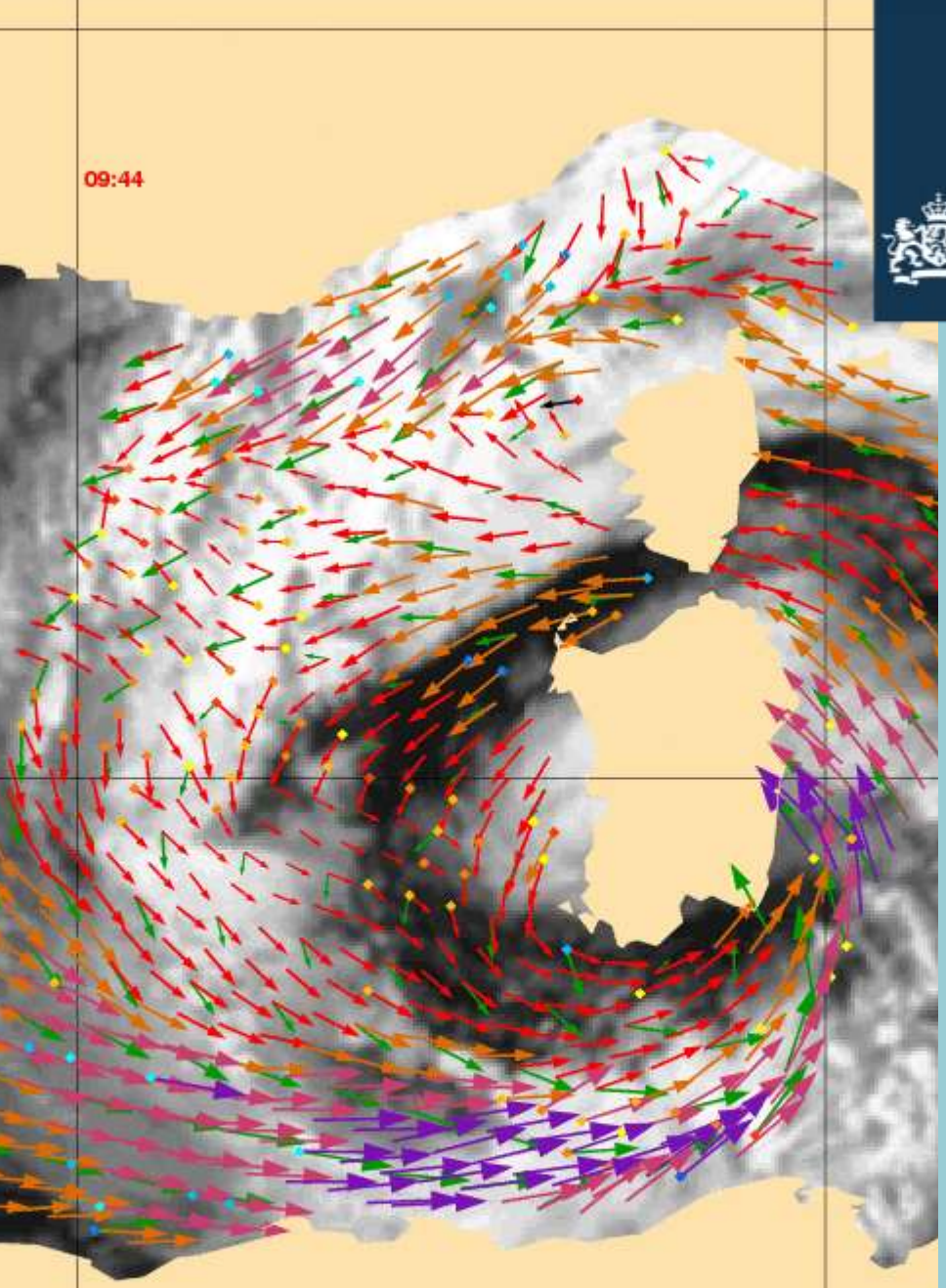


Royal Netherlands
Meteorological Institute
Ministry of Infrastructure and the Environment

Scatterometer Winds for NRT Support to Mesoscale Forecasting

Ad.Stoffelen@knmi.nl

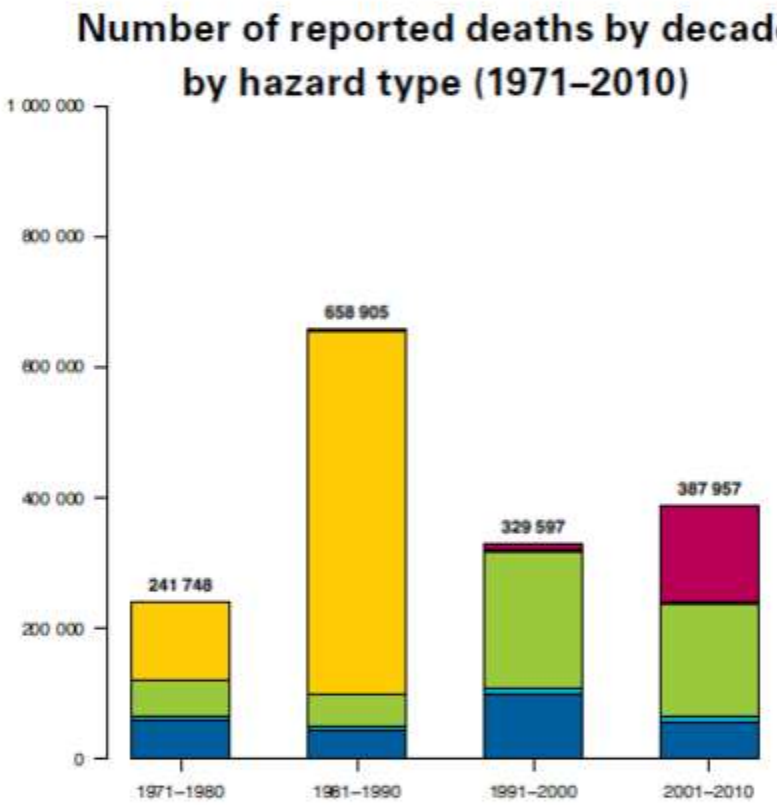
Leader Active Remote Sensing Group
Satellite Observations, KNMI

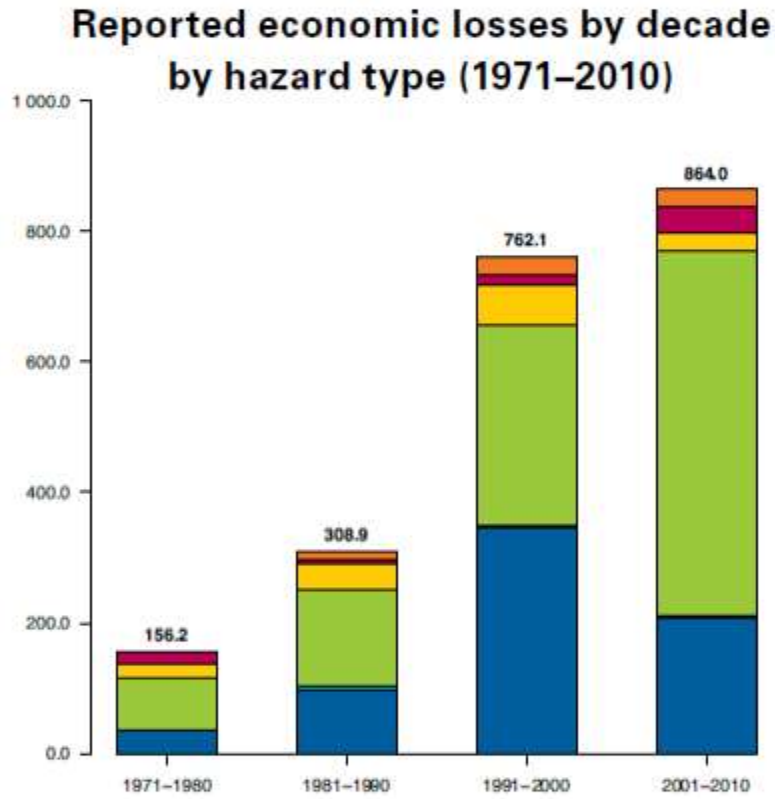
EUMETSAT OSI SAF
EU Copernicus Marine Core Services
EUMETSAT NWP SAF

Scatterometer Winds for NRT Support to Mesoscale Forecasting

- Introduction
- Scatterometer wind observations
- NWP model winds
- Mesoscale forecasting

Deaths and economic losses by hydrometeorological hazards



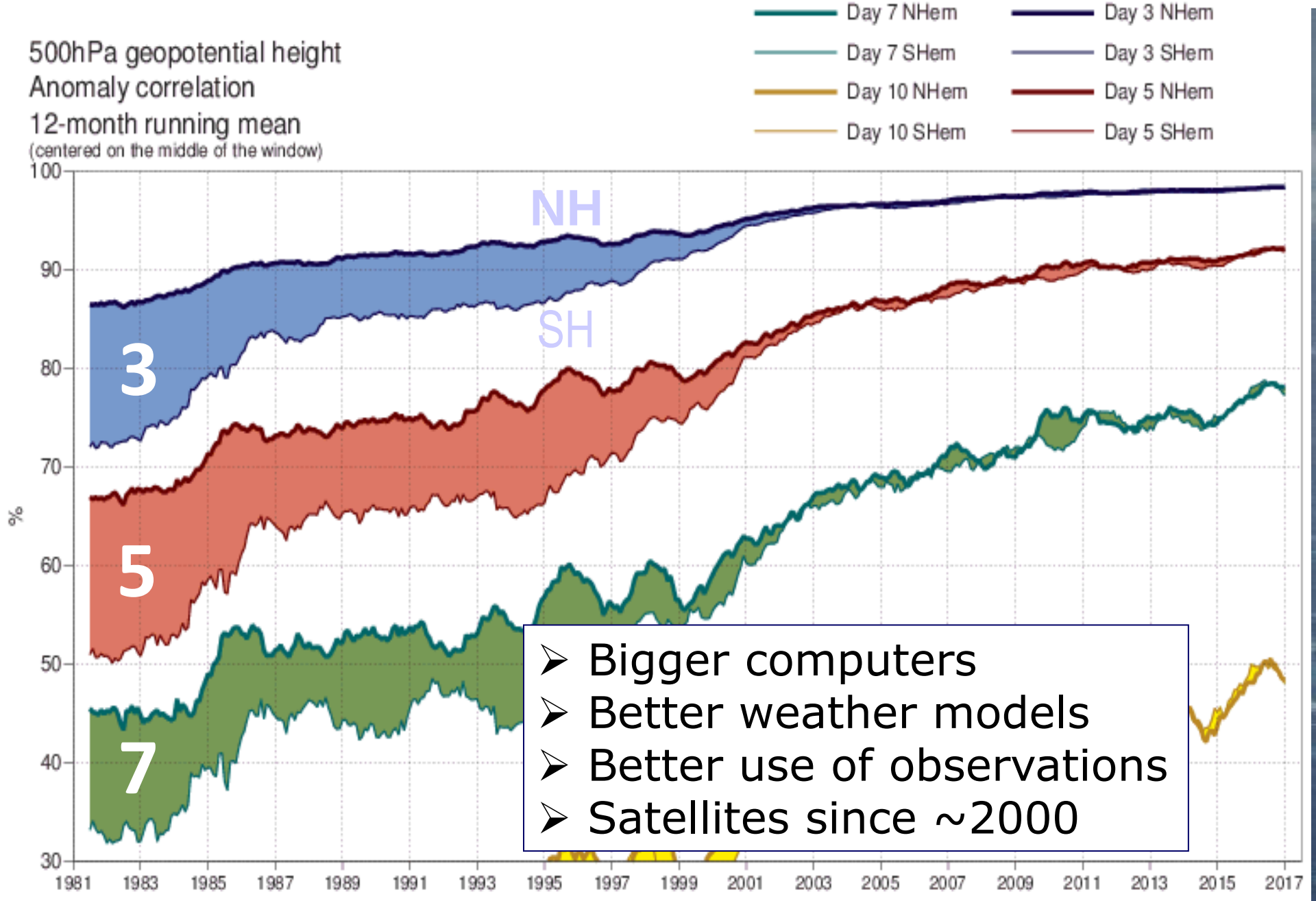


(in US$ billion, adjusted to 2012)

