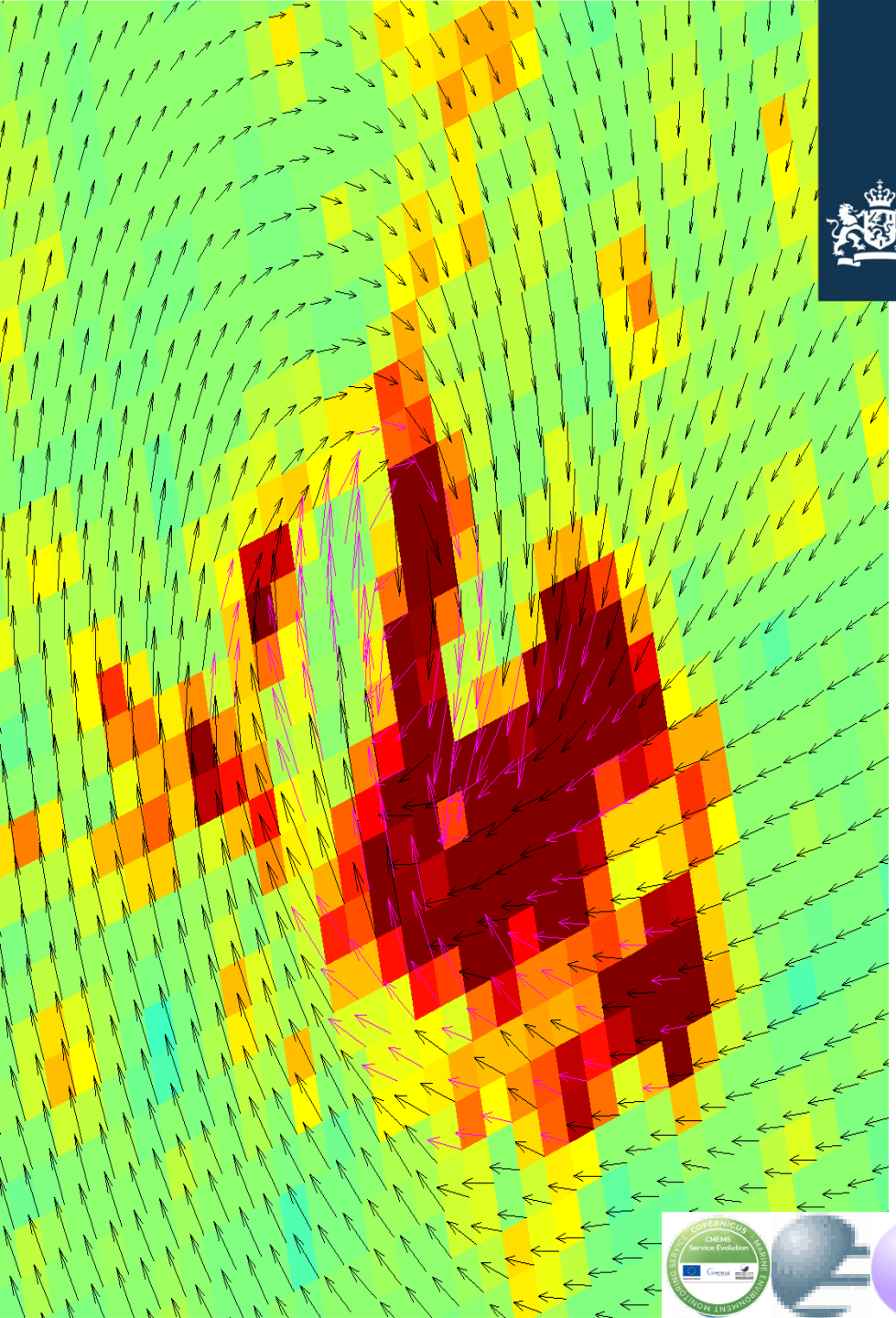


Royal Netherlands
Meteorological Institute
Ministry of Infrastructure and Waterworks

WMO CGMS
Scatterometer action

Ad.Stoffelen@knmi.nl
Paul Chang (NOAA) CEOS OSVW-VC
Raj Kumar (ISRO) CEOS OSVW-VC
Stefanie Linow (EUMETSAT) CEOS OSVW-VC
Régis Bordes (EUMETSAT) IWWG/CGMS
Steve Wanzong (NOAA) IWWG/CGMS

IWW15, 12-16 April 2021

CGMS-48 Action on SCAT task team

- WMO/CGMS at its 48th meeting defined the actions below:

CGMS-48 actions – Plenary Session					
Actionee	**AGN item**	**Action #**	**Description**	**Deadline**	**Status**
CGMS members	7.3	A48.	CGMS members to provide point(s) of contact to be part of the SCAT task team (together with Ad Stoffelen, OSVW-VC (Co-chairs Paul Chang/NOAA, Raj Kumar/ISRO, Stefanie Linow/EUM), and IWWG (Co-chairs Regis Bordes/Steve Wanzong),		OPEN
SCAT task team	7.3	A48.	SCAT task team to present the **Terms of Reference, and roadmap** for the work to CGMS-49 plenary for endorsement	CGMS-49	OPEN

- Use IOVWST (NASA based) and IWW15 (serves WMO CGMS) as discussion venues
- Terms of Reference and roadmap to be presented in CGMS-49 Plenary
- The CGMS links to the WMO WIGOS 2040 view to optimize and exploit satellite missions for meteorological, ocean and climate applications
- Based on capabilities and broad user application requirements in WMO OSCAR, other user aspects (RFI), outreach and training
- All above authorities and acronyms are explained in the following slides
- Contact me at your earliest convenience when interested in ToR or Roadmap

(Ad.Stoffelen@knmi.nl)

Roadmap (TBD)

- Priorities based on user requirements (IOVWST, IWWg, SAF, ..)
- Recommendations on optimization/exploitation Virtual Constellation (i.c.w. CEOS)
  - Missions and LST, diurnal cycle, intercalibration, risk, redundancy, expert community support
  - Data exchange ground segment, timeliness
  - Comparison studies, calibration, validation, verification standards
  - Open software
  - Mission monitoring, visualization
  - Transparancy in processing, standards, user guidance, user access
  - Service messages, nowcasting alerts
  - Gridded products
- Radio Frequency Interference (RFI)
- . . . your input is welcome

Terms of Reference OSW group (TBD)

