# Progress in Ocean Surface Vector Winds

## CGMS Ocean Surface Winds Task Group & IOVWST

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# Current CGMS OSW Task Group

- Ad Stoffelen (KNMI, lead)
- Fangli Du (CMA)
- Jian Shang(CMA)
- Régis Borde(EUMETSAT, **IWWG**)
- Stefanie Linow (EUMETSAT)
- Mark Bourassa (FSU, **IOVWST**)
- Dave Halpern (**IOC**)
- Raj Kumar (ISRO, ret.)
- Ernesto Rodriguez (NASA)
- Svetla Hristova (NASA)
- Paul S Chang (NOAA, **CEOS VC**)
- Juhong Zou (NSOAS)
- Dong Xiaolong (NSSC, **CEOS WGCV MSSG**)
- Steve Wanzong (UW-Madison/SSEC/CIMSS, **IWWG**)
- Heikki Pohjola (**WMO**)

Instruments

- WindRad (CMA)
- HY2-B/C/D (NSOAS)
- ASCAT-A/B/C (EUMETSAT)
- CFOSAT (NSOAS/CNES)
- OceanSat-2/3, ScatSat (ISRO)
- NSCAT, QuikScat, RapidSCAT (NASA)
- ERS-1/2 (ESA)
- WindSat, SSMI, AMSR, MWI
- SAR (ERS, Envisat, S-1, RadarSat, . . . )
- (GNSS-R)
- (Altimeters)

# CGMS-49 Recommendation

- **Establish an Ocean Surface Wind Task Group (OSW TG) in the CGMS International Winds Working Group (IWWG) that coordinates its actions and recommendations with GSICS, CEOS and the IOVWST**

- This implies that OSW TG actions and recommendation will be reported to/from CGMS through established IWWG mechanisms and in addition to CEOS and IOVWST

- Following CGMS-48 WGII A.48.10 and CGMS-48 plenary A.48.10 & 9

- Following informal contacts since 1996

# Motivation / Potential

- Scatterometer winds were introduced and represented at the IWWG meetings since 1996 (Ascona meeting)
- OSW side meetings were held at several IWWG meetings with representatives of the NWP community
- Several topics need further attention beyond CEOS and IOVWST, such as:
  - Intercalibration of wind products for Climate Data Records and operational user convenience
  - An in-situ wind speed reference for high and extreme winds
  - Methods for the elimination of model biases in NWP data assimilation (local VARBC)
  - Improved spatial NWP wind assimilation methods; assimilate unique products
  - QC optimization for NWP, Ku-band rain
  - Open high-level wind services and timeliness of the virtual constellation
  - Open data comparisons and open software to share in the community
  - Exploit scatterometer wind stress measurements for improved atmosphere-ocean coupling
  - Development of coastal winds for all scatterometers
- The OSW TG facilitates an open and shared environment to address above points for the general benefit of the meteorological/ocean community

# Roadmap

- Priorities based on user requirements (IOVWST, IWWG, SAF, ..)
- Recommendations on optimization/exploitation Virtual Constellation (in collaboration with CEOS OSVW-VC)
  - Missions and LST, diurnal cycle, NRCS intercalibration, risk, redundancy, expert community support (link to GSICS and CEOS WGCV MSSG)
  - Data exchange, ground segment, timeliness
  - Comparison studies, wind intercalibration, validation, verification standards (link to GSICS and CEOS WGCV MSSG)
  - Open version-controlled software
  - Mission monitoring, visualization
  - Transparancy in processing, data standards, user guidance, user access
  - Service messages, nowcasting alerts
  - Characterization and comparison of gridded products (L3/L4)
- Radio Frequency Interference (RFI)

# Terms of Reference OSW TG

- OSW included in the IWWG ToR established at CGMS-49
- Operational OSW are, inter alia, obtained by scatterometers, SARs and radiometers
- The CGMS OSW TG 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, timeliness, operations, intercalibration of sensors, processing algorithms, products and their validation, and data transmission standards
- The OSW TG harmonizes to the extent possible satellite mission parameters such as orbits, sensors, data formats and ground segment
- The OSW TG encourages complementarity and compatibility through cooperative mission planning, consolidated 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 OSW TG convenes as subgroup of the bi-annual IWWG, being informed by the IOVWST and CEOS OSVW-VC
- The OSW TG interacts with the CGMS plenary through the IWWG and informs CEOS
- The OSW TG is co-chaired, coordinating the information exchanges, actions and recommendations

# 2023 OSW TG key issues of relevance to CGMS:

- ESA MAXSS project on wind extremes made good progress providing consistent satellite extreme wind speeds among the different instruments and producer inputs, though uncertainty in in-situ wind speed references is high (Stoffelen et al., 2021);
- WMO International Workshop on Tropical Cyclones (IWTC-10) recommended an operational framework to ensure timely and valuable high-resolution SAR acquisitions of TCs;
- Progress in the commissioning and servicing of scatterometer winds, notably for the NSOAS HY2 series, CMA WindRad, the CFOSAT scatterometer and in preparations for ISRO's Oceansat-3, following OSW TG goals. Today, 7 scatterometers are operated in orbit. Of particular concern remains the uptake of scatterometer winds in NWP systems, due to lack of resources at NWP centers. A correction of geographical OSW model biases in the data assimilation procedure will be needed for an effective use of the virtual constellation of scatterometers that is now available, with potentially large beneficial impact on the NWP forecast quality (~2% per scatterometer? ).
- Model biases in OSW, curl and divergence, limit realistic air-sea coupling in models and effective data assimilation

# Context OSW TG

- WMO
- WMO OSCAR data base
- WIGOS 2040
- CGMS IWWG, in particular the new ToR
- GSICS
- CEOS
- CEOS OSW-VC and CEOS WGCV MSSG
- IOVWST
- IOC