Floods | Mass movement wet | Storms | Droughts | Extreme temperature | Wildfires

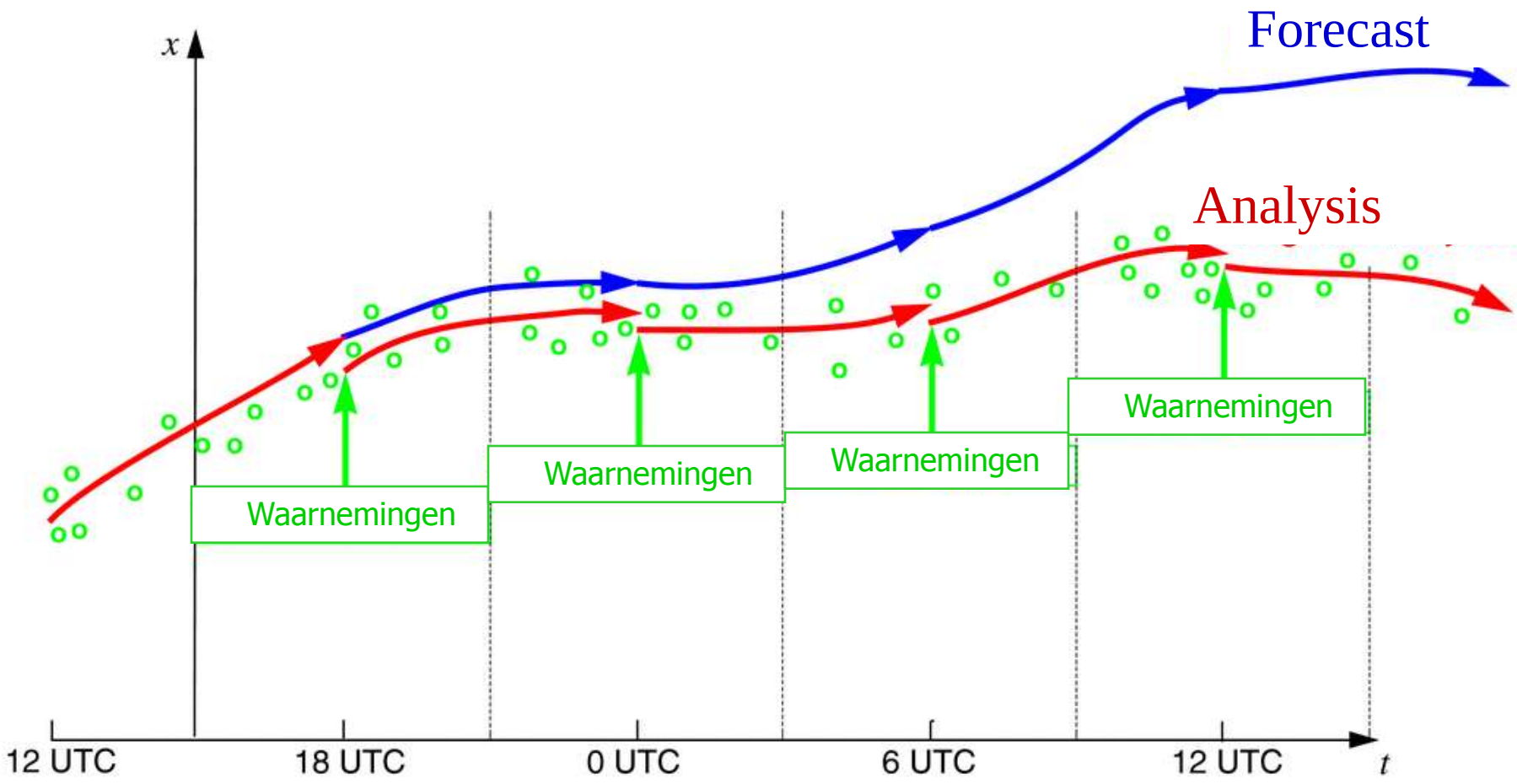
WMO-CRED-UCL 2014

Weather Forecasts keep improving



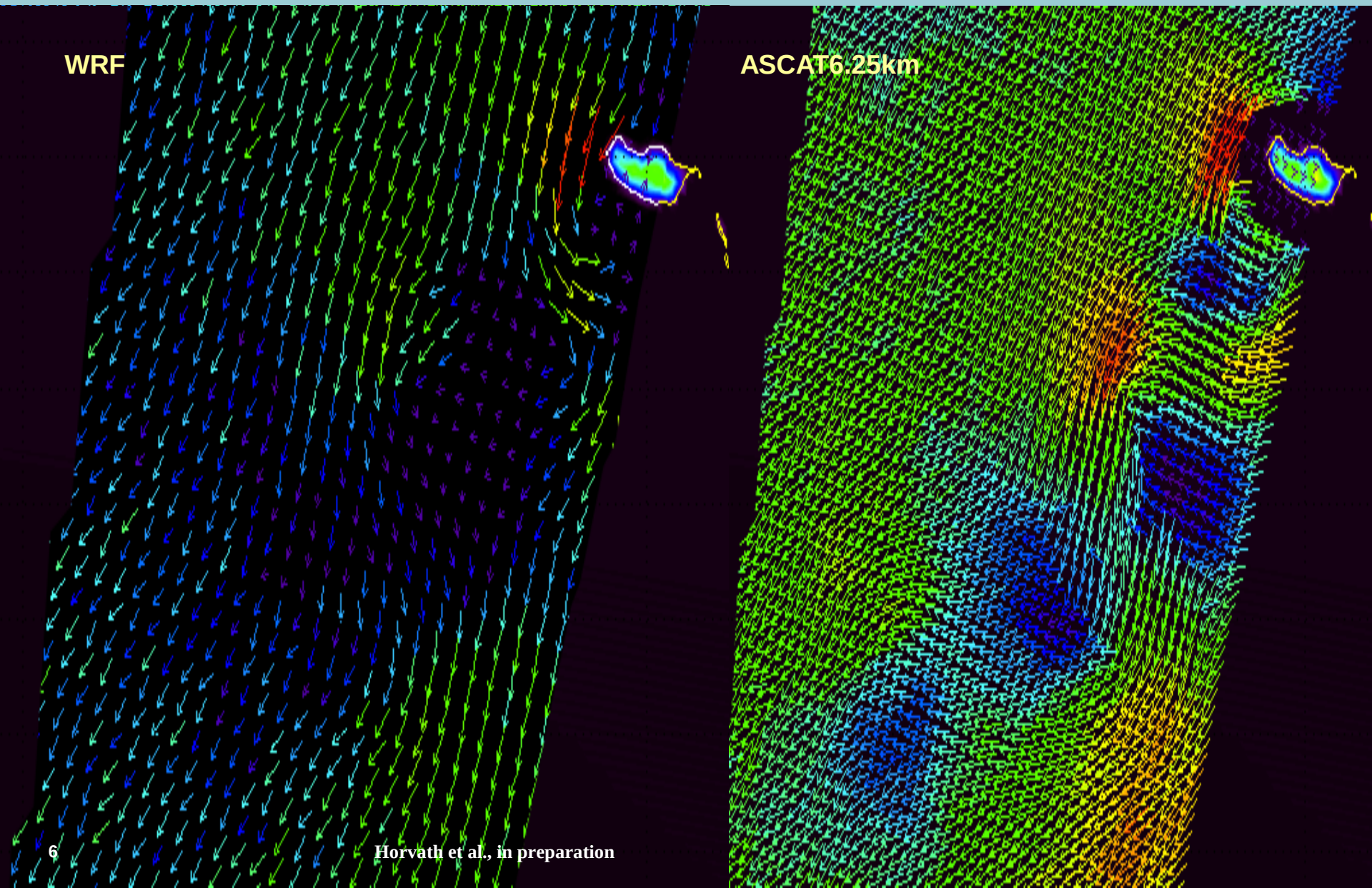
- Bigger computers
- Better weather models
- Better use of observations
- Satellites since ~2000