- Ocean Surface Winds (OSW) are obtained by scatterometers, SARs and radiometers
- The CGMS OSW group provides a forum for the exchange of information on polar-orbiting satellite ocean wind missions, such as reporting on current satellite status and future plans, data exchange matters, operations, intercalibration of sensors, processing algorithms, products and their validation, and data transmission standards;
- CGMS OSW harmonizes to the extent possible satellite mission parameters such as orbits, sensors, data formats and ground segment;
- CGMS OSW encourages complementarity and compatibility through cooperative mission planning, compatible meteorological data products and services and the coordination of space and data related activities, thus complementing the work of other international satellite coordinating mechanisms;
- The CGMS OSW group may convene as subgroup of the bi-annual IWWg, being informed by the NASA IOVWST and CEOS Ocean Surface Vector Wind Virtual Constellation;
- The CGMS OSW group interacts with the CGMS plenary and informs CEOS VC
- The CGMS OSW group has a chairman and a secretary, coordinating the information exchanges, actions and recommendations;

Context of authorities

- WMO
- OSCAR
- WIGOS 2040
- CGMS
- IWWg
- CGMS and ocean vector winds
- IOVWST
- CEOS
- Coordination
- Way forward

Focus areas

Tags: Applications Data exchange Technology transfer Environment Natural hazards Observations Oceans

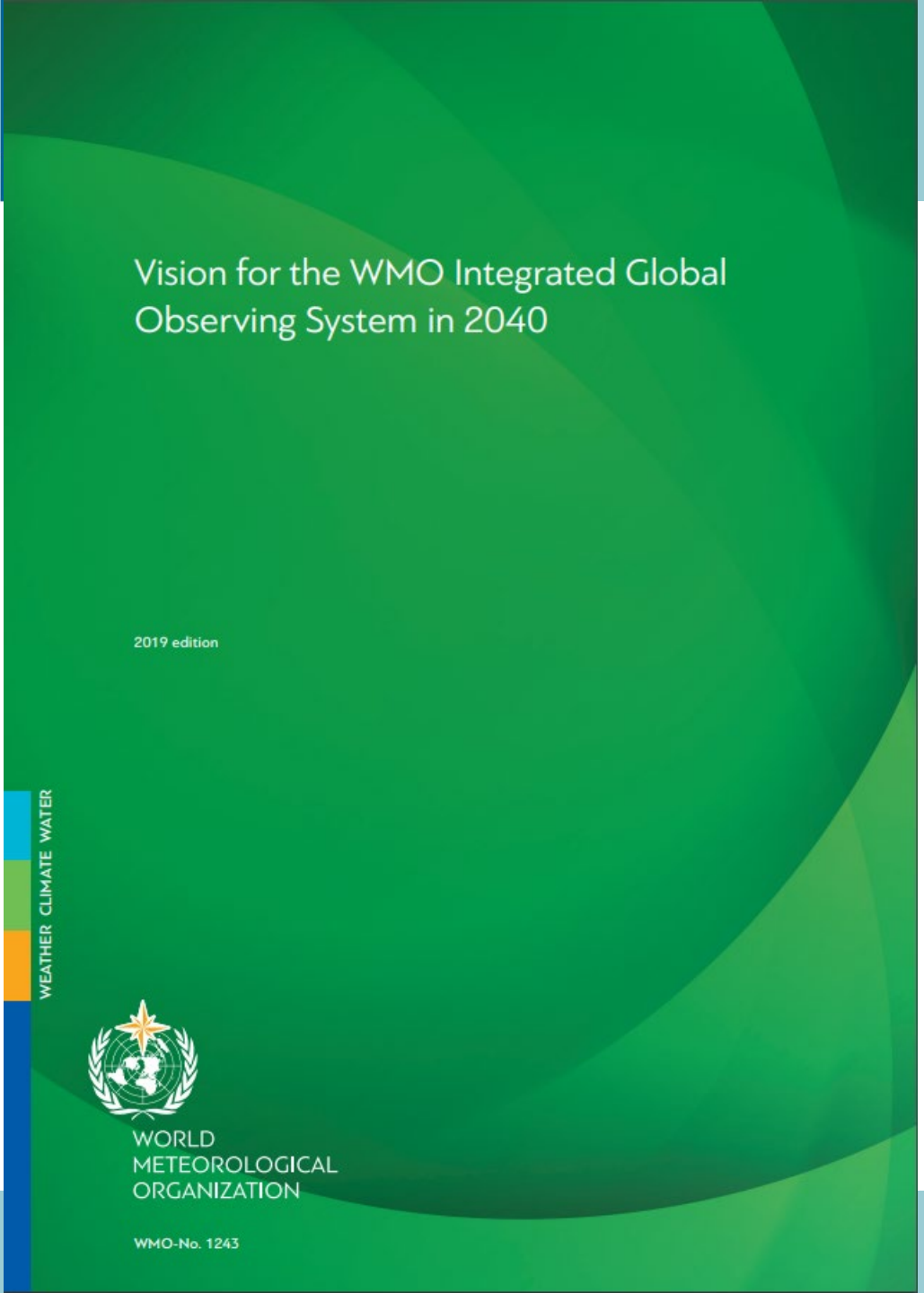
Within its mandate in the areas of weather, climate and water, WMO focuses on many different aspects and issues from observations, information exchange and research to weather forecasts and early warnings, from capacity development and monitoring of greenhouse gases to application services and much, much more.

- Many links to ocean winds

Weather

Climate

Water



WIGOS 2040

community.wmo.int/vision2040

- Links to CEOS and IOVWST, but includes further user aspects, e.g., on nowcasting and NWP

Variable: Wind vector (near surface)

Definition

Full name	Wind vector (near surface)		
Definition	Horizontal wind vector, at a known height above the surface which is to be sprcified in the metadata		
Measuring Units	m/s	**Uncertainty Units**	m/s
Horizontal Res Units	km	**Vertical Res Units**	
Stability Units	m/s (Stability /decade)		

Comment:	
Last modified:	2019-10-15
Applied in OSCAR/Space Gap Analysis:	Yes

Classification

- **Domain:** Atmosphere
  - **Sub-domain:** Basic atmospheric
    - **Variable:** Wind vector (near surface)
      - **Measured in Layers:**
        - Near Surface
- **Cross-cutting themes:**

- **Used in Application Areas:**
  - CLIC (deprecated)
  - Agricultural Meteorology
  - Climate-AOPC (deprecated)
  - CLIVAR (deprecated)
  - Climate Modelling Research (deprecated)
  - Global NWP
  - High Res NWP
  - Nowcasting / VSRF
  - Ocean Applications
  - Climate-OOPC (deprecated)
  - Aeronautical Meteorology

