Sep, 2013
(need to be updated)

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs as of Sep, 2013 (1/10)

(1) Programmatic

	CIMSS	EUMETSAT	JMA/MSC
Current data holdings	GOES, SMS-1, -2, MODIS, KALPANA, POES AVHRR, COMS, GMS, METEOSAT-3 onwards, MTSAT, FY-2C/D/E	METEOSAT, METOP and POES AVHRR (starting with NOAA-18)	GMS, (GOES-9), MTSAT
Already reprocessed	AMV from POES AVHRR (NOAA-7 to –18)	1) AMV and CSR from METEOSAT-2 to -7 up to end of 2000 2) AMV from AVHRR METOP-A up to end of 2012 (using two algorithms, EUMETSAT operational and CIMSS)	AMVs from GMS-1 to MTSAT, CSRs from GMS-5 to MTSAT
Current production	GOES GVAR -8 to -15 (1995-present): AMV. Expected to be available by 2014. Includes processing of 30-minute images, 15-minute images, and 7-minute rapid scan images (producing possibly 1 wind product every 7 minutes, though limited to extreme weather situations)	AMV, CSR, ASR, THU, CTH, NDVI, CLM, Cloud type, cloud top pressure, cloud top temperature, from METEOSAT-8 and -9. Expected to be available by 2014	AMVs and CSRs

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs as of Sep, 2013 (2/10)

	CIMSS	EUMETSAT	JMA/MSC
Funding for current production	SSEC grant	EU FP7 ERA-CLIM and EUMETSAT own resources	JMA/MSC own resources
Committed reprocessing		1) AMV, CSR, ASR from Meteosat-7 for years 2001-2004 for zero degree, and for years from 2001 and up to real time for Indian Ocean Data Coverage. Expected to be available by 2014. 2) AMV from AVHRR POES and AVHRR METOP-A and -B reprocessed by 2015. 3) AMV, CSR, ASR from METEOSAT-2 to -9 based on inter-satellite calibrated IR radiances and updated algorithm. Expected to be available by 2016.	
Funding for committed reprocessing		EU FP7 ERA-CLIM2 and EUMETSAT own resources	

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs as of Sep, 2013 (3/10)

	CIMSS	EUMETSAT	JMA/MSC
Considered reprocessing	POES AVHRR using updated code and input and more metadata in output MODIS from EOS-Aqua and Terra Repeat current GVAR reprocessing but with latest algorithm (NESDIS GOES-R tracking), and extend reprocessing to older GOES satellites, pre-GVAR.	After ERA-CLIM2 updated codes may arrive from SCOPE-CM and can be used for increasing the consistency of geostationary AMV products. Also planned Meteosat First Generation image reprocessing and inter-satellite calibration lead to new reprocessing of the same data	
Of value, but unfunded	- KALPANA - GOES-1 to -7 (1978-1995) - SMS-1 and SMS-2 (1979-1981) - ATS (1974)	- Routine METEOSAT-8 and -9 rapid scan images (since May 2008) at 5-minute intervals, producing possibly 1 wind product every 20 minutes, limited to 15N-70N - METEOSAT-8 and -9 high resolution visible channel images	

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs as of Sep, 2013 (4/10)

	CIMSS	EUMETSAT	JMA/MSC
Problems preventing reprocessing of earlier data	- GOES-1 to -7 cannot be reprocessed until navigation and calibration have been corrected - Upcoming (GOES-R) winds algorithm cannot be applied to reprocessing prior to GOES-8; requires development to cloud analysis	- Current CCC algorithm cannot be applied to METEOSAT-2 to -7 on the current EUMETSAT reprocessing system; requires development to cloud analysis product - For Meteosat First Generation a reprocessing of the Image data including improvements in navigation and image resampling as well as anomaly detection is planned but the resources are tight and time of realisation is uncertain.	VIS AMV of GMS-1 not processed due to stripe noise
Input data preservation	All original tapes transferred to digital (online) at SSEC Data Centre	Funded and committed archive preservation (EUMETSAT Data Centre)	Some original digital data was lost in early date for GMS period; IR image before March 1981, VIS image before March 1987 excepting 1979

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs as of Sep, 2013 (5/10)

	CIMSS	EUMETSAT	JMA/MSC
Input data backup (disaster recovery)	- NOAA NCDC holds the official GOES archive - SSEC has additionally processed the original GOES archive and has rescued more data and produced data of higher quality than current NCDC holdings.	- EUMETSAT Data Centre - Third copy back-up off-site	- JMA/MSC Data Archives - Third copy back-up in distributed universities and research institutes (no systematic preservation)

(2) Reprocessing methods, including input and output interfaces

	CIMSS	EUMETSAT	JMA/MSC
Input sensor data	GVAR level 1b AVHRR POES level 1b and regridded	METEOSAT level 1.5 MVIRI and SEVIRI AVHRR METOP level 1b (and IASI METOP level 1c)	VISSR, SVISSR for GMS HIRID and HRIT for MTSAT

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs as of Sep, 2013 (6/10)