Observations lead weather models

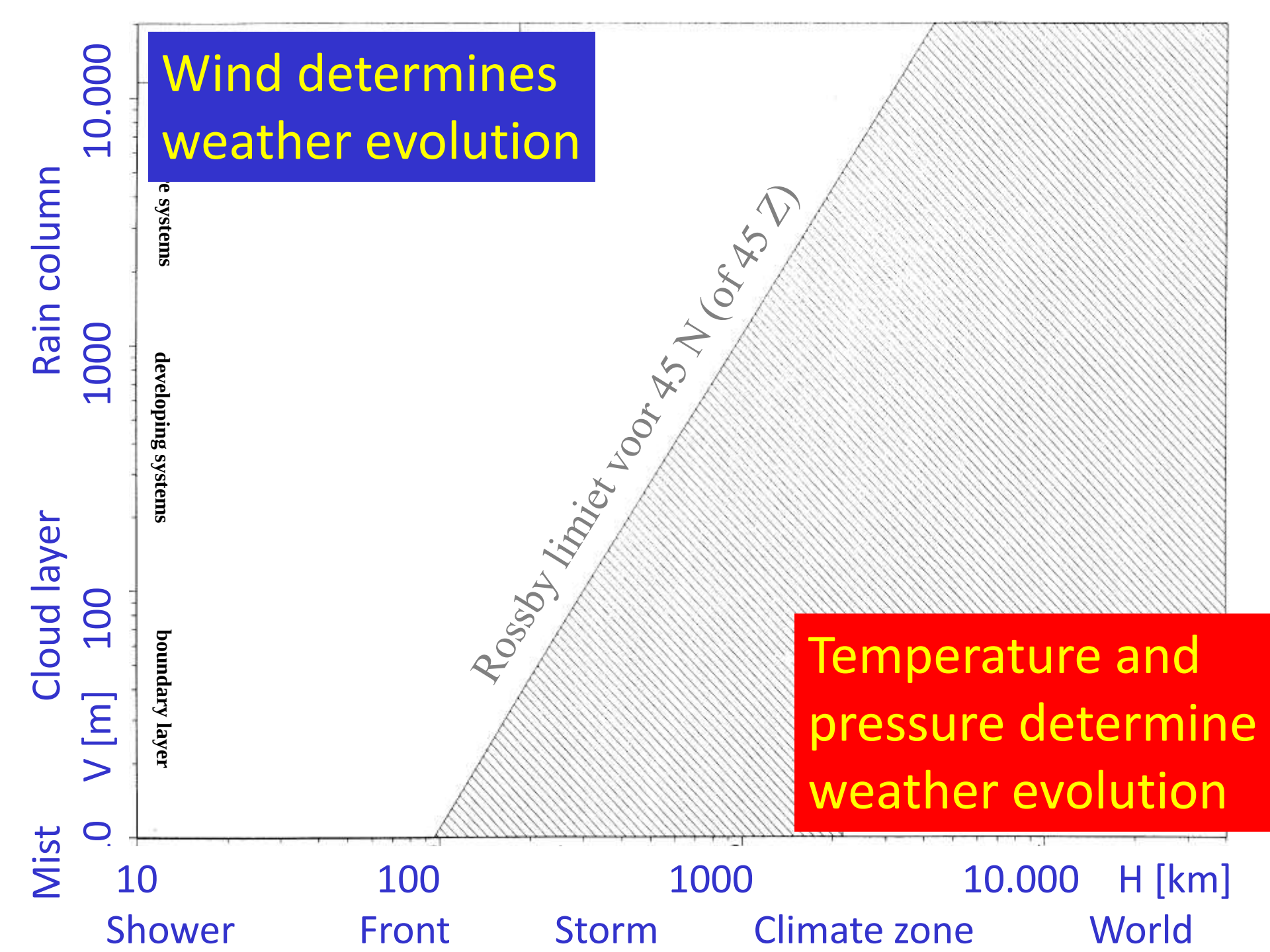


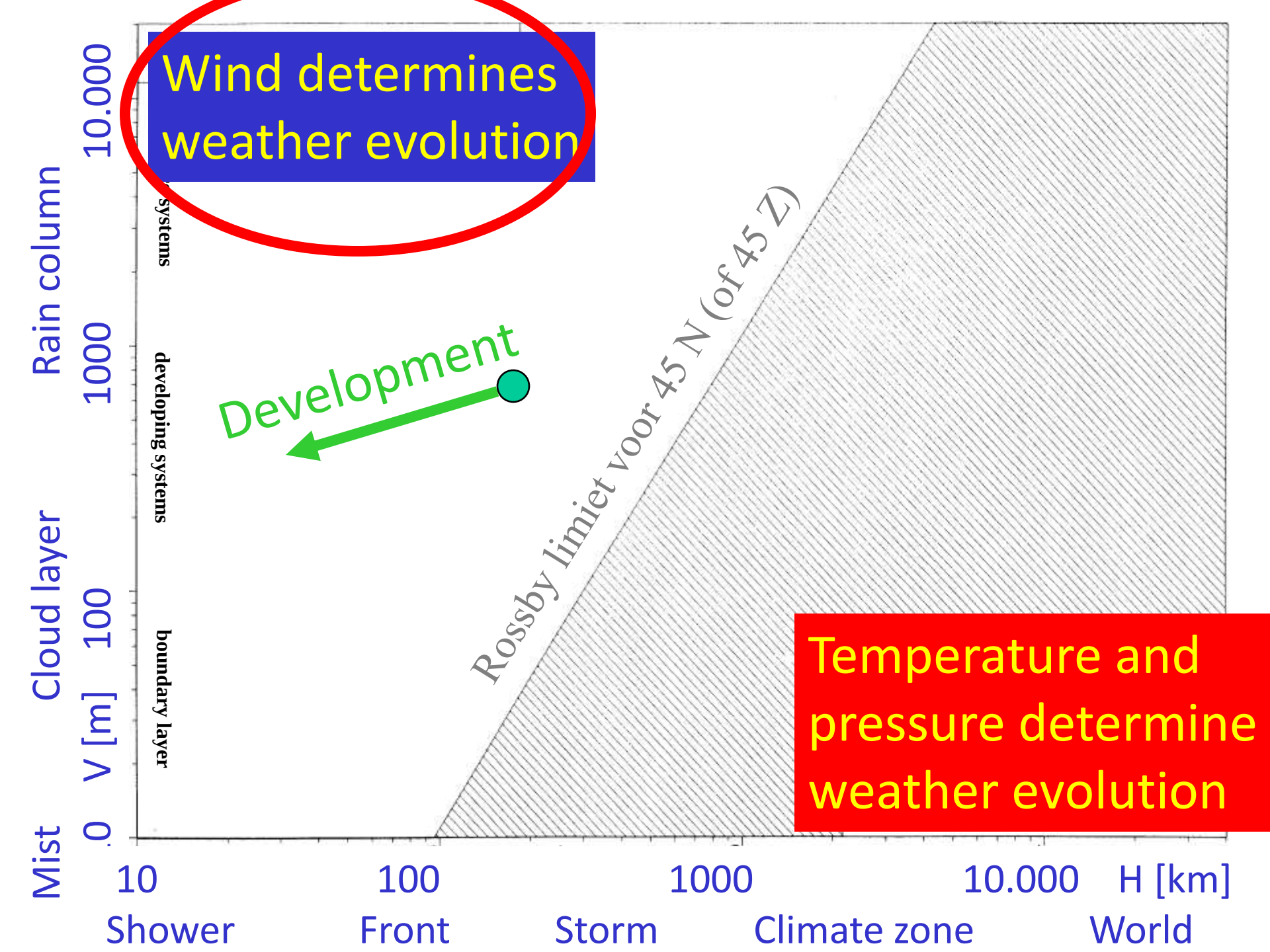
- New observations become available continuously

Observations and Models



Horvath et al., in preparation


Wind determines weather evolution
Temperature and pressure determine weather evolution
Rossby limiet voor 45 N (of 45 Z)
e systems
developing systems
boundary layer
Mist
Cloud layer
Rain column
0
V [m]
100
1000
10.000
10
100
1000
10.000
H [km]
Shower
Front
Storm
Climate zone
World


Wind determines weather evolution
Development
Rossby limiet voor 45 N (of 45 Z)
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Temperature and pressure determine weather evolution
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0
V [m]
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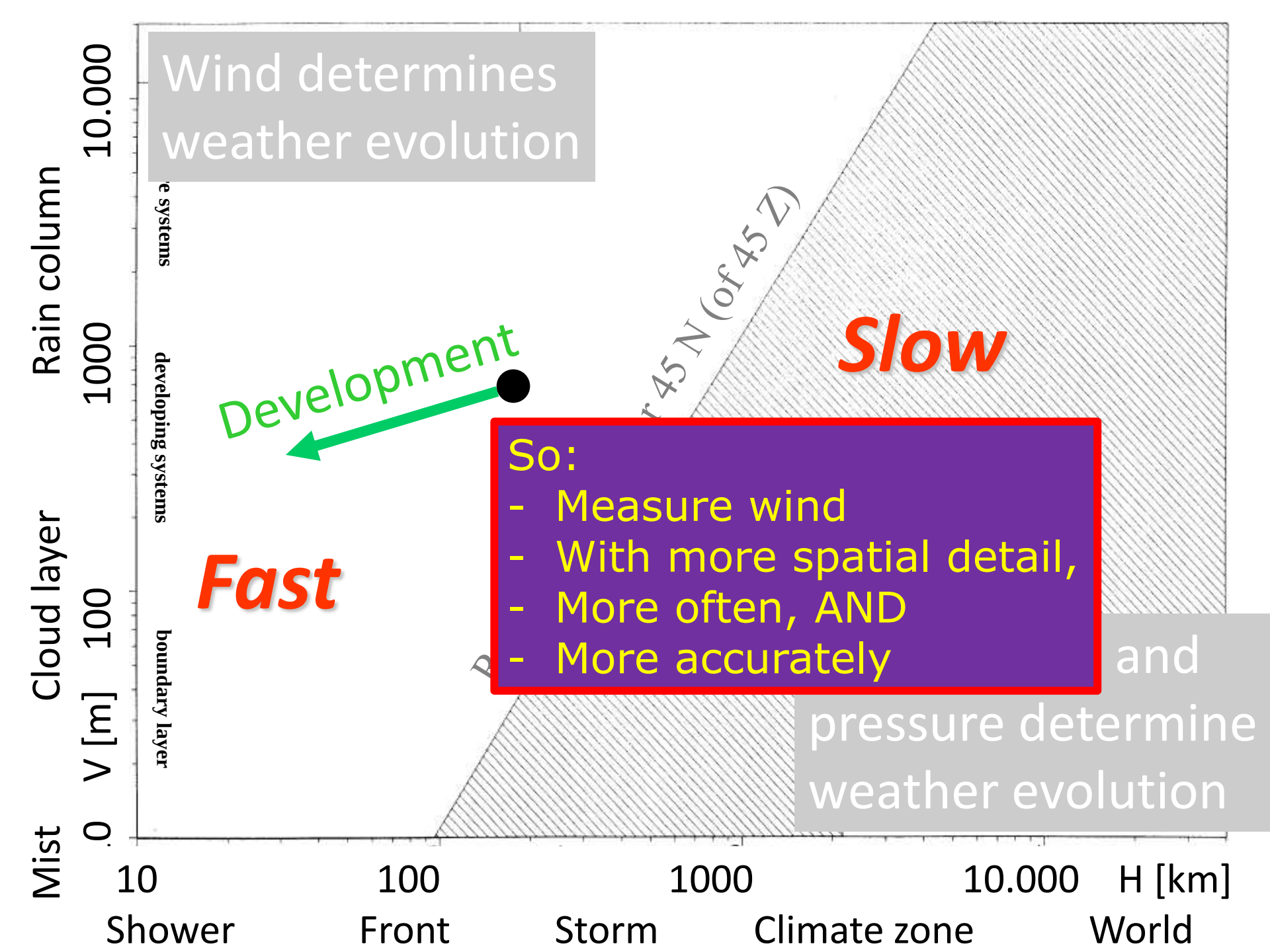
H [km]
Shower
Front
Storm
Climate zone
World


Wind determines weather evolution
Development
Slow
Fast
So:
- Measure wind
- With more spatial detail,
- More often, AND
- More accurately
and pressure determine weather evolution
Rain column
Cloud layer
Mist
10.000
1000
100
0
V [m]
10
100
1000
10.000
H [km]
Shower
Front
Storm
Climate zone
World
developing systems
boundary layer

Definition

Full name	Wind speed over the surface (horizontal)		
Definition	Module of the horizontal component of the 3D wind vector.		
Measuring Units	m/s	**Uncertainty Units**	m/s
Horizontal Res Units	km	**Vertical Res Units**	
Stability Units	m/s (Stability /decade)		

Comment:	
Last modified:	

Classification

- **Domain:** Atmosphere
  - **Sub-domain:** Basic atmospheric
    - **Variable:** Wind speed over the surface (horizontal)
      - **Measured in Layers:**
        - Near Surface
- **Cross-cutting themes:**

- **Used in Application Areas:**
  - Agricultural Meteorology
  - Global NWP
  - High Res NWP
  - Nowcasting / VSRF
  - Climate-OOPC

WMO OSCAR data base https://www.wmo-sat.info/oscar/variables/view/181

Requirements defined for *Wind speed over the surface (horizontal)* (8)

This tables shows all related requirements. For more operations/filtering, please consult the full list of Requirements

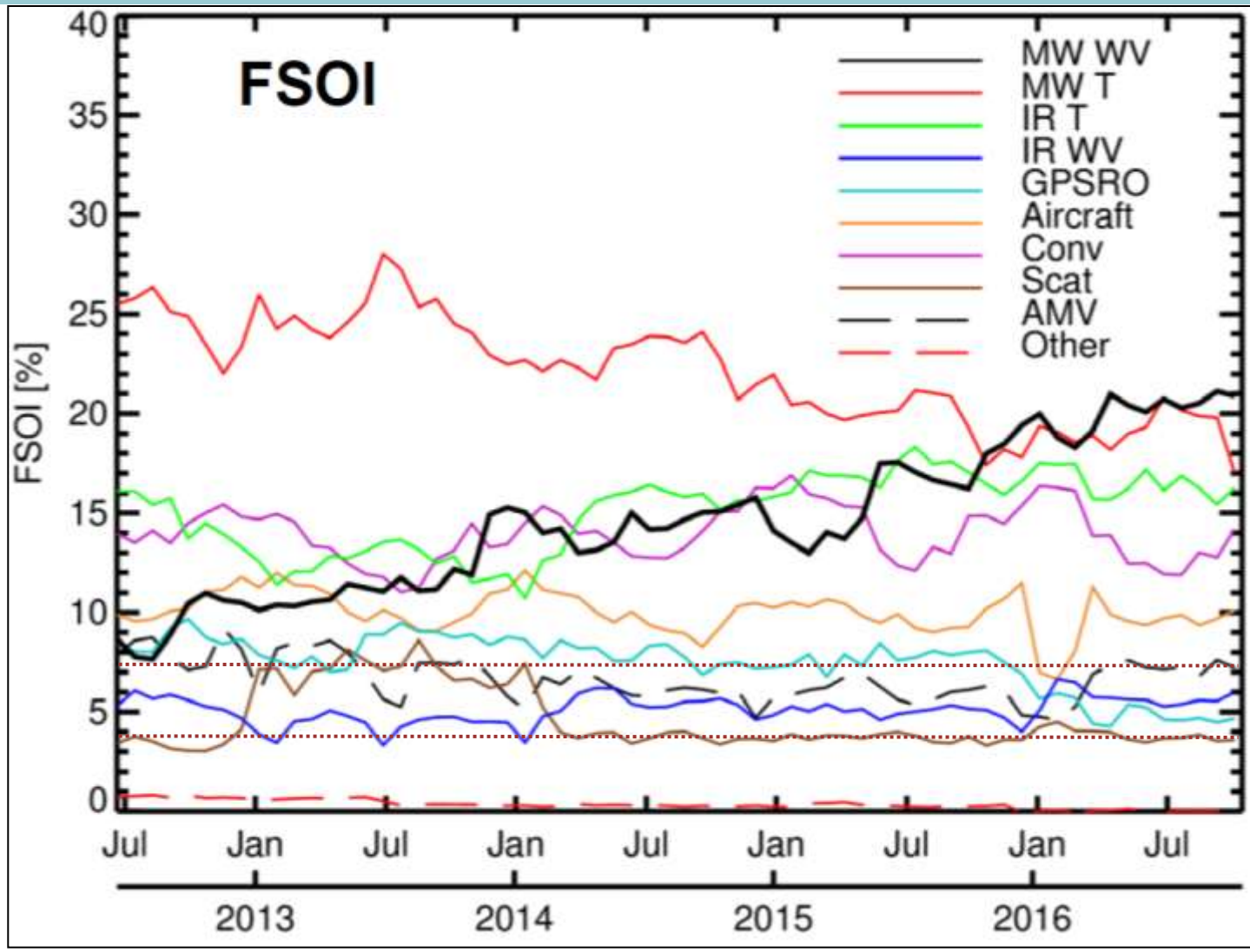
Note: In reading the values, goal is marked blue, breakthrough green and threshold orange