➢ Community consensus on capabilities and requirements for ocean vector winds

Requirements defined for *Wind vector (near surface)* (19)

This tables shows all related requirements. For more operations/filtering, please consult the full list of Requirements
Note: In reading the values, goal is marked blue, breakthrough green and threshold orange

Id	Variable	Layer	App Area	Uncertainty	Stability / decade	Hor Res	Ver Res	Obs Cyc	Timeliness	Coverage	Conf Level	Val Date	Source
14	Wind vector (near surface)	Near Surface	CLIC (deprecated)	1 m/s 1.7 m/s 5 m/s		25 km 39.7 km 100 km		12 h 15 h 24 h	30 d 38 d 60 d	Global ocean	reasonable	1998-10-29	WCRP
321	Wind vector (near surface)	Near Surface	Global NWP	0.5 m/s 2 m/s 3 m/s		15 km 100 km 250 km		60 min 6 h 12 h	6 min 30 min 6 h	Global ocean	firm	2009-02-10	John Eyre
391	Wind vector (near surface)	Near Surface	High Res NWP	0.5 m/s 1.077 m/s 5 m/s		2 km 10 km 40 km		30 min 60 min 3 h	15 min 30 min 2 h	Global land	firm	2011-02-01	T Montmerle
546	Wind vector (near surface)	Near Surface	Ocean Applications	0.5 m/s 2 m/s 5 m/s		5 km 10 km 60 km	10	6 min 3 h 24 h	5 min 60 min 6 h	Global ocean	reasonable	2011-03-07	JCOMM (Ali Mafimbo)

www.cgms-info.org/

CGMS

The Coordination Group
for Meteorological Satellites

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Satellite status

Working Papers

CGMS-49

CGMS-48

HOME › ABOUT › OBJECTIVES

Objectives

The main goals of the coordination activities of the Coordination Group for Meteorological Satellites are to support operational weather monitoring and forecasting as well as climate monitoring, in response to requirements formulated by WMO, its programmes and other programmes jointly supported by WMO and other international agencies.

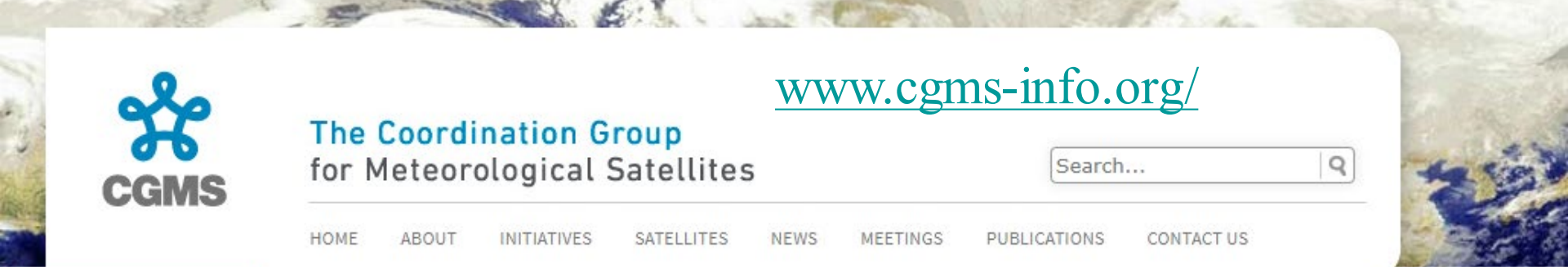
It is the policy of CGMS to coordinate satellite systems of its members in an end-to-end perspective, including protection of in-orbit assets and support to users - e.g. through appropriate training - as required to facilitate and develop shared access to and use of satellite data and products in various applications. This policy is reflected in the structure of the so called High Level Priority Plan (HLPP) initially endorsed by CGMS-40 plenary session in 2012, covering: Coordination of observing systems and protection of assets:

1. Coordination of observing systems and protection of assets
2. Data dissemination, direct read out services and contribution to the WIS product development
3. Enhance the quality of satellite-derived data and products
4. Outreach and training activities
5. Cross-cutting issues and new challenges

Charter

The objectives of CGMS are formalised within its Charter:

- CGMS provides a forum for the exchange of technical information on geostationary and polar-orbiting meteorological satellite systems and research & development missions, such as reporting on current meteorological satellite status and future plans, telecommunications matters, operations, intercalibration of sensors, processing algorithms, products and their validation, data transmission formats and future data transmission standards.
- CGMS harmonises meteorological satellite mission parameters (such as orbits, sensors, data formats and downlink frequencies) to the greatest extent possible.
- CGMS encourages complementarity, compatibility and possible mutual back-up in the event of system failure through cooperative mission planning, compatible meteorological data products and services and the coordination of space and data-related activities, thus complementing the work of other international satellite coordinating mechanisms.



WORKING GROUPS

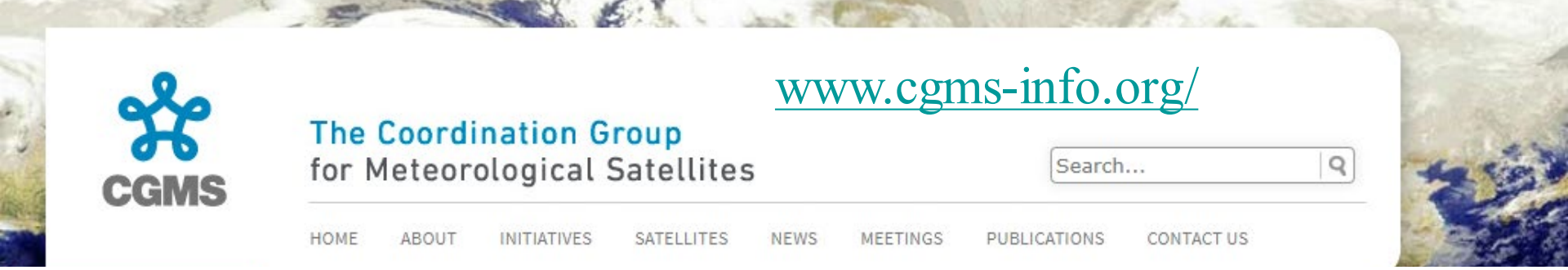
- WORKING GROUP I: SATELLITE SYSTEMS AND OPERATIONS
- WORKING GROUP II: SATELLITE DATA AND PRODUCTS
- WORKING GROUP III: OPERATIONAL CONTINUITY AND CONTINGENCY PLANNING
- WORKING GROUP IV: DATA ACCESS AND END USER SUPPORT
- SWCG: SPACE WEATHER COORDINATION GROUP