➢ See following slides

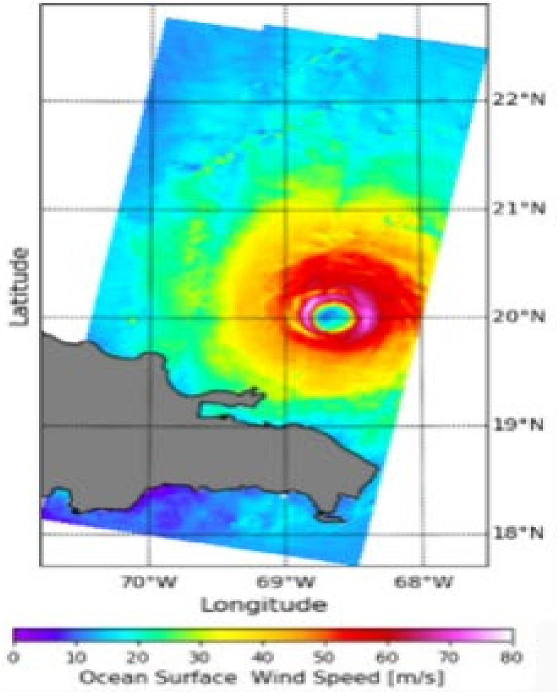
➢ Discussion on how to contribute to shared community assets will be useful

# OSV TG representations

- Virtual International Ocean Vector Winds Science Team in 2023
- Reference-quality emission and backscatter modelling for the ocean (ISSI)
  - Bring emission and backscatter modelling together
- Survey Geophysics (2023): Satellite Remote Sensing of Surface Winds, Waves, and Currents: Where are we Now? Chapter under the guidance of Daniele Hauser
- WMO 10th Int. Workshop Tropical Cyclones (IWTC-10)
- SeaSAR 2023
  - Addressing links between SAR and scatterometry
- IWW16
  - Providing IWWG recommendations to the CGMS

# The SAR way to CYMS: from R&D towards an operational service

1km Winds from Sentinel-1 over Irma on 2017/09/07




**2016** — SEOM Program

**1st SHOC Campaign:** building TC archive, analyzing R&D

**2017**

**1st high wind processing chain** used for S& over the past acquisitions (e.g. Irma, José, Maria major TCs)

**2018** — R&D

**Very active global SHOC Campaign**

- Massive SAR database of TC obs.
- Consolidated « service chain »

**2019**

**CYMS preparation**

**Consolidation**

**2020** — CYMS

**Operational demonstration + extension to European extreme winds in 2021**

➢ Plan to be taken up in the Copernicus Marine Service Wind TAC

CYMS with Sentinel-1 · CLS · Ifremer · Norwegian Meteorological Institute · esa · copernicus

# SAR and scatterometer

SAR

- Shows details of processes, in particular extremes, coastal and air-sea interaction, useful for scatterometer understanding
- Cannot capture the temporal variability of the atmosphere due to sparse sampling
- Are poorly calibrated with respect to scatterometers and with larger wind errors
- Different producers generate wind products with different characteristics

Scatterometers

- Scatterometers show much more details of mesoscale weather processes than global NWP models do
- The virtual international constellation of Chinese, European and Indian wind scatterometers can capture the temporal variability of the atmosphere on a sub-daily scale
- Scatterometers are generally very stable and well calibrated; NRCS and wind errors are well known and low as compared to in-situ data and model data
- The same empirical GMFs are used for different instruments (also for SAR)
- Very similar retrieval is used for different instruments

The CGMS Ocean Surface Winds Task Group is tasked to standardize wind products for users

# Working thesis at the IWW16

Wind extremes calibration

- To what in-situ winds would you tune your model (drag)?
- Any need for a consolidated physical in-situ reference?

Encouragement and support for the effective use of the constellation

- Are you ready to exploit the constellation?
- How do you correct large geographical model biases?
- What is needed for ocean coupling and earth system dynamics?
- What support would be needed (manpower, data, open tools, advice)?

Operational framework high-resolution SAR acquisitions of Tropical Cyclones

- Need for coastal winds (wind farming, civil protection, ocean forcing . . .)

Any other OSW needs, observations, . . .

OSW priorities?

# To be considered by CGMS from OSW TG

- For improved satellite wind speed calibration, collaboration on WMO level with in-situ experts and with dropsonde providers is recommended in order to better comprehend in-situ measurement data and their accuracy in extreme conditions, which is of large societal relevance;
- Encouragement and support from satellite agencies would accelerate the effective use of the OSW that they produce in NWP with potentially large effect on forecast quality of the extending virtual scatterometer constellation;
- To define an official international operational framework to ensure timely and valuable high-resolution SAR acquisitions of Tropical Cyclones (cf. WMO IWTC-10).

# F2F IOVWST

- Overview of the constellation
- Combining scatterometers to improve (inter)calibration and QC
- Improvements in spatial processing at extremes, coastal
- Scatterometer data assimilation
- Ocean forcing using scatterometers
- Novel missions and science

WORLD METEOROLOGICAL ORGANIZATION
Weather · Climate · Water

# public.wmo.int

English



## Focus areas

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

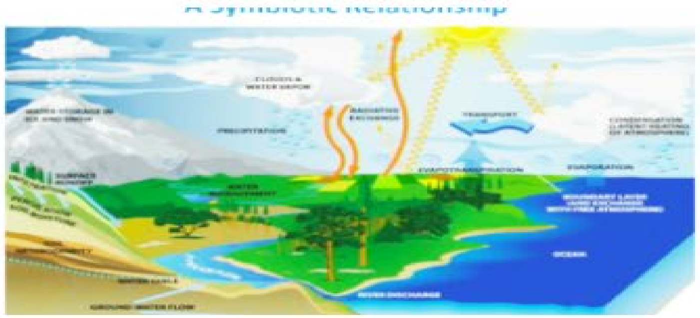
Within its mandate in the areas of weather, climate and water, WMO focuses on many different aspects and issues from observations, information exchange and research to weather forecasts and early warnings, from capacity development and monitoring of greenhouse gases to application services and much,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