Id	Variable	Layer	App Area	Uncertainty	Stability / decade	Hor Res	Ver Res	Obs Cyc	Timeliness	Coverage	Conf Level	Val Date	Source
318	Wind speed over the surface (horizontal)	Near Surface	Global NWP	0.5 m/s 1.5 m/s 2 m/s		15 km 100 km 250 km		60 min 6 h 12 h	6 min 30 min 6 h	Global land	firm	2009-02-10	John Eyre
319	Wind speed over the surface (horizontal)	Near Surface	Global NWP	0.5 m/s 1.5 m/s 2 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
389	Wind speed over the surface (horizontal)	Near Surface	High Res NWP	0.5 m/s 1 m/s 3 m/s		0.5 km 5 km 20 km		30 min 60 min 3 h	15 min 30 min 2 h	Global land	firm	2011-08-04	T Montmerle
390	Wind speed over the surface (horizontal)	Near Surface	High Res NWP	0.5 m/s 1 m/s 3 m/s		0.5 km 5 km 20 km		30 min 3 h 12 h	15 min 30 min 2 h	Global ocean	firm	2011-08-04	T Montmerle
455	Wind speed over the surface (horizontal)	Near Surface	Nowcasting / VSRF	1 m/s 1.4 m/s 3 m/s		1 km 5 km 20 km		5 min 15 min 60 min	5 min 15 min 60 min	Global land	reasonable	2013-04-08	P. Ambrosetti
456	Wind speed over the surface (horizontal)	Near Surface	Nowcasting / VSRF	1 m/s 1.4 m/s 3 m/s		5 km 10 km 50 km		15 min 30 min 3 h	15 min 30 min 60 min	Global ocean	firm	2013-04-08	P. Ambrosetti

Needed time coverage of wind data

- Wind information at 12:00 from OSCAT in 2013 appears fully complement-ary to wind information at 9:30 from ASCATs in global NWP

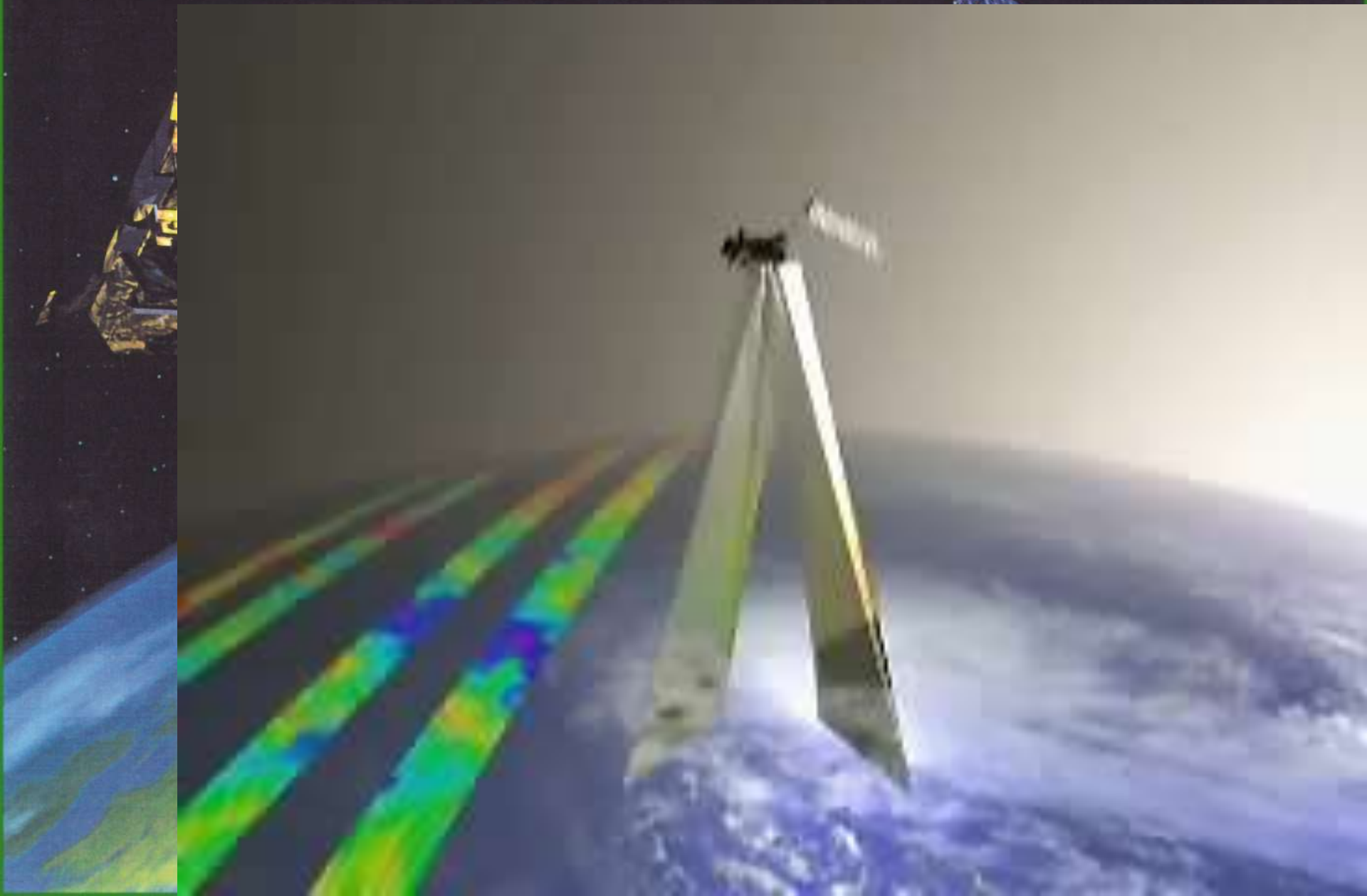
- Fly a wind sensor every 3 hours



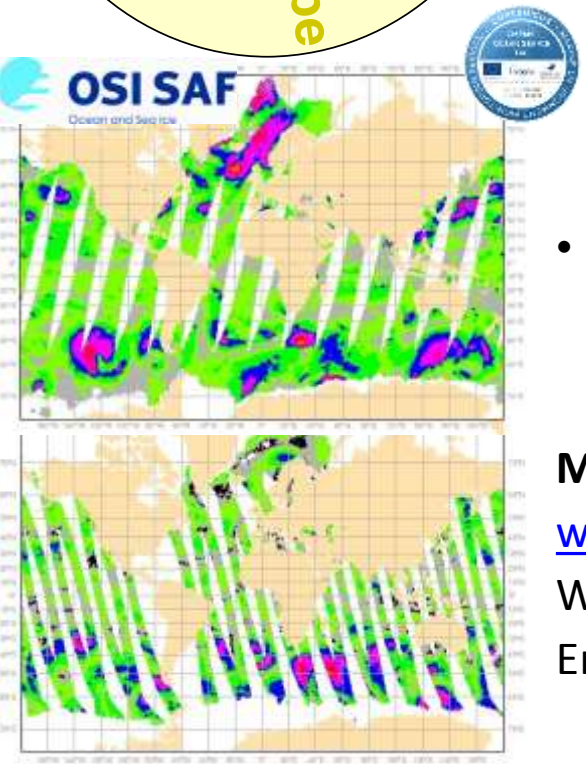
Scatterometer Winds for NRT Support to Mesoscale Forecasting

- Introduction
- Scatterometer wind observations
- NWP model winds
- Mesoscale forecasting

ASCAT scatterometer



Satellite Wind Services



- 24/7 Wind services (OSI SAF)
  - Constellation of satellites
  - High quality winds, QC
  - Timeliness 30 min. – 2 hours
  - Service messages
  - QA, monitoring
- Software services (NWP SAF)
  - Portable Wind Processors
  - Weather model comparison

Organisations involved:
KNMI, EUMETSAT, EU, ESA, NASA, NOAA, ISRO, SOA, WMO, CEOS, ..

- Users: NHC, JTWC, ECMWF, NOAA, NASA, NRL, BoM, UK MetO, M.France, DWD, CMA, JMA, CPTEC, NCAR, NL, . . .

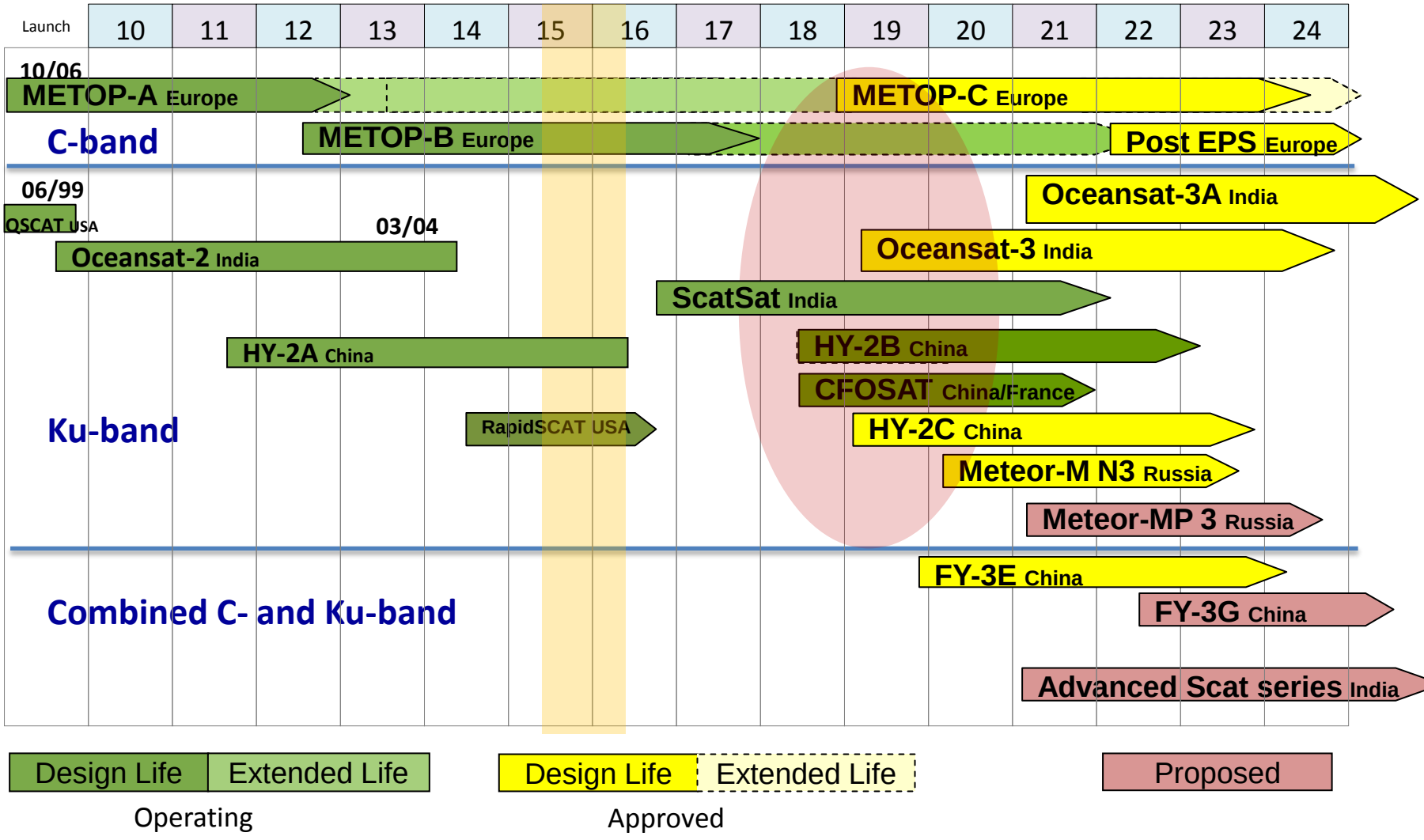
More information:

www.knmi.nl/scatterometer

Wind Scatterometer Help Desk

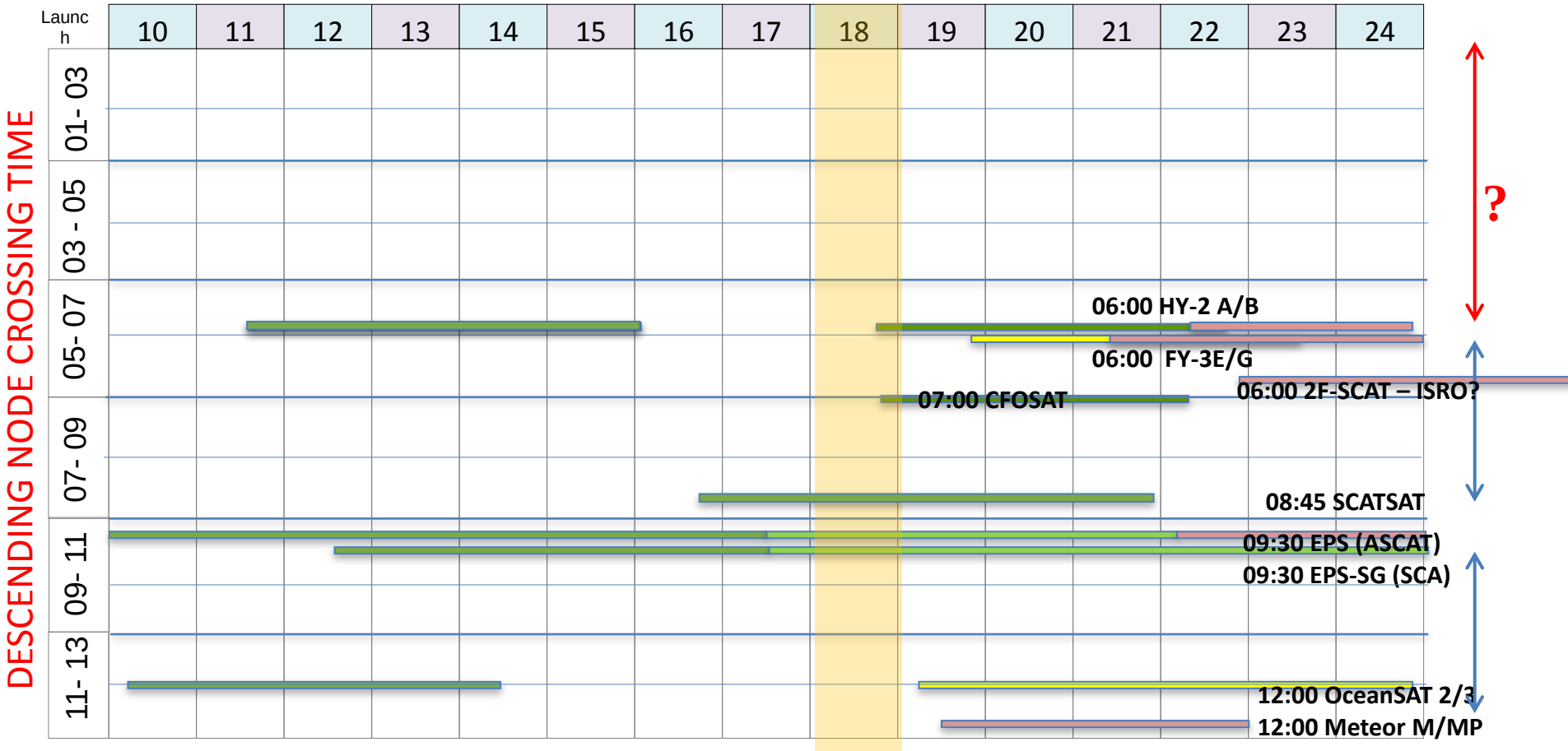
Email: scat@knmi.nl

CEOS Ocean Vector Surface Winds Virtual Constellation (OSVW-VC)
Current status and outlook – NRT data access



Source: WMO OSCAR database and direct interactions with agencies

Ocean Vector Surface Winds Constellation
Local time coverage assessment (ground track) - NRT data access



Design Life | Extended Life — Operating

Design Life | Extended Life — Approved

Proposed

Source: WMO OSCAR database and direct interactions with agencies

CEOS
Committee on Earth Observation Satellites

OSI SAF
Ocean and Sea Ice

Ocean and Sea Ice SAF
Wind Processing Centre

GO TO
OSI SAF CENTRAL
WEB SITE

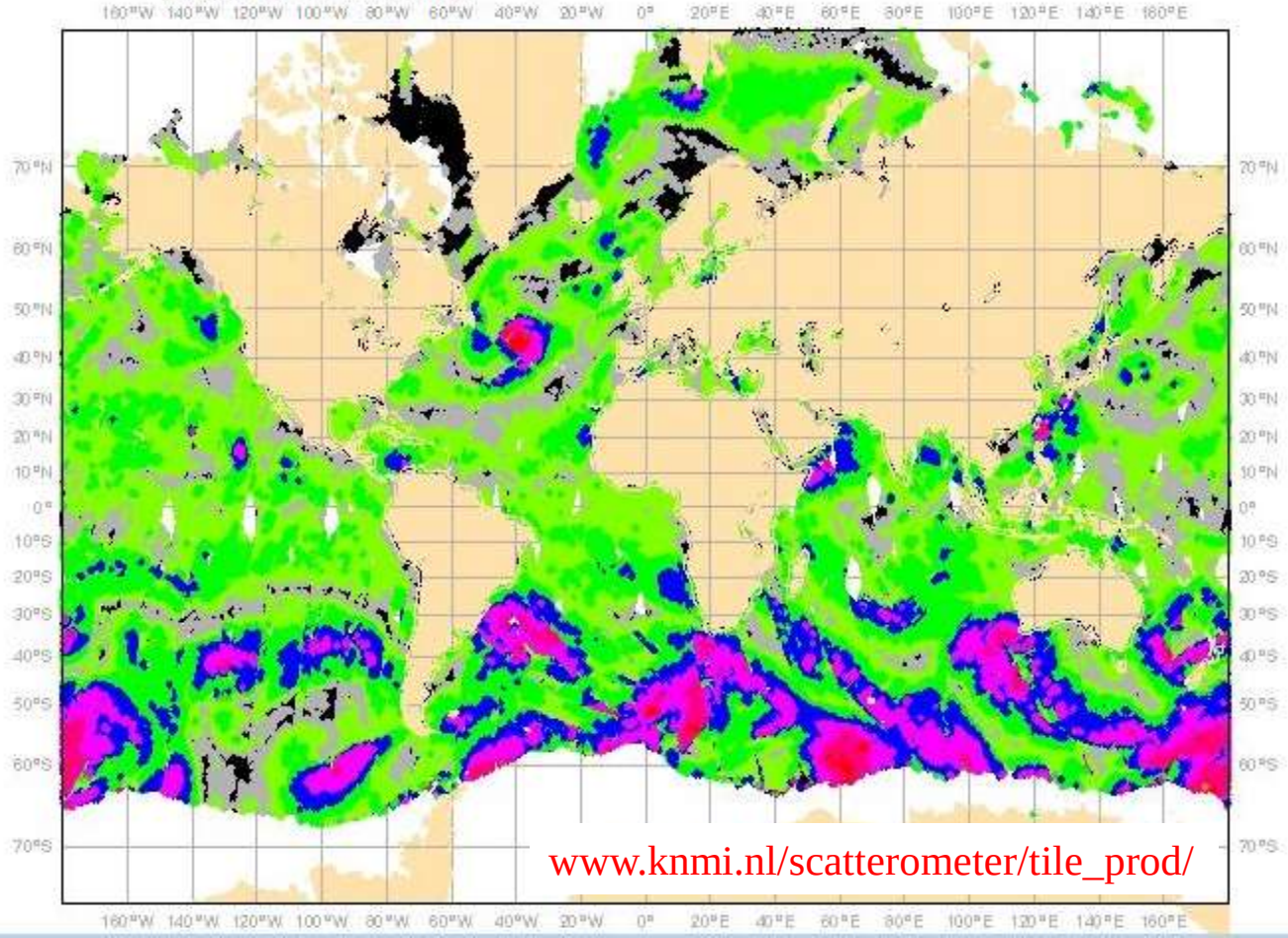
New!

Updated @ 2016-07-07 22:06 utc

OSI SAF multi-platform product viewer

OSI SAF
Ocean and Sea Ice

Click in the map to zoom in



www.knmi.nl/scatterometer/tile_prod/

Background information
- Home OSI SAF Wind Centre

OSI SAF Wind Products
- ASCAT-A 25-km winds
  Operational status
- ASCAT-A 12.5-km winds
  Discontinued status
- ASCAT-A Coastal winds
  Operational status
- ASCAT-B 25-km winds
  Operational status
- ASCAT-B Coastal winds
  Operational status
- RapidScat 25-km 2hrs
  Operational status
- RapidScat 25-km 3hrs
  Operational status
- RapidScat 50-km 2hrs
  Operational status
- RapidScat 50-km 3hrs
  Operational status
- Oceansat-2 50-km winds
  Discontinued status
- Reprocessed SeaWinds L2 winds
  CDR released
- Wind Products Processing Status
- Archived wind and stress products

Other Wind Services at KNMI
- ASCAT-A 25-km winds (EARS)
  Operational status
- ASCAT-A Coastal winds (EARS)
  Operational status

RE: SCATTEROMETER VISUALIZATION AT KNMI

by kleoniki tsioutra - Thursday, 7 July 2016, 7:40 AM

Dear Ad,

I found the website you recommended to us very interesting. It would be very useful to Greek forecasters.

Thank you for all the information you gave us during the training course.

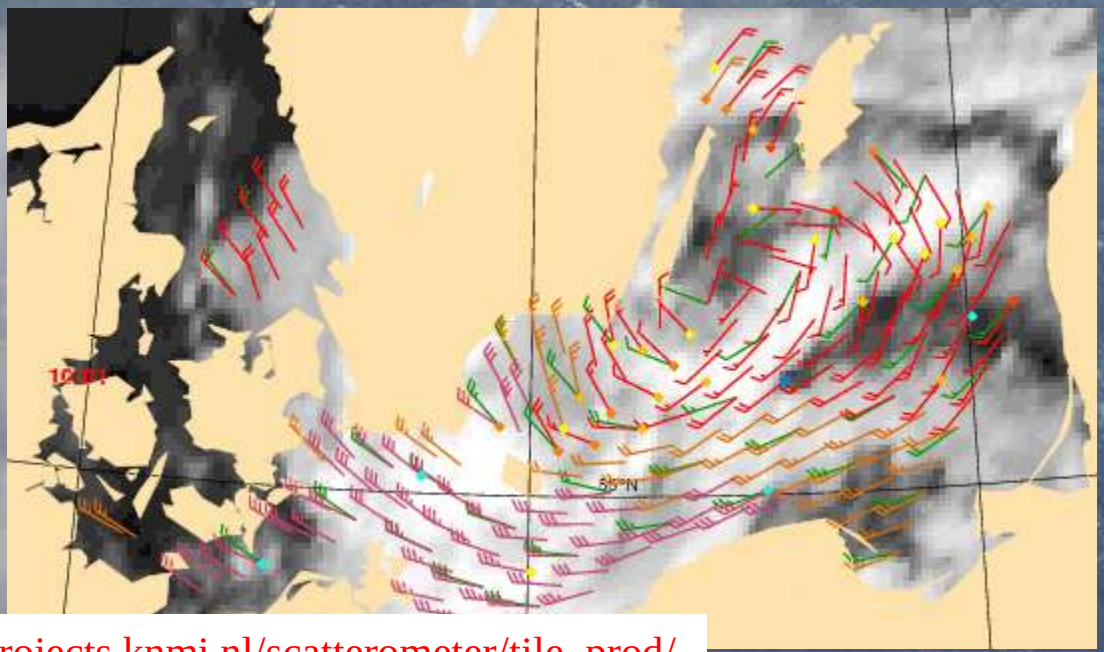
RE: SCATTEROMETER VISUALIZATION AT KNMI

by Maja Jeromel - Thursday, 7 July 2016, 6:00 PM

Hi Ad,

great operational product! I really like the "Go North", "Go South" etc. options - used it right away :-) I also like "Proc
views!