INTERNATIONAL SCIENCE WORKING GROUPS

- INTERNATIONAL TOVS WORKING GROUP: ITWG
- INTERNATIONAL PRECIPITATION WORKING GROUP: IPWG
- INTERNATIONAL RADIO OCCULTATION WORKING GROUP: IROWG
- INTERNATIONAL WINDS WORKING GROUP: IWWG
- INTERNATIONAL CLOUDS WORKING GROUP: ICWG

OTHER RELEVANT WORKING GROUPS OR TEAMS

- CEOS-CGMS JOINT WORKING GROUP ON CLIMATE



OBJECTIVES WORKING GROUP II

WG II is the forum where aspects of technical and scientific nature related to instrument calibration and products from satellites are discussed. The agenda is determined by a) papers that relate to actions and recommendations from previous meetings and b) by additional submissions of papers from delegates. New proposals for actions and recommendations emerging from the discussions at WG II are presented at the subsequent plenary session and, once adopted, are placed as action or recommendation on CGMS members. Terms of reference of WG II (as endorsed by CGMS-48 plenary, august 2020). WG II also serves as important link between the annual CGMS meetings and the CGMS international science working groups which provide regular reports and feedback to CGMS.

SCOPE OF WORKING GROUP IV

CGMS WG IV will provide a regular forum for CGMS agencies to address topics of interest in areas related to data access in general and the contribution to the WMO information system. The working group will address issues related to the dissemination systems, data formats and metadata exchange, and will also deal with the user interfaces and data access.

INTERNATIONAL WINDS WORKING GROUP

International Winds Working Group

Welcome to the **International Winds Working Group** website

The International Winds Working Group (IWWG) was established in 1991 and became a formal working group of the Coordination Group for Meteorological Satellites (CGMS) in 1994.

IWWG was initially established to focus on cloud track winds from geostationary data. As the satellite observing system has developed, the IWWG has broadened its interest to cover the range of wind datasets derived from current and future satellite missions. The main focus remains the atmospheric motion vectors produced by tracking features (clouds and water vapour) in geostationary and polar imagery sequences. Other winds datasets addressed by the group include: (i) ocean surface winds derived from radar backscatter and conical-scanning microwave radiometers (ii) data from research missions (e.g. MISR winds) and (iii) future datasets including wind profile information from space-borne lidar and 3-D wind fields derived from tracking features in clear sky moisture fields produced from future geostationary hyperspectral infrared sounders.

IWWG provides a forum to discuss and coordinate research and developments in data production, verification/validation procedures and assimilation techniques.

General Announcements	Latest News
15th INTERNATIONAL WINDS WORKSHOP April 12 - 16, 2021 Virtual **IWW15 web page** Abstract Deadline: Feb 1, 2021 Cisco webex	For older news items see the **news archive** **Mar 2020:** 9th NWP SAF AMV monitoring report released by the Met Office **Dec 2018:** Operational AMV Production Survey **Jun 2018:** Introduction to the Himawari-8 AMV Algorithm. **Mar 2018:** 8th NWP SAF AMV monitoring report released by the Met Office

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Last updated 08 Feb 2021

15th International IWWG Workshop

April 12 - 16, 2021 Virtual

One of the key meteorological parameters for weather forecasting, meteorological studies and climate applications is wind. It has therefore been a major task for the science and operational community to exploit the imagery data from satellites in order to derive Atmospheric Motion Vectors (AMVs) by tracking observed cloud and moisture features. The globally derived AMV fields are an established and essential product, especially for numerical weather prediction, and are complemented by other satellite-based observations of the atmospheric flow. The biennial International Winds Workshops are the forums used by the International Winds Working Group (IWWG) for co-operation in the operational and research community, and have strongly contributed to the improvement in quality of the derived wind fields.

The Workshop is an opportunity to present advances and new ideas in this specialised field. We therefore encourage participation from all organisations operating meteorological satellites, as well as from data users and the science community. Presentations on operational and experimental wind retrievals from satellite imagery data and their use for Numerical Weather Prediction, nowcasting, or in climatological applications are welcome. In addition, research work on wind retrievals from active and passive microwave instruments and active optical systems (lidar) is encouraged.

Workshop Organizers

The meeting is being organised by a joint Scientific Program Committee:

- Dr Régis Borde (Eumetsat), Co-chair
- Mr Steve Wanzong (UW-Madison/SSEC/CIMSS), Co-chair
- Dr Ad Stoffelen (KNMI)

To eliminate the need for a spam filter, all comments on presentations will need to be approved by the moderator, Steve Wanzong.

CGMS and ocean vector winds

- Define WMO OSCAR requirements and contribute capabilities
  - Temporal coverage
  - Timeliness for NWP and nowcasting
  - Contribute user requirement and capability assessments
- CGMS
  - Calibration, e.g., wind speed reference determination for user consistency of products
  - Processing, e.g., open software
  - Validation, verification, product comparison
  - Standardization of service (formats, metadata, quality monitoring/assessment)
  - User dissemination / training / guidance
  - Mission planning and redundancy
- Carry out actions and make recommendations
- Inform, report and feedback
- Coordination IOVWST,CEOS, IWWg

Actionable CGMS members

- Current and prospective developers and operators of meteorological satellites;
- WMO, because of its unique role as representative of the world meteorological data user community, and other programmes jointly supported by WMO and other international agencies;
- Space agencies operating R&D satellites contributing to WMO programmes.