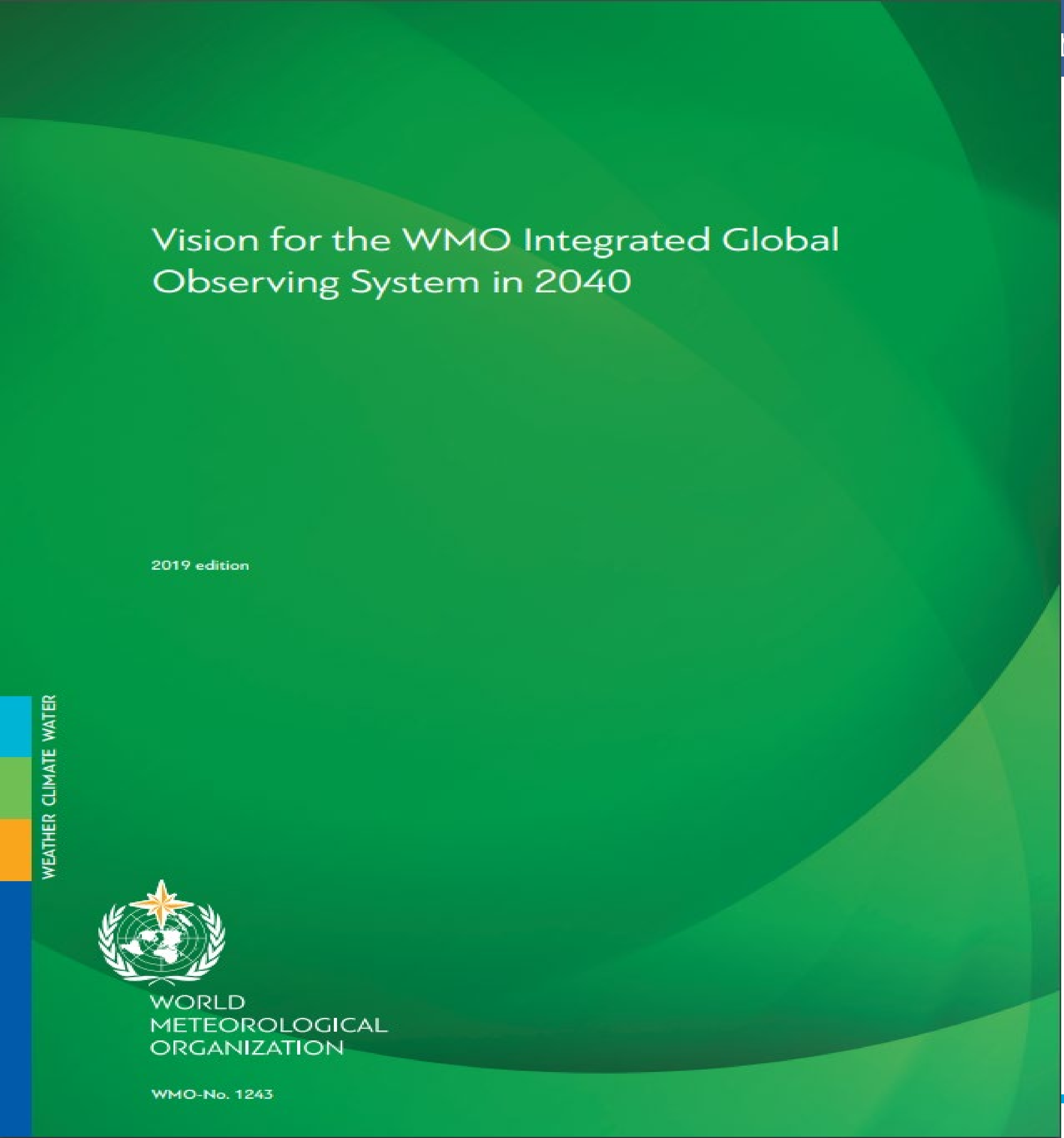
- OSW for hazards, water, ocean

### Weather

### Climate

### Water








# WIGOS 2040

community.wmo.int/vision2040



- Links to OSW user requirements in all WMO application areas and WIGOS integrated capabilities

Add CGMS agency logo here (in the slide master)

CGMS

# 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

- Bring and exploit 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<br>1.7 m/s<br>5 m/s | | 25 km<br>39.7 km<br>100 km | | 12 h<br>15 h<br>24 h | 30 d<br>38 d<br>60 d | Global ocean | reasonable | 1998-10-29 | WCRP |
| 321 | Wind vector (near surface) | Near Surface | Global NWP | 0.5 m/s<br>2 m/s<br>3 m/s | | 15 km<br>100 km<br>250 km | | 60 min<br>6 h<br>12 h | 6 min<br>30 min<br>6 h | Global ocean | firm | 2009-02-10 | John Eyre |
| 391 | Wind vector (near surface) | Near Surface | High Res NWP | 0.5 m/s<br>1.077 m/s<br>5 m/s | | 2 km<br>10 km<br>40 km | | 30 min<br>60 min<br>3 h | 15 min<br>30 min<br>2 h | Global land | firm | 2011-02-01 | T Montmerle |
| 546 | Wind vector (near surface) | Near Surface | Ocean Applications | 0.5 m/s<br>2 m/s<br>5 m/s | | 5 km<br>10 km<br>60 km | 10 | 6 min<br>3 h<br>24 h | 5 min<br>60 min<br>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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## 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.

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## 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

>

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## 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.