	CIMSS	EUMETSAT	JMA/MSC
Input channels	- AVHRR: IR 10.8 micron - GOES: WV 6.7 micron, IR 10.7 micron, SWIR 3.9 micron, and VIS 0.63 micron	- AVHRR: IR 10.8 micron - METEOSAT-8 and -9: IR 10.8 micron, WV 6.2 and 7.3 micron, VIS 0.8 micron Note: VIS 0.6 micron not used for AMV METEOSAT-2 to -7: IR [10.5-12.5 micron], WV [5.7-7.1 micron], VIS [0.5-0.9 micron]	GMS-5,GOES-9 and MTSAT (IR,WV,VIS) GMS-(1-5) (IR, VIS)
Input background	- GOES: ERA-Interim reanalysis analyses Pressure levels 1x1 degree2 grid 6-hourly - AVHRR: NCEP/NCAR reanalysis analyses Pressure levels 1x1 degree2 grid 6-hourly	ERA-Interim 6-hourly forecasts (+6h and +12h steps) 60 model levels for AVHRR, 31 model levels for METEOSAT-8 and -9, 16 model levels for METEOSAT-2 to - 7 0.5x0.5 degree2 grid for AVHRR, 1x1 degree2 grid for METEOSAT-8 and -9, 1.5x1.5 degree2 grid for METEOSAT-2 to -7 6-hourly	JRA-25 reanalysis data (Grid:1.25 degree 23 Layers)
Background time interpolation	Linear in time	Linear in time	Linear in time

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs as of Sep, 2013 (7/10)

	CIMSS	EUMETSAT	JMA/MSC
Background used for	- Height assignment for AVHRR and GOES - First-guess to tracking solution for AVHRR and GOES - Quality control for GOES and AVHRR in recursive filter editing system	- Height assignment for AVHRR and METEOSAT (no best fit applied, EBBT only) - First-guess to tracking solution for AVHRR	Cloud height assignment for AMV, Sea Surface Temperature for CSR
Tracking	Compute 2 vectors from 3 consecutive images, spaced by 30 minutes for GOES and 100 minutes for AVHRR, using first-guess tracking solution from background, and then average the two individual vectors to produce final solution Lp norm for GOES Cross-correlation for AVHRR	METEOSAT: Compute 3 vectors from 4 consecutive images, spaced by 30 minutes for METEOSAT-2 to -7, and 15 minutes for METEOSAT-8 and -9 AVHRR: Compute 1 vector from 2 consecutive images spaced by 100 minutes, using first-guess tracking solution from background	Cross Correlation method, Compute 2 vectors from 3 consecutive imagery
Height assignment	GOES: EBBT for VIS, IR, and WV H2O-intercept for IR and cloudy WV, only upper levels CO2-slicing for IR and cloudy WV, only upper levels Cloud base for VIS and IR, only low levels Height assignment based on the above (decision tree) POES AVHRR: Same as above, but no H2O-intercept and CO2-slicing	METEOSAT: EBBT for VIS, IR, and WV and H2O-intercept for IR and WV from METEOSAT-2 to -7, Cloud analysis product's output for METEOSAT-8 and -9 (CCC method) Final assignment for METEOSAT based on 3 intermediate products (average) METOP AVHRR: EBBT (and IASI)	EBBT : from GMS-1 to GMS-4 EBBT and IR-WV intercept : GMS-5, GOES-9, MTSAT

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs as of Sep, 2013 (8/10)

	CIMSS	EUMETSAT	JMA/MSC
Height assignment future method	1DVAR for GOES and AVHRR	Optimal estimation using the OCA output for METEOSAT-8 and -9	
Quality indicator	EUMETSAT quality indicators (QIs), with and without background (forecast) check RFF quality indicator using height reassignment and potential speed bias adjustment	EUMETSAT quality indicators (QIs), with and without background (forecast) check	EUMETSAT QI
Quality control (yes/no)	QI has to exceed **60** Visual inspection of time-series of validation metrics w.r.t RAOB	QI has to exceed **30**	QI has to exceed **60**
Native output format	McIDAS MD format (binary)	METEOSAT-native EPS format for AVHRR	"JMA Vector File"
Delivery format	Text (space-separated)	BUFR	BUFR

Summary of reprocessing efforts for GOES, METEOSAT, Himawari, and AVHRR, mostly AMVs as of Sep, 2013 (9/10)

	CIMSS	EUMETSAT	JMA/MSC
Processing system: input data acquisition	Satellite data online	Satellite data retrieved from EUMETSAT Data Centre	Satellite data retrieved from JMA/MSC Data Centre
Processing system: hardware	Linux cluster, can run ~50 simultaneous streams	Legacy RMPEF (32-bit SUN environment) for METEOSAT R-EPS (IBM AIX Power6) for AVHRR Can run 3 simultaneous streams for METEOSAT, and 24 for AVHRR	Linux
Hardware resource	In-kind contribution from SSEC	Funded by EUMETSAT	Funded by JMA/MSC
Processing system: main software	For GOES, NOAA/NESDIS operational For AVHRR, CIMSS code	EUMETSAT operational ground segment software, adapted for reprocessing purposes	JMA AMV derivation software
Reprocessing speed	3900 days/day for AVHRR (using regridded input) Estimated 440 days/day for GOES	50 days/day for AVHRR (including radiance mapping) 9 days/day for METEOSAT	MTSAT : 10days/1day OTHERS : 45days/1day

Discussion