CMA	China Meteorological Administration
CNES	Centre National d'Etudes Spatiales
CNSA	China National Space Administration
ESA	The European Space Agency
EUMETSAT	EUMETSAT
IMD	India Meteorological Department
IOC-UNESCO	Intergovernmental Oceanographic Commission - UNESCO
ISRO	Indian Space Research Organisation
JAXA	Japan Aerospace Exploration Agency
JMA	Japan Meteorological Agency
KMA	Korea Meteorological Administration
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
ROSCOSMOS	Russian Federal Space Agency
ROSHYDROMET	Russian Federal Service for Hydrometeorology and Environmental Monitoring
WMO	World Meteorological Organization

Observers

CSA	Canada Space Agency
ENV CAN	Environment Canada
GCOS	Global Climate Observing System
KARI	Korea Aerospace Research Institute
KIOST	Korea Ocean Research & Development Institute
SOA	State Oceanic Administration (National Satellite Ocean Application Service, NSOAS, under the Ministry of Natural Resources, MNR)

Our Work

Working Groups

Virtual Constellations

- Atmospheric Composition
- Land Surface Imaging
- Ocean Colour Radiometry
- Ocean Surface Topography
- Ocean Surface Vector Wind
- Precipitation
- Sea Surface Temperature

Ad Hoc Teams

Systems Engineering Office

Other CEOS Activities

Best Practices and Guidelines

CEOS / Our Work / Virtual Constellations / Ocean Surface Vector Wind

Ocean Surface Vector Wind

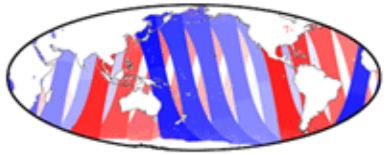
The Ocean Surface Vector Wind Virtual Constellation (OSVW-VC) fosters the availability of best quality ocean surface vector wind data for applications in short, medium, and decadal time scales in the most efficient manner through international collaboration, scientific innovation, and rigor. Strategic objectives to address this aim are:

- Improve coordination, consolidation, and development of the collective OSVW capability
- Achieve a more active engagement by nations operating or preparing satellite ocean surface vector winds sensors with the international wind vector community
- Maintain a strong and mutually supportive relationship with the International Ocean Vector Winds Science Team (IOVWST)
- Provide an interface to CEOS for the IOVWST
- Develop recommendations on the driving requirements to create, validate, and sustain the development of an international ensemble of Essential Climate Variable (ECV) measurements
- Provide advice on and advocate to the international community for the importance of OSVW measurements
- Develop and consolidate training on the use of scatterometer winds for different applications,as well as outreach to the general public to demonstrate the societal benefit of these data

The current status of the OSVW-VC and medium term activities and plans are laid out in the OSVW-VC Terms of Reference.

The OSVW-VC serves as the formal link between the CEOS community and the IOVWST. The IOVWST has worked for many years on making available the best quality scatterometer wind data, based on state of the art scientific and calibration/validation developments. The OSVW-VC showcases those developments and their applications to the CEOS community, which helps supporting the IOVWST, particularly with regard to calibration/validation and outreach efforts.

The OSVW-VC is also active in other international fora, such as the Coordination Group for Meteorological Satellites CGMS, where it also advocates for a sustainable operational scatterometer winds capability. Additionally, the OSVW-VC has presented its mission objectives and achievements to the International Winds Working Group IWWG .



SCATTEROMETRY & OCEAN VECTOR WINDS
Satellite Studies

International Ocean Vector Winds Science Team Meeting Virtually via GoToMeeting, 2021

https://mdc.coaps.fsu.edu/scatterometry/meeting/

Location

The meeting will take place Virtually via GoToMeeting

All asynchronous presentations will be available one week before the meeting, and must be submitted two weeks before the meeting.

February 24, March 3rd, and March 10th from 10:00 AM ET to 11:30 AM ET, 2021.

Dates:
February 24, March 3rd, and March 10th from 10:00 AM ET to 11:30 AM ET, 2021 are the dates for the main meeting.

Questions and requests for the meeting organizer(s):
Please do not hesitate to contact Mark Bourassa.

Deadlines:

Abstract deadline: January 23

Registration deadline: February 19

Presentation deadline: February 19

Coordination

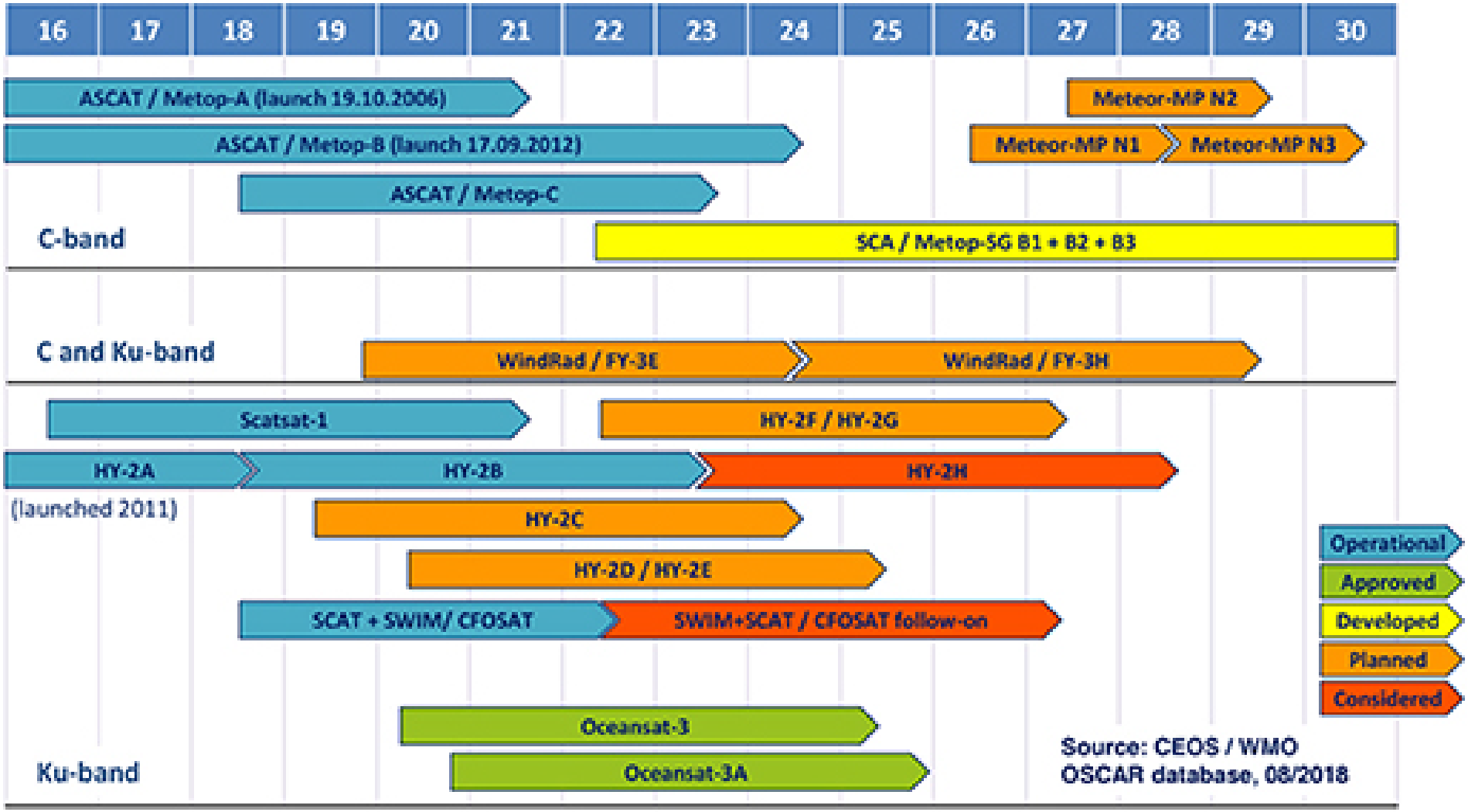
- Formal integration in IWWg under CGMS for recommendation and action
- WMO OSCAR
- IOVWST for science
- Link to CEOS VC and Working Group on Cal/Val