# Coordination Group for Meteorological Satellites - CGMS

# INTERNATIONAL WINDS WORKING GROUP

International Winds Working Group

| HOME | ABOUT US | INFORMATION (wiki) | ACTIVITIES (wiki) | WORKSHOPS | LINKS | CONTACT US |
|---|---|---|---|---|---|---|

## 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

**16th INTERNATIONAL WINDS WORKSHOP**
May 8 - 12, 2023 - Hosted by Environment and Climate Change Canada
Montreal, Quebec, Canada

### Latest News

For older news items see the **news archive**

**Sep 2023:** 2023 Operational AMV Production Survey

**Apr 2023:** 10th NWP SAF AMV monitoring report released by the Met Office

**Jan 2023:** 4th AMV Intercomparison Results

**Apr 2022:** Recommendations for AMV Configuration

**Apr 2021:** Terms of Reference for the IWWG

**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 07 Sep 2023

# CGMS and ocean surface **winds**

- Define WMO OSCAR user requirements and contribute capabilities
  - Temporal coverage high priority
  - Timeliness for nowcasting and NWP needs improvement
  - Contribute user requirement and capability assessments for WMO applications
- CGMS
  - Support satellite agency efforts in CEOS OSVW-VC and in addition:
  - Calibration, e.g., wind speed reference determination for user consistency of products, particularly at high and extreme winds, e.g., CHEFS
  - Processing, e.g., open software, version control
  - Validation, verification, product comparison
  - Standardization of service (formats, metadata, quality monitoring / NRT assessment)
  - User dissemination / training / guidance
  - Link mission planning and redundancy to WMO OSCAR
- Carry out actions and make recommendations
- Inform, report and feedback
- Coordination IOVWST,CEOS, IWWG, CGMS, GSICS

# 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 | 1989 |
| CNES | Centre National d'Etudes Spatiales | 2004 |
| CNSA | China National Space Administration | 2006 |
| ESA | The European Space Agency | 2003 |
| EUMETSAT | EUMETSAT | 1987 |
| IMD | India Meteorological Department | 1979 |
| IOC-UNESCO | Intergovernmental Oceanographic Commission - UNESCO | 2001 |
| ISRO | Indian Space Research Organisation | 2015 |
| JAXA | Japan Aerospace Exploration Agency | 2003 |
| JMA | Japan Meteorological Agency | 1972 |
| KMA | Korea Meteorological Administration | 2005 |
| NASA | National Aeronautics and Space Administration | 2003 |
| NOAA | National Oceanic and Atmospheric Administration | 1972 |
| ROSCOSMOS | Russian Federal Space Agency | 2003 |
| ROSHYDROMET | Russian Federal Service for Hydrometeorology and Environmental Monitoring | 1973 |
| WMO | World Meteorological Organization | 1973 |

## Observers

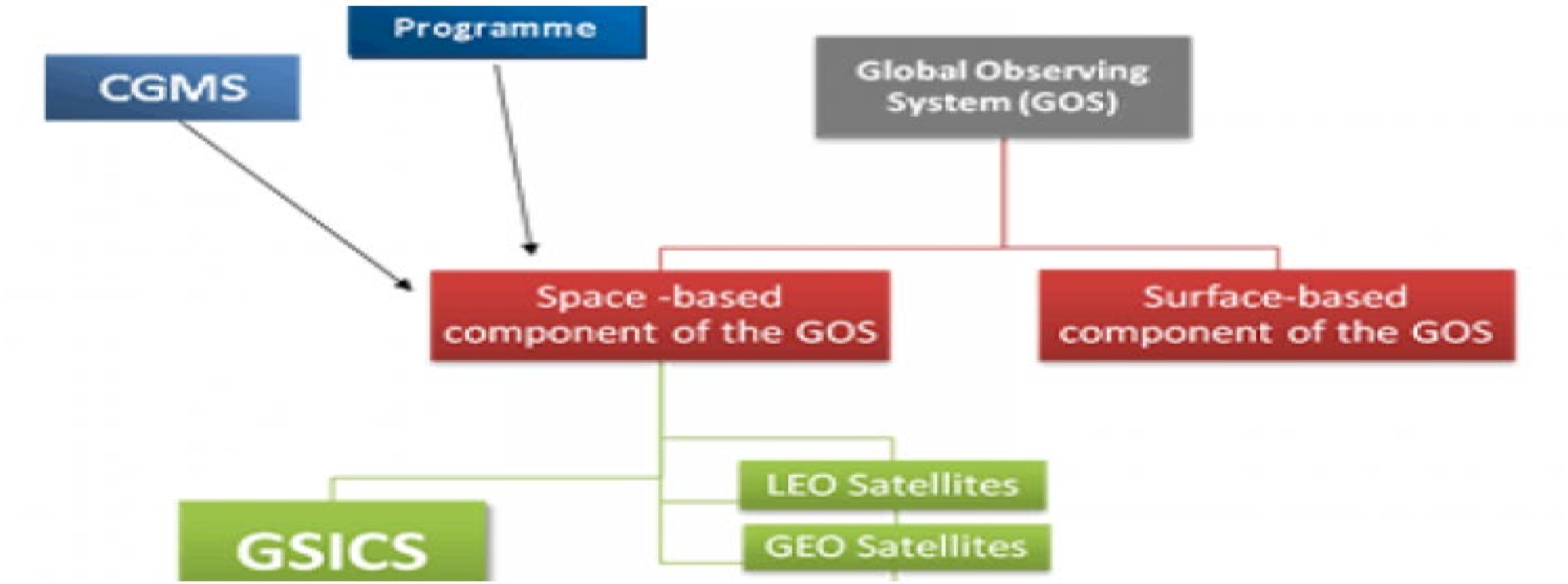
| | |
|---|---|
| CSA | Canada Space Agency |
| ENV CAN | Environment Canada |
| GCOS | Global Climate Observing System |
| KARI | Korea Aerospace Research Institute |
| KIOST | Korea Ocean Research & Development Institute |
| SOA | State Oceanic Administration (National Satellite Ocean Application Service,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

**Global Space-based Inter-Calibration System**

An international collaboration to monitor, improve and harmonize data quality from operational environmental satellites for climate monitoring and weather forecasting.

Home | Objectives | Members | Structure | Focal Points | Links

gsics.wmo.int/en/welcome




Global Space-based Inter-Calibration Sytem (GSICS) is an international collaborative effort initiated in 2005 by the World Meteorological Organization (WMO) and the Coordination Group for Meteorological Satellites (CGMS) to 1-monitor, 2-improve and 3-harmonize the quality of observations from operational weather and environmental satellites of the Global Observing System (GOS).
GSICS aims at ensuring consistent accuracy among space-based observations worldwide for climate monitoring, weather forecasting, and environmental applications.