And last, but not least - I found 7.7.2016 is a good day for the Adriatic Sea, even for the norhernmost part :-D



RE: SCATTEROMETER VISUALIZATION AT KNMI

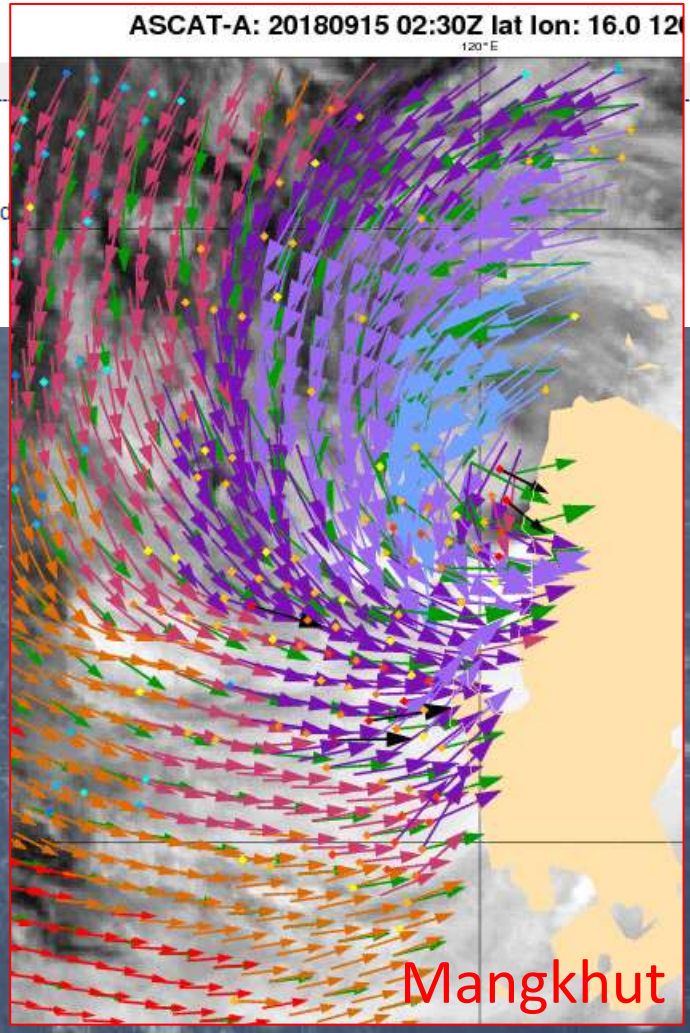
by Dionysia kotta - Tuesday, 5 July 2016, 4:36 PM

Dear Ad,

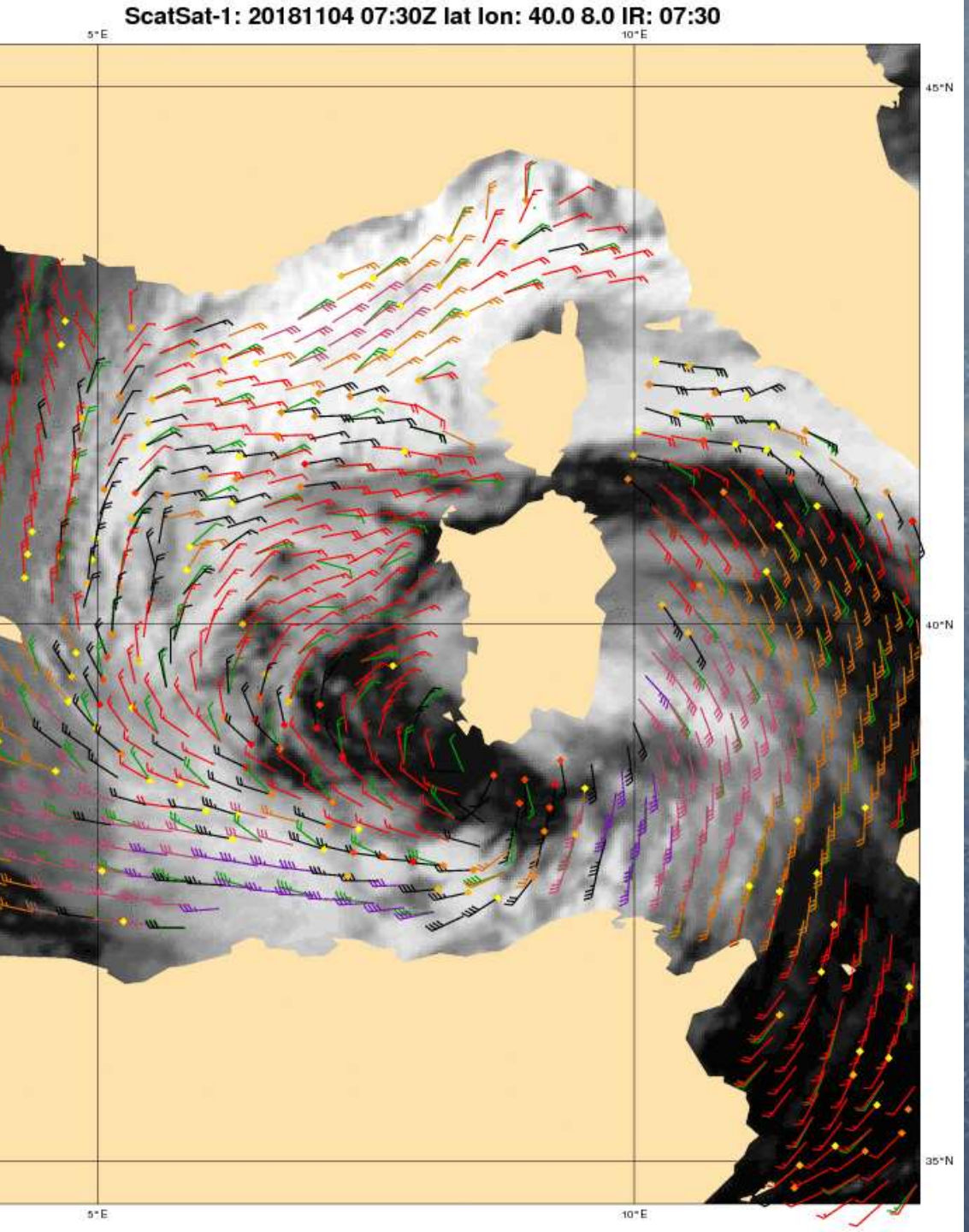
this is very useful, I like it!!!!