Way Forward

- Present CGMS-48 action at IOVWST and ask community feedback
- Present CGMS-48 action at IWWg and ask community feedback
  - Formal representation in CGMS through IWWg actions, recommendation and feedback?
- Present Roadmap and Terms Of Reference of Ocean Winds contribution to CGMS-49
- Discuss at CEOS

SOME BACKGROUND

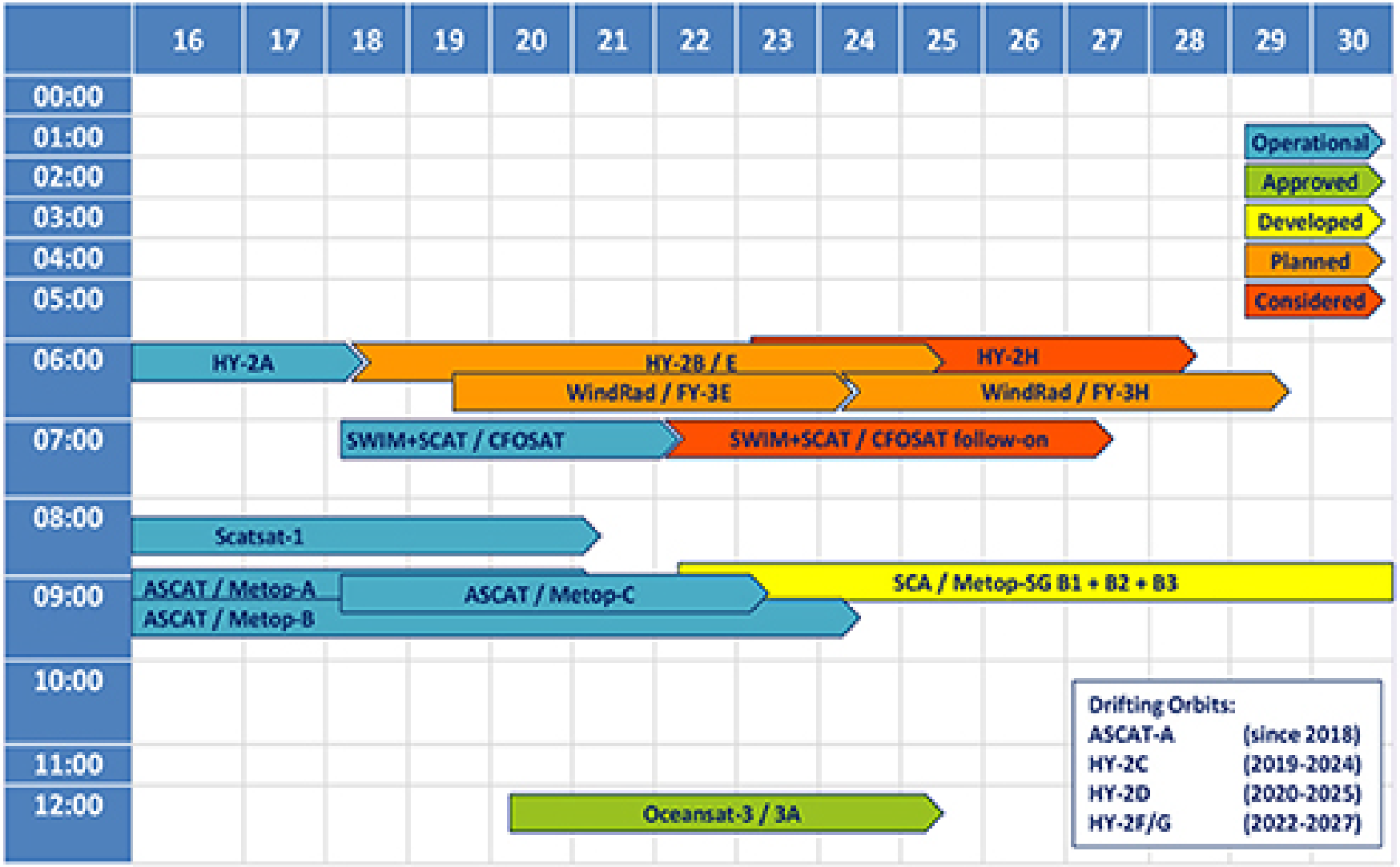
VIRTUAL CONSTELLATION



Note: Near real-time and open data access not assured for all missions listed

Operational = on orbit but does not distinguish between research and operational mission

DAILY SAMPLING CYCLE



descending node crossing time

Source: CEOS /WMO OSCAR database, 08/2018

6 hour WMO minimum observation cycle requirement. Note: OSCAT and ASCAT with only 2.5 hour separation shown to have impacts in NWP data assimilation