This is achieved through a comprehensive calibration strategy which involves:

- monitoring instrument performances,
- operational inter-calibration of satellite instruments,
- tying the measurements to absolute references and standards, and
- recalibration of archived data

- Consistent accuracy needs consolidation among providers / producers
- This is achieved through sharing of resources
  - Satellite L1 data
  - Monitoring
  - Open software
  - Comparison studies
  - In-situ references
  - Intercalibration
  - Reprocessing
- Partly covered by CEOS WGCV MSSG

CEOS Committee on Earth Observation Satellites

ceos.org/ourwork/virtual-constellations/osvw/

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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


- Link to CGMS, WIGOS, OSCAR, IWWG, in-situ references, RFI, ..

*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 .

# WGCV Microwave Subgroup & GSICS/GRWG Microwave Subgroup Meeting

**Event Dates:** July 6th - 7th, 2016

The Working Group on Calibration & Validation (WGCV) Microwave Subgroup & Global Space-based Inter-Calibration System (GSICS) & GSICS Research Working Group (GRWG) Microwave Subgroup Meeting

Location: Beijing, China

Hosted by: The Chinese Academy of Sciences

Contact: Professor Xiaolong Dong

- Covers NRCS intercalibration
- Link to and coordinate with OSW WG and GSICS to extend NRCS intercalibration of CEOS WGCV MSSG to winds

COAPS

# Center for Ocean-Atmospheric Prediction Studies

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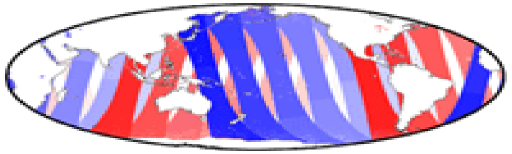


SCATTEROMETRY & OCEAN VECTOR WINDS
Satellite Studies

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

Home | Announcement | Agenda | Contacts | Location and Lodging | Sponsors | Past Meetings
Abstract Submission | Edit Information | List of Attendees | Logout | Registration

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.

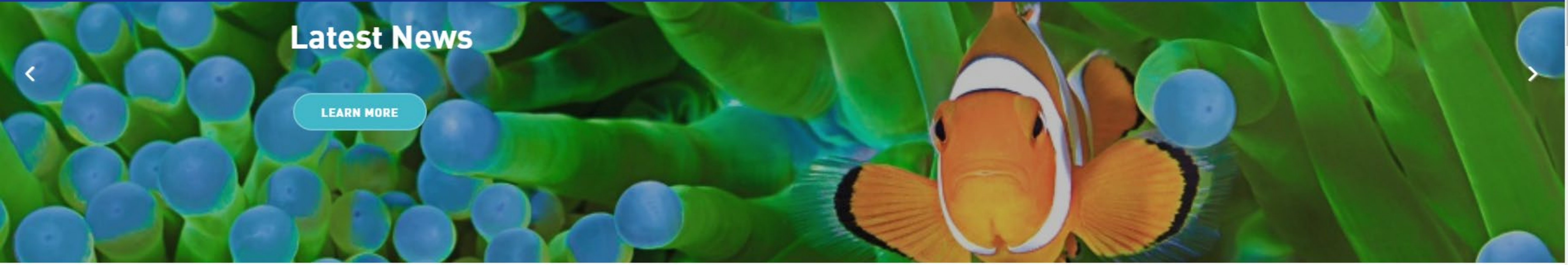
**Deadlines:**

**Abstract deadline:** January 23

**Registration deadline:** February 19

**Presentation deadline:** February 19

- Covers retrieval methods and ocean and climate applications
- Link to and coordinate with OSW WG for other application areas and data standards