Thanks a lot for this information

Dionysia

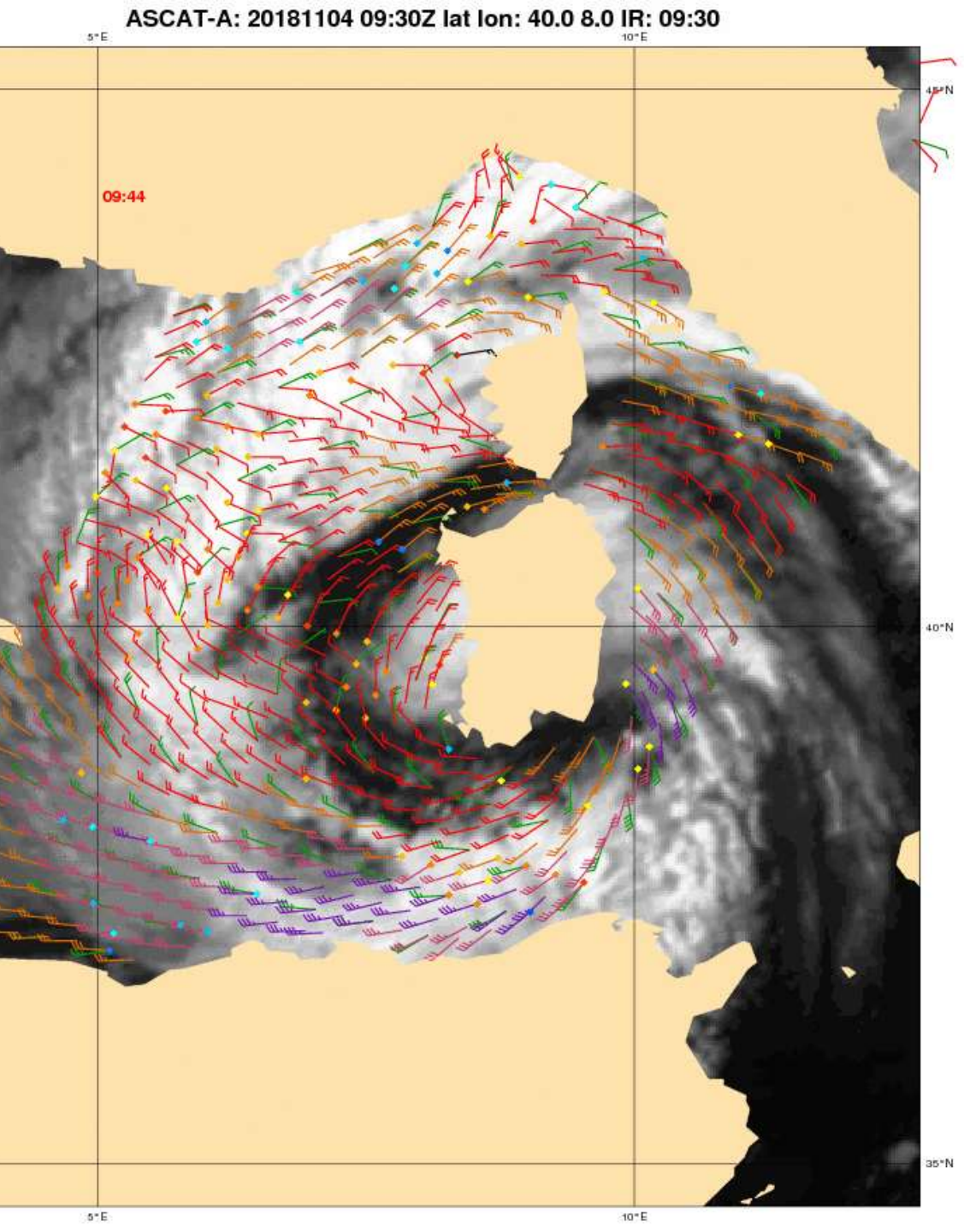


projects.knmi.nl/scatterometer/tile_prod/



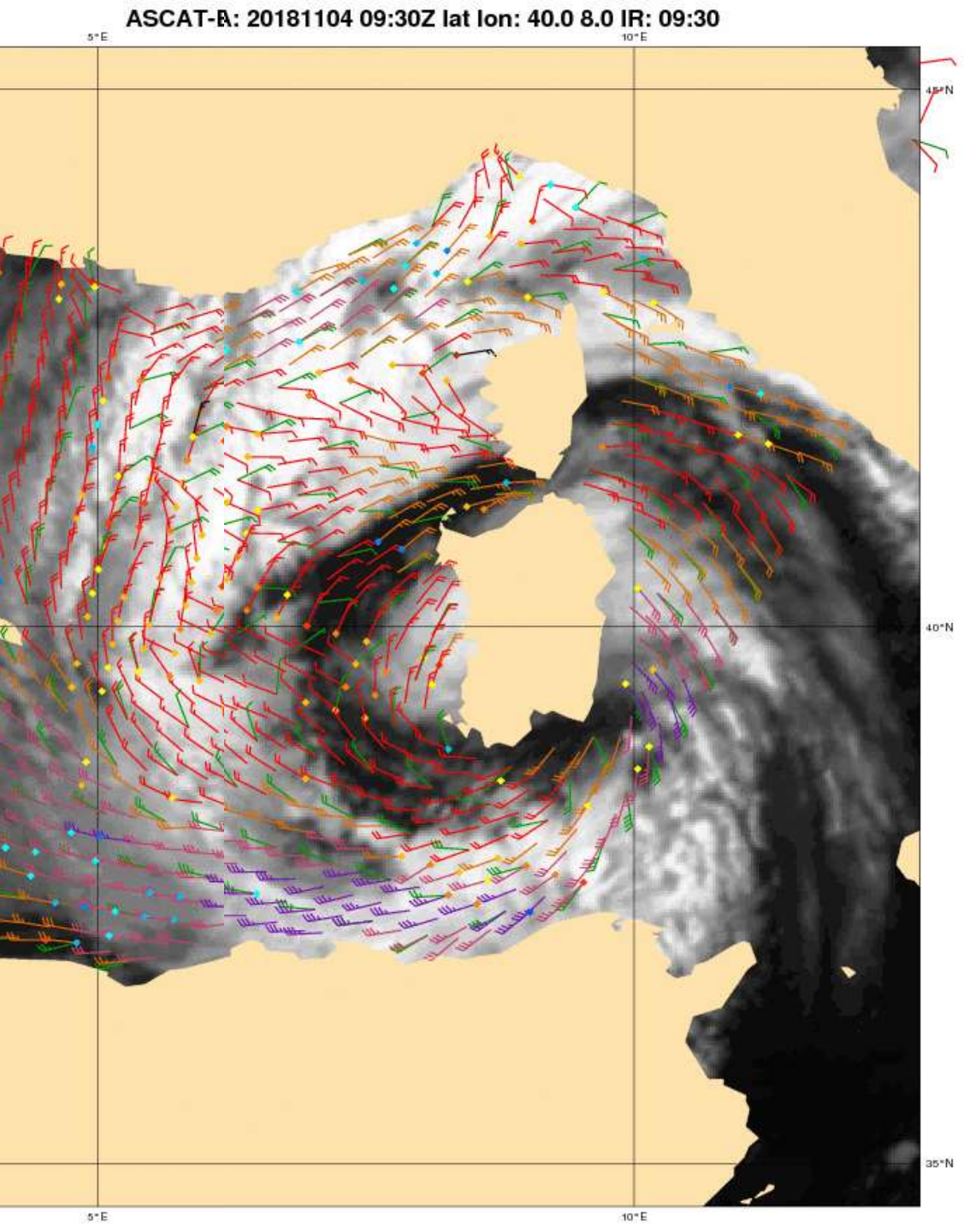
ScatSat

- Large coverage
- Many rejected (black)
- Some (reddish) differ from ECMWF (green)
- Far from coast
- Smooth wind field



ASCAT-A

- Narrow swath
- Very few rejected
- Some (reddish) differ from ECMWF (green)
- Closer to coast
- More mesoscale detail than ScatSat



ASCAT-B/A

- Broader coverage
- Few rejected (black)
- Some (reddish) differ from ECMWF (green)
- Closer to coast

- ASCAT-C launches next week
- ASCAT-A+B+C have the same coverage as ScatSat or HY-2B

Stress-equivalent wind, U10S

- Radiometers/scatterometers measure ocean roughness
- Ocean roughness consists in small (cm) waves generated by air impact and subsequent wave breaking processes; depends on gravity, air/water mass density, water viscosity, 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 $\boldsymbol{u}_*$
- Stress-equivalent winds, $\boldsymbol{u}_{10S}$, depend only on $\boldsymbol{\tau}$, and are currently used for backscatter geophysical model functions (GMFs)
- Surface layer winds (e.g., $\boldsymbol{u}_{10}$) depend on $\boldsymbol{u}_*$, atmospheric stability, surface roughness and the presence of ocean currents (drag)
- Buoy and NWP winds must be corrected for ocean currents, air stability, and air mass density before comparison to scatterometer wind, $\boldsymbol{u}_{10S}$
- Correct for SST at Ku band

Triple Collocation

Triple collocation result

Scatterometer Scale Error SD	U m/s	V m/s
Buoy	1.21±0.02	1.23±0.02
ASCAT	0.69±0.02	0.82±0.02
ECMWF	1.54±0.02	1.55±0.02
Representativeness (r^2)	0.78±0.02	1.00±0.02

ECMWF Scale Error SD	U m/s	V m/s
Buoy	1.44±0.02	1.59±0.02
ASCAT	1.05±0.02	1.29±0.02
ECMWF	1.32±0.02	1.18±0.02

Trend	U m/s	V m/s
ASCAT	0.99	0.99
ECMWF	0.97	0.96

- ASCAT winds are very accurate
- ASCAT error SD is smaller than representativeness vector error SD
- Buoy errors appear large (current, wind variability)
- ECMWF winds appear smooth and biased low on average
- In extreme weather much larger deviations will occur

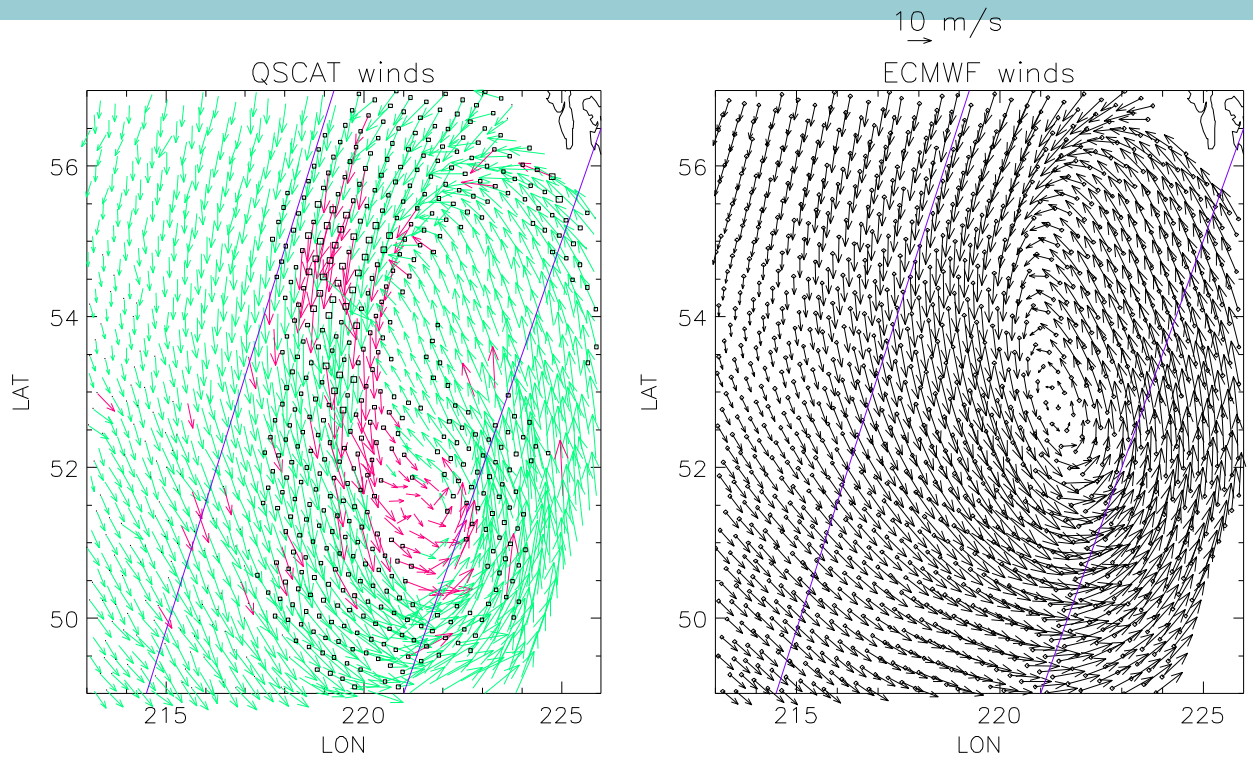
Vogelzang et al., JGR, 2011

SeaWinds ScatSat-1 OceanSat-2

Triple collocation in ms^{-1}	Scatterometer		Buoys		ECMWF	
	ε_u	ε_v	ε_u	ε_v	ε_u	ε_v
25 km ScatSat-1	0.77	0.60	1.37	1.40	1.10	1.13
25 km Oceansat-2	0.80	0.71	1.44	1.45	1.33	1.40
25 km SeaWinds	0.64	0.54	1.39	1.41	1.28	1.35
50 km ScatSat-1	0.60	0.44	1.45	1.50	0.99	1.00
50 km Oceansat-2	0.61	0.48	1.53	1.54	1.20	1.29
50 km SeaWinds	0.46	0.40	1.50	1.49	1.20	1.28

- ERAint: SeaWinds (1999 – 2009) en Oceansat-2 (2009 - 2014)
- OPS (clearly better quality): All ScatSat-1 v113
- ScatSat-1 quality well within requirements (~1.4 m/s)
- Better than OceanSat-1 quality
- Buoy quality best at smallest scale (25 km), NWP at largest scale (50 km)

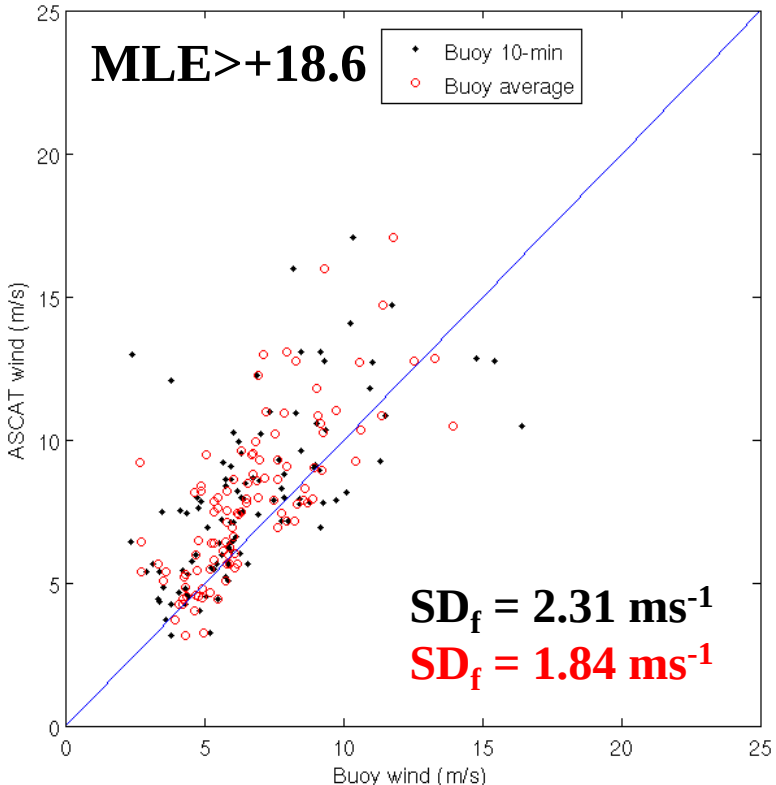
Quality Control for Ku Band

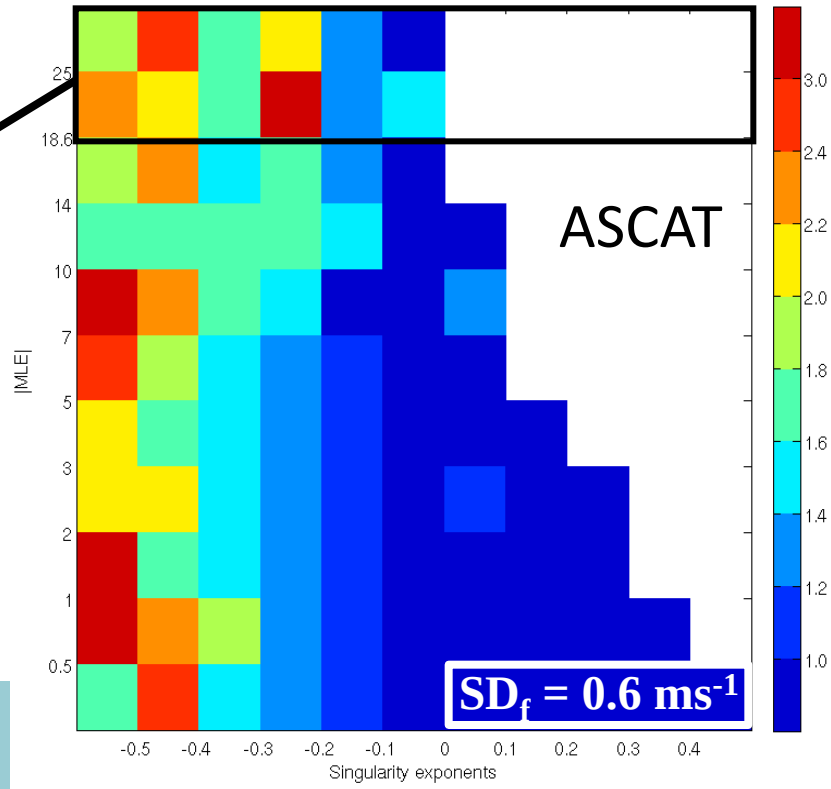


- Areas with significant Rain (large squares) effectively detected
- Frontal and low-pressure centre areas effectively removed
- Vast majority of spatially consitent winds are accepted (green arrows)

QC: Which error is acceptable?