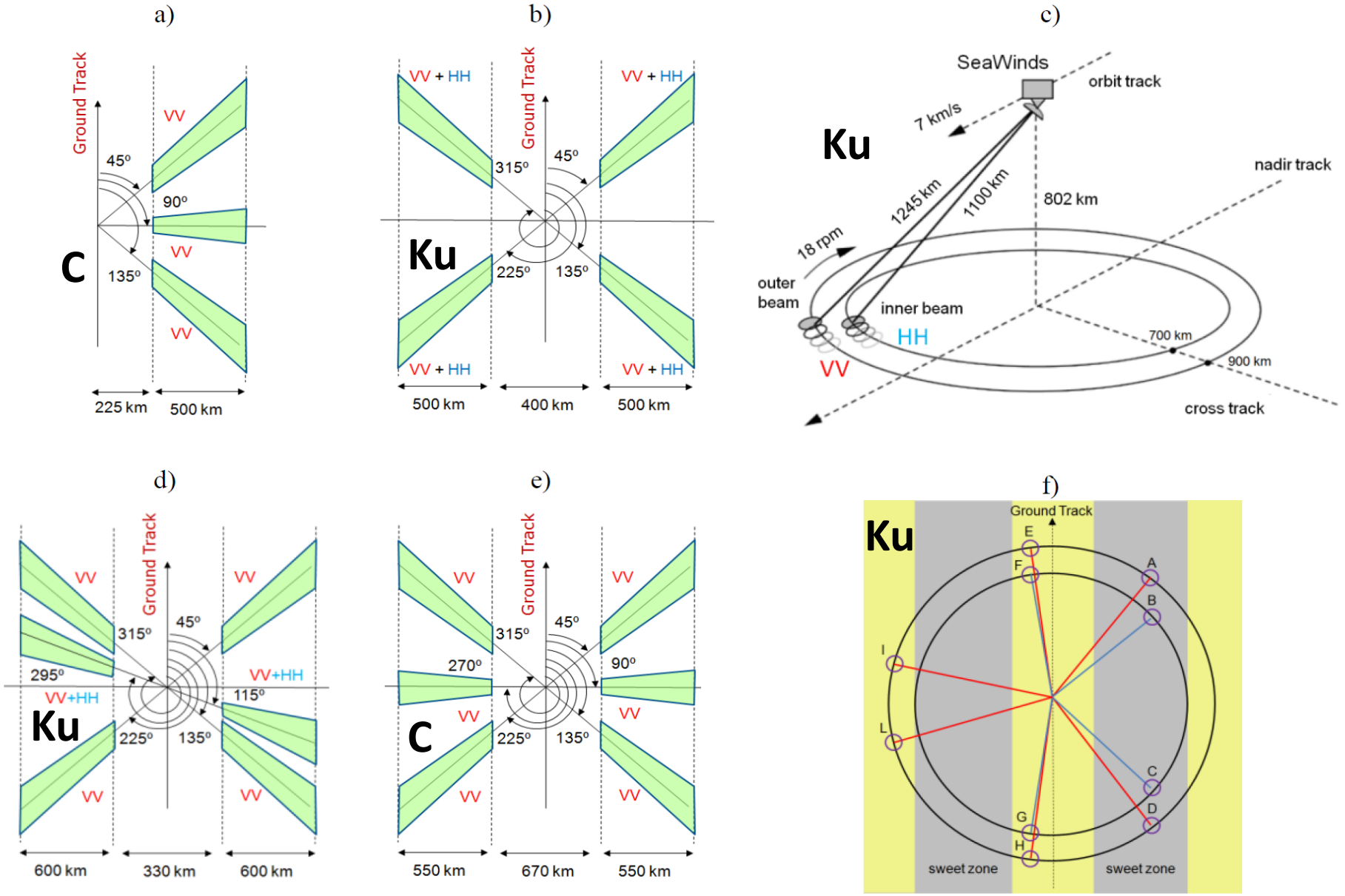


Fig. 1.4 *Sketch of the microwave illumination patterns of: a) AMI (ERS-1/2); b) SASS (SeaSat-A); c) and f) SeaWinds, Oceansat-2 SCAT and HY-2A; d) NSCAT; e) MetOp ASCAT-A and B. The case a), b), d) and e) correspond to a fan beam geometry whereas c) and f) correspond to a pencil beam geometry.*

Franco Fois, PhD thesis, 2015

Stress-equivalent wind

- Radiometers/scatterometers measure ocean roughness
- Ocean roughness consists in small (cm) waves generated by air impact and subsequent wave breaking processes; depends on gravity, water mass density, surface tension s, and e.m. sea properties (assumed constant)
- Air-sea momentum exchange is described by $\boldsymbol{\tau} = \rho_{air}\, u_* \boldsymbol{u}_*$, the stress vector; depends on air mass density ρ_{air}, friction velocity vector $\boldsymbol{u}_*$
- Surface layer winds (e.g., $\boldsymbol{u}_{10}$) depend on $\boldsymbol{u}_*$, atmospheric stability, surface roughness and the presence of ocean currents
- Equivalent neutral winds, $\boldsymbol{u}_{10\mathrm{N}}$, depend only on $\boldsymbol{u}_*$, surface roughness and the presence of ocean currents and is currently used for backscatter geophysical model functions (GMFs)

- $\boldsymbol{u}_{10\mathrm{S}} = \sqrt{\rho_{air}} \cdot \boldsymbol{u}_{10\mathrm{N}} / \sqrt{\rho_0}$ is now used to be a better input for backscatter GMFs (stress-equivalent wind)
- This prevents regional biases against local wind references