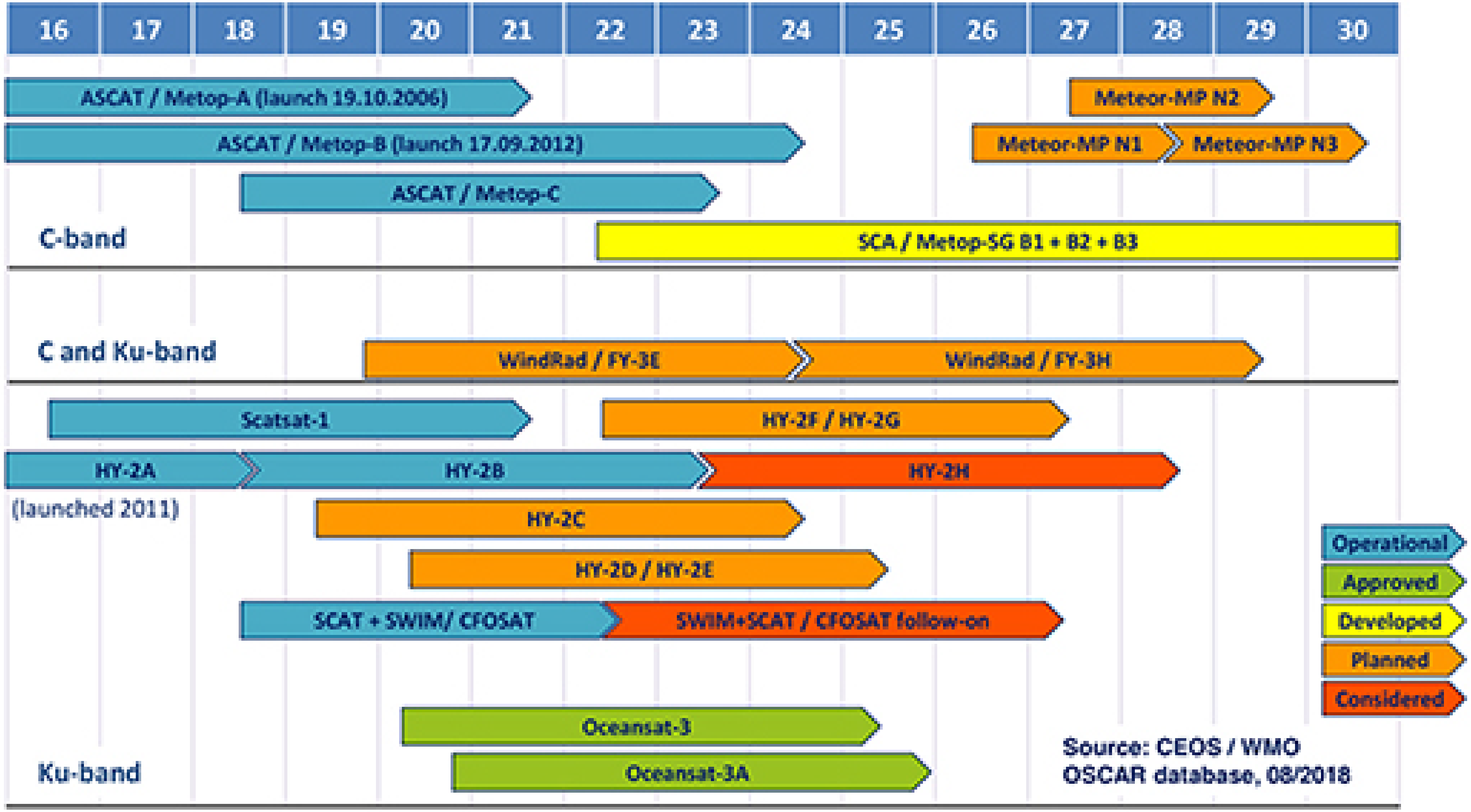



# Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO)

The Intergovernmental Oceanographic Commission of UNESCO (IOC) is the United Nations body responsible for supporting global ocean science and services. The IOC enables its 150 Member States to work together to protect the health of our shared ocean by coordinating programmes in areas such as ocean observations, tsunami warnings and marine spatial planning. Since it was established in 1960, the IOC has provided a focus for all other United Nations bodies that are working to understand and improve the management of our oceans, coasts and marine ecosystems. Today, the IOC is supporting all its Member States to build their scientific and institutional capacity in order to achieve the global goals including the UN Agenda 2030 and its Sustainable Development Goals, the Paris Agreement on Climate Change and the Sendai Framework on Disaster Risk Reduction.