- We can produce winds with SD of buoy-scatterometer difference of 0.6 m/s, but would exclude all high-wind and dynamic air-sea interaction areas
- The winds that we reject right now in convective tropical areas are noisy (SD=1.84 m/s), but generally not outliers!
- What metric makes sense for QC trade-off?

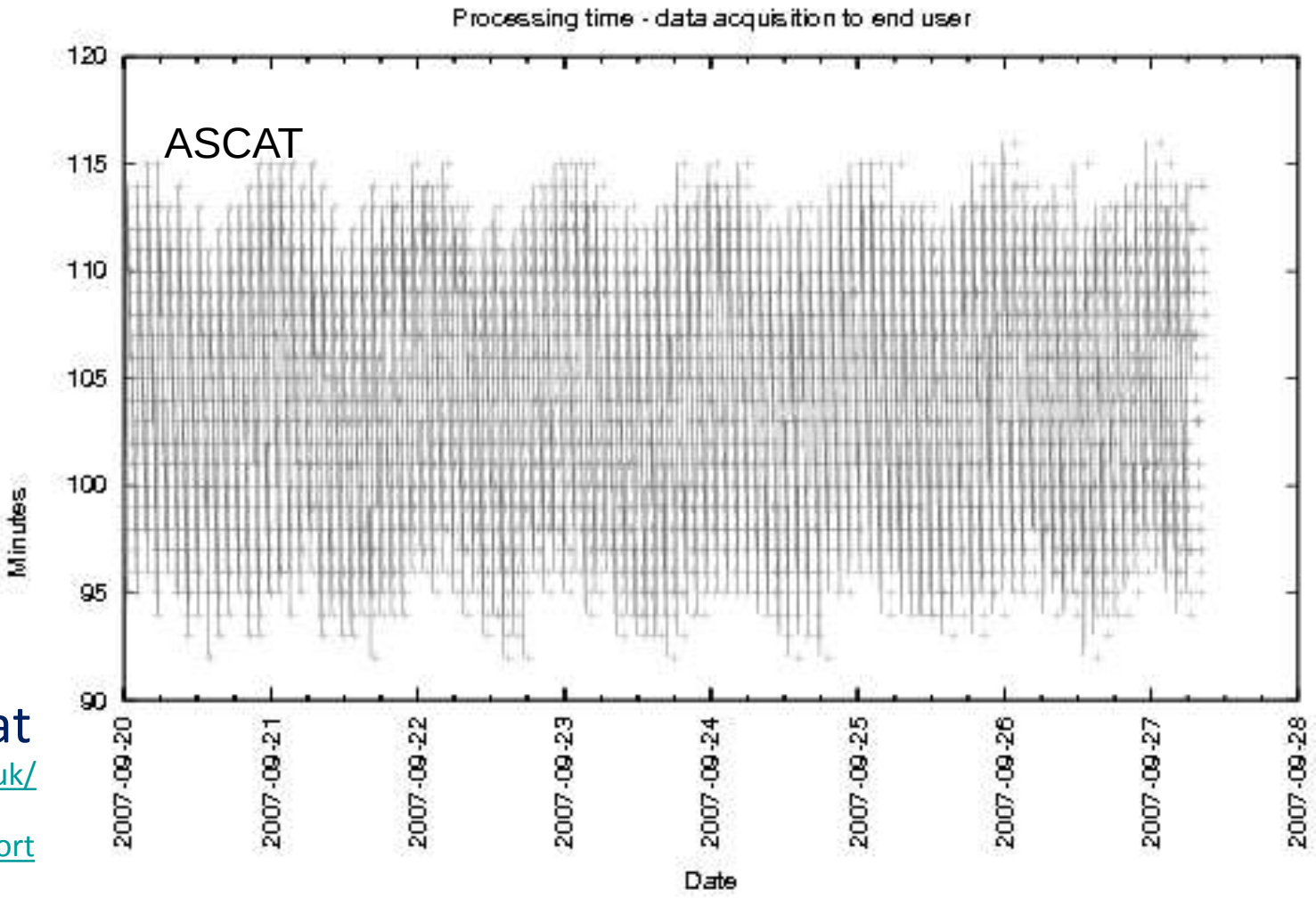




Monitoring of each product

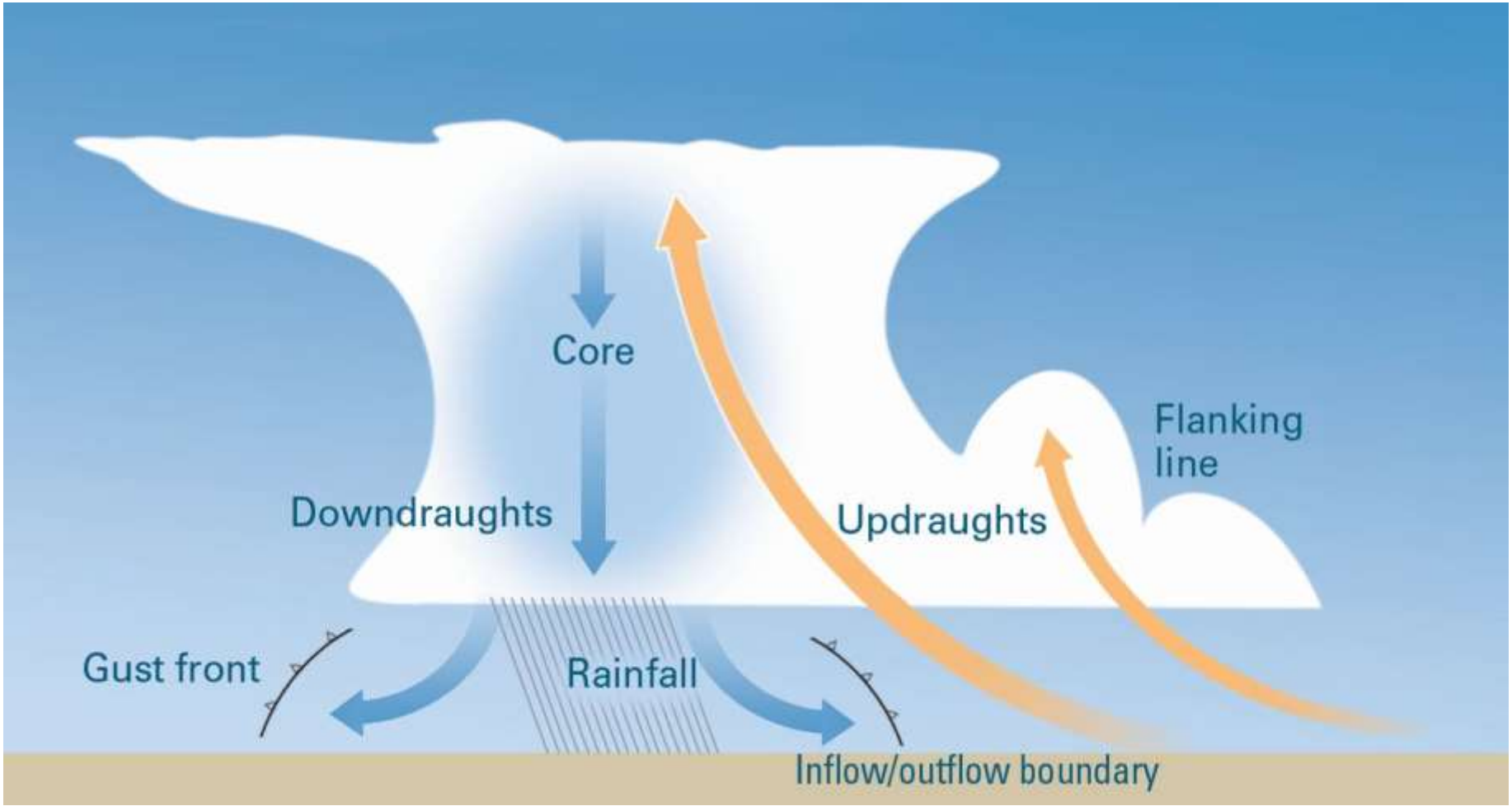
- 1st rank MLE
- Speed bias
- RMS u&v scat - EC
- Timeliness
- Product flag

- NWP SAF integrated monitoring at www.metoffice.gov.uk/research/interproj/nwpsaf/scatter_report

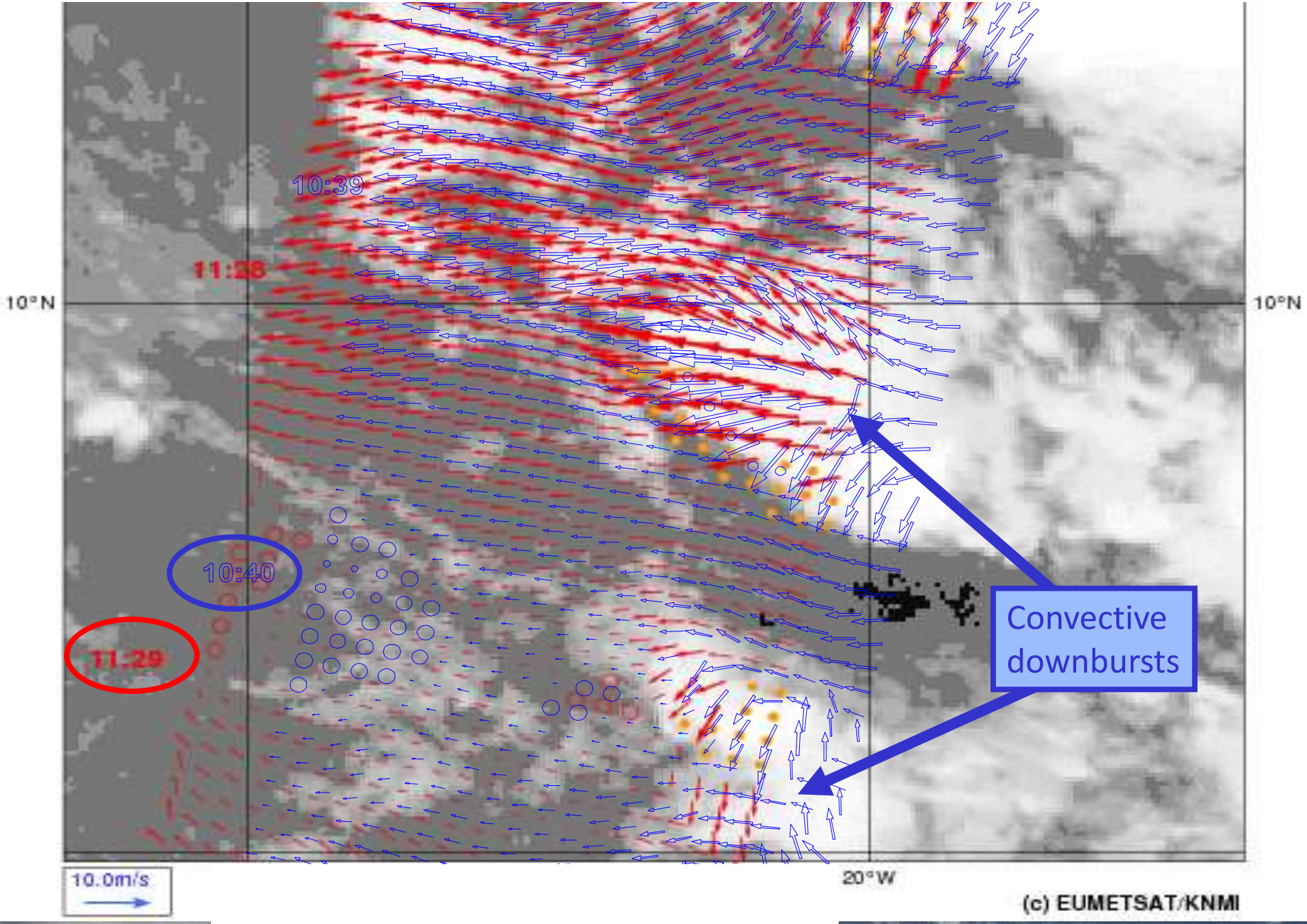


http://