Jos de Kloe et al., 2017

Inconsistencies in wind references

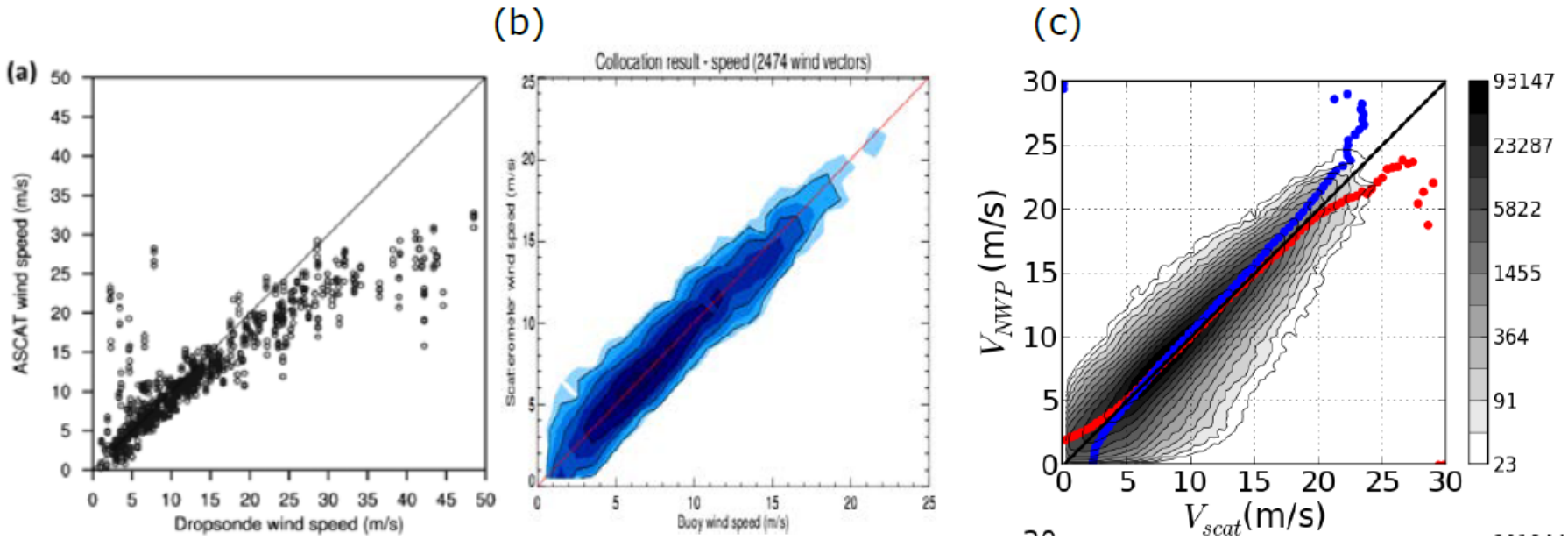
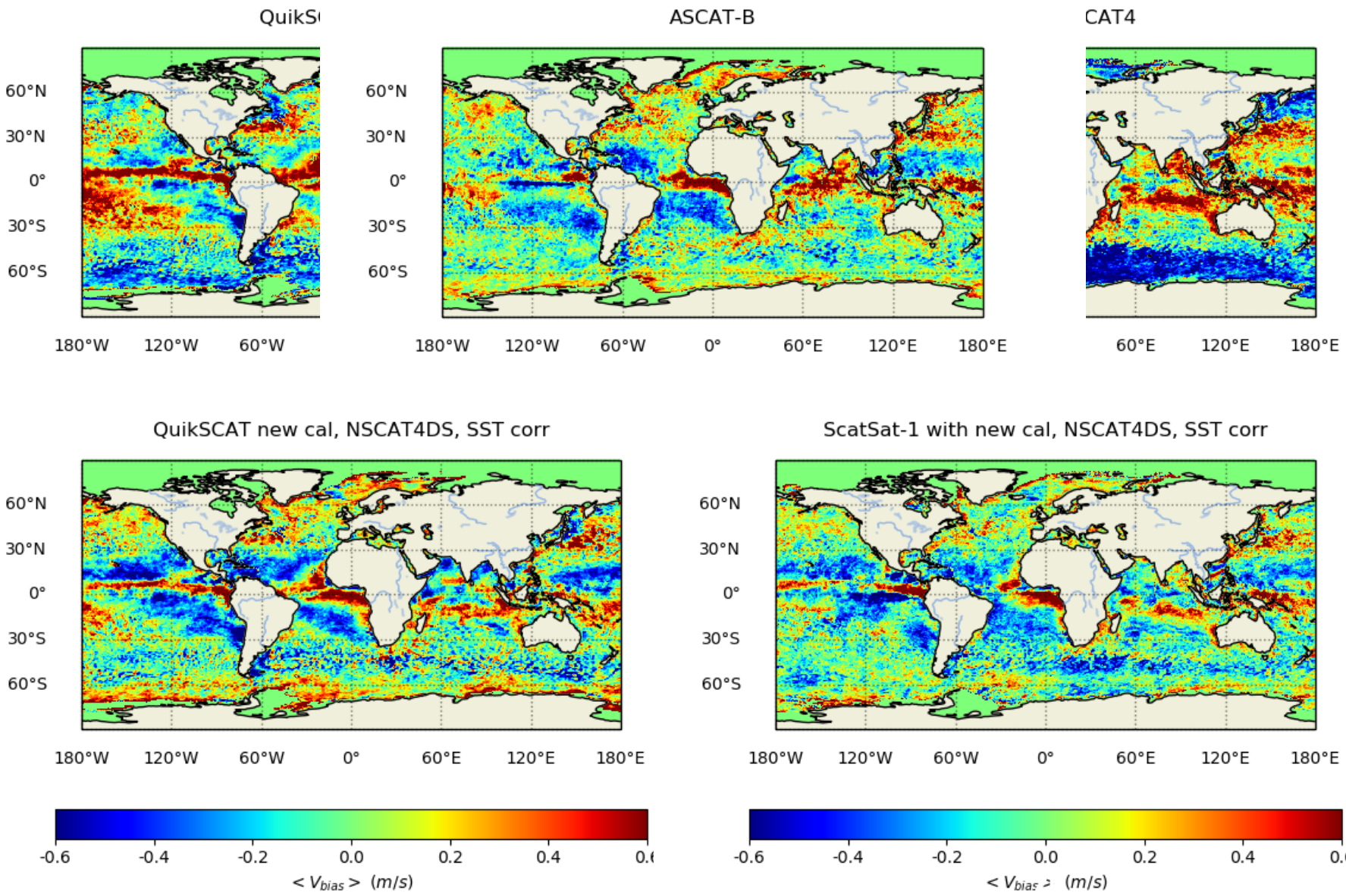


Figure 3.3: ASCAT wind speed scatter plots of a) ASCAT versus drop sondes (from [37]), b) ASCAT versus moored buoy winds and c) ECMWF NWP winds versus ASCAT. Using drop sondes, moored buoy winds and NWP references above 15 m/s may result in discrepancies due to height and position reprepresentation differences.

- Are dropsondes too high, or moored buoys and ECMWF too low at 15-25 m/s ?
- EUMETSAT CHEFS project www.eumetsat.int/CHEFS and ESA MAXSS projects address this, as well as other IOVWST activities

K.-H. Chou et al., 2013

Global wind speed biases



Model Wind Errors

- Typically 0.5 to 1 m/s in component bias and SD (10-20%) on model scales
- Underestimation of wind turning in NWP model: surface winds more aligned to geostrophic balance above than to pressure gradient below → stable model winds are more zonal with reduced meridional flows
- Sandu (ECMWF) reports that turbulent diffusion is too large (enlarged to reduce sub-grid mesoscale variability) which helps improve the representation of synoptic cyclone development at the expense of reducing the ageostrophic wind turning angle …

→ It is a problem that the ocean is forced in the wrong direction though

- Other processes poorly represented include 3D turbulence on scales below 500 km and wide-spread wind downbursts in (tropical) moist convection (King et al., 2017)

→ Atmospheric mesoscale variability stirs the ocean and enhances fluxes

→ Adaptive bias correction needed for data assimilation and ocean forcing