# BACKGROUND INFORMATION

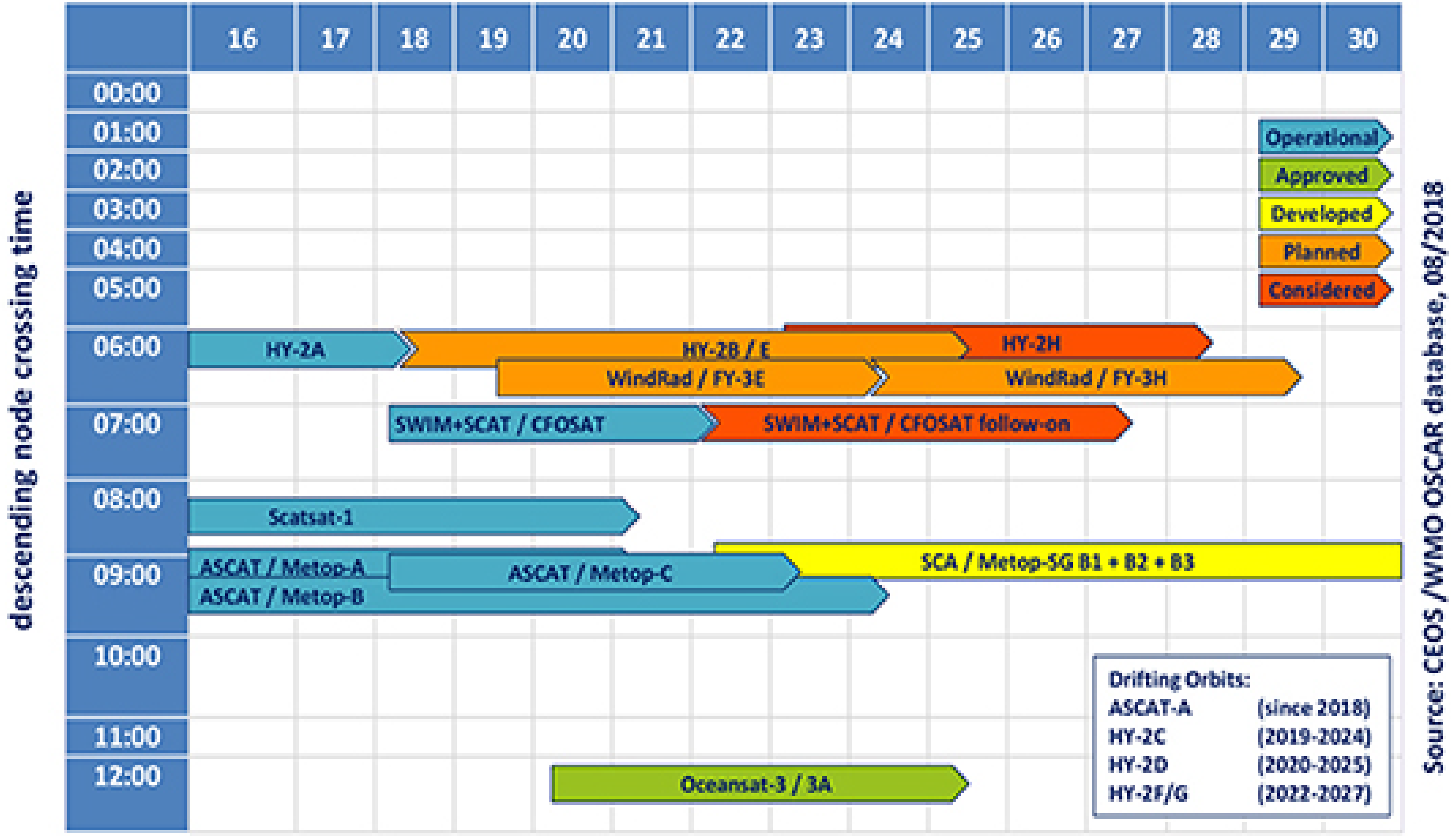
# VIRTUAL CONSTELLATION




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




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

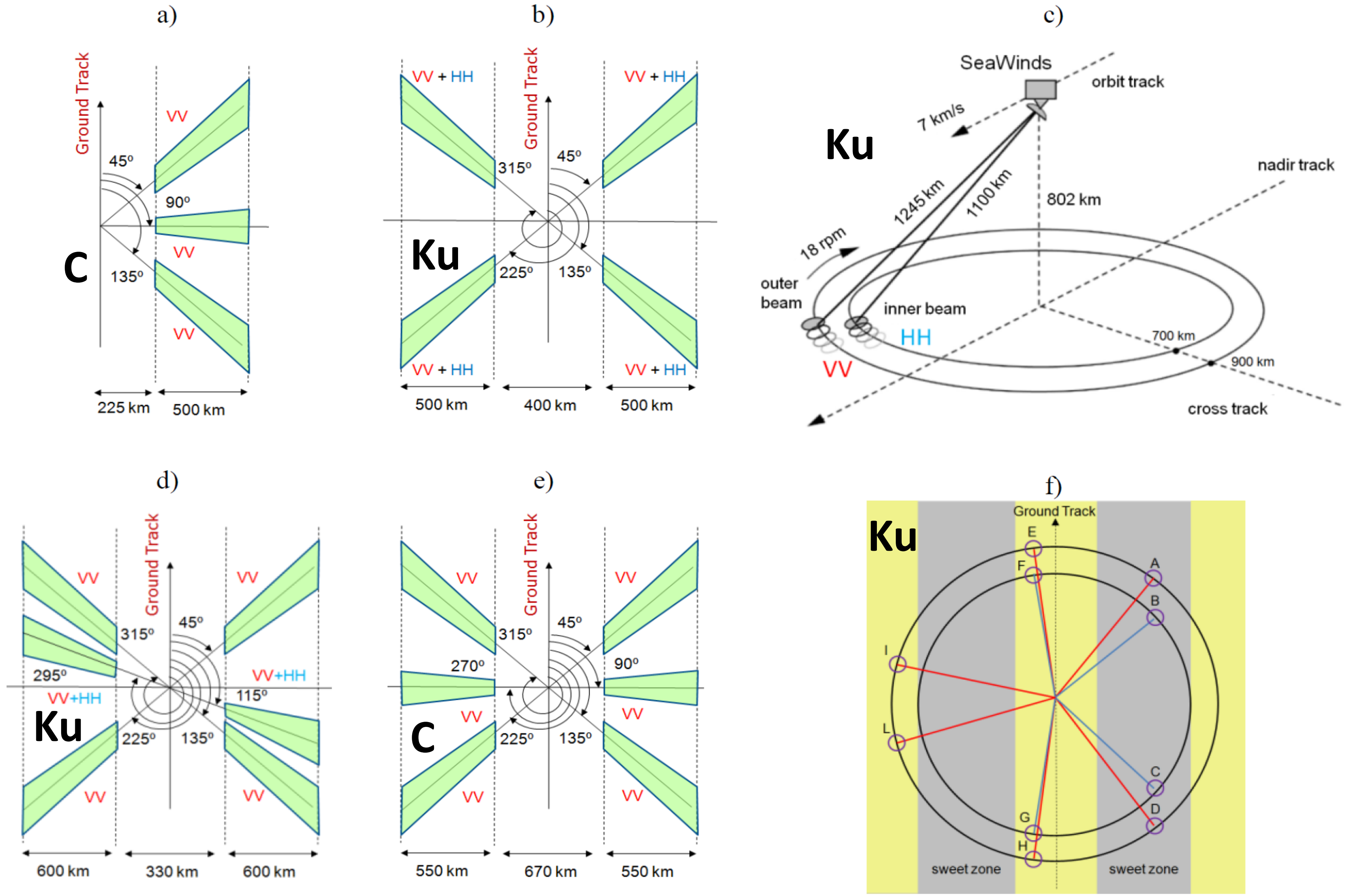



Fig. 1.4 *Sketch of the microwave illumination patterns of: a) AMI (ERS-1/2); b) SASS (SeaSat-A); c) and f) SeaWinds, Oceansat-2 SCAT and HY-2A; d) NSCAT; e) MetOp ASCAT-A and B. The case a), b), d) and e) correspond to a fan beam geometry whereas c) and f) correspond to a pencil beam geometry.*

**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 $\rho_{air}$ , 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, $\boldsymbol{u}_{10N}$ , depend only on $\boldsymbol{u}_*$ , surface roughness and the presence of ocean currents and is currently used for backscatter geophysical model functions (GMFs)

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

# Inconsistencies in wind references

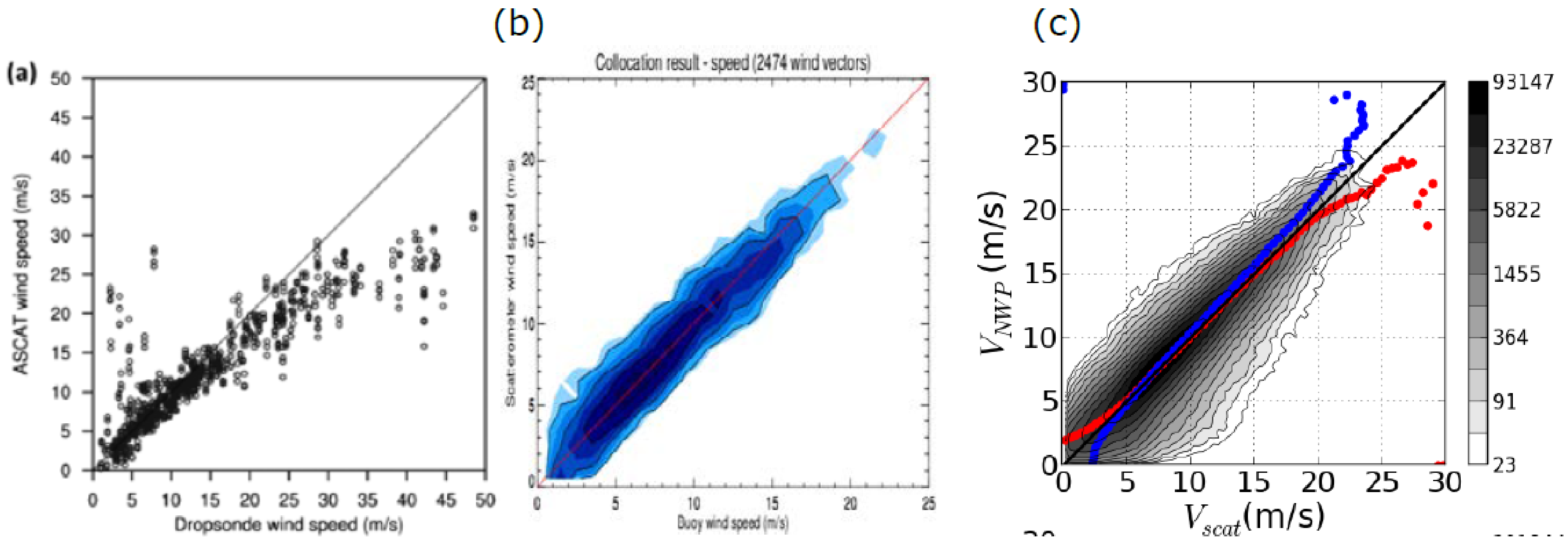
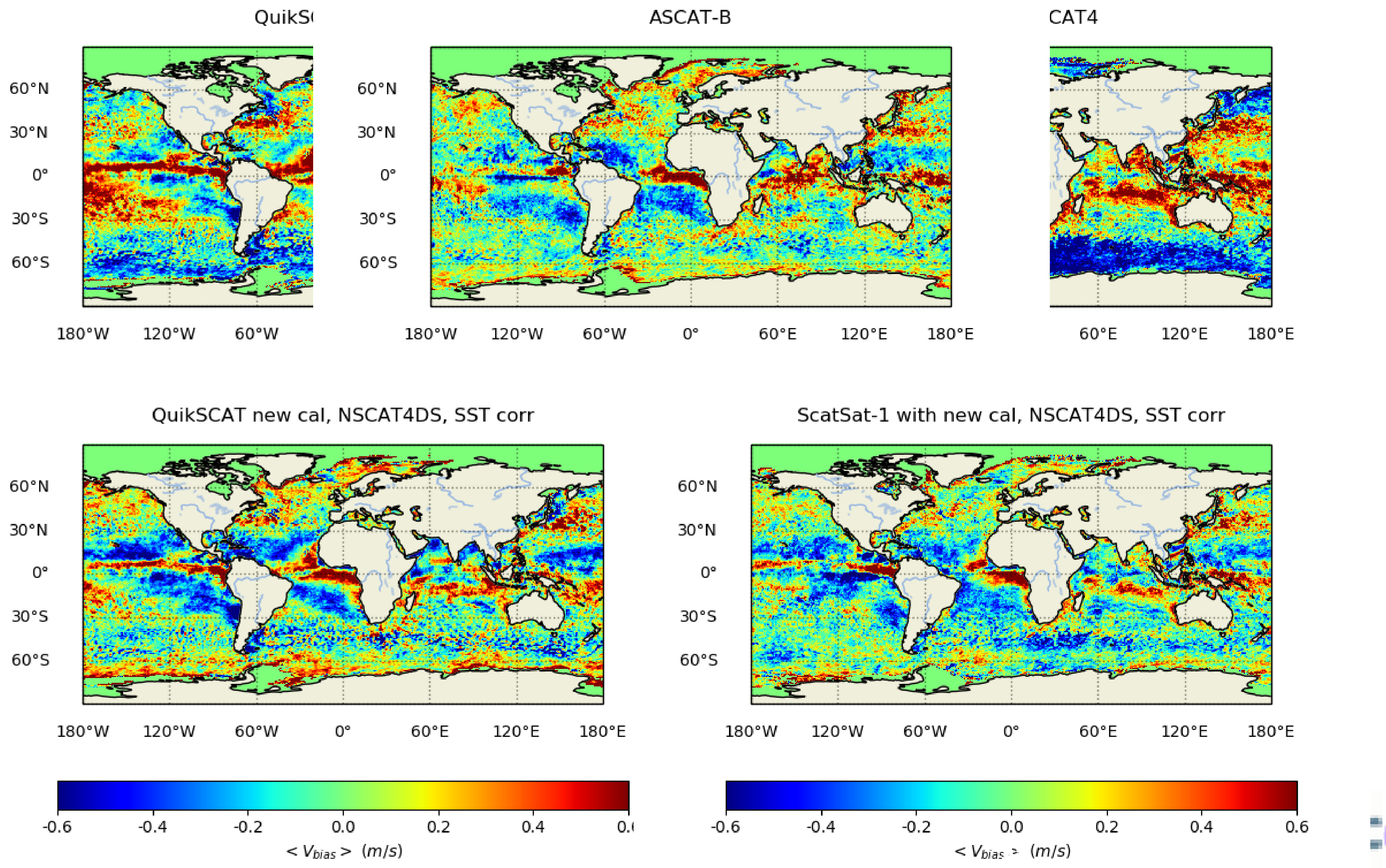



***Figure 3.3: ASCAT wind speed scatter plots of a) ASCAT versus drop sondes (from [37]), b) ASCAT versus moored buoy winds and c) ECMWF NWP winds versus ASCAT. Using drop sondes, moored buoy winds and NWP references above 15 m/s may result in discrepancies due to height and position reprepresentation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



# Coupling 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., 2022)

→ Atmospheric mesoscale variability stirs the ocean and enhances fluxes

→ Adaptive bias correction needed for data assimilation and ocean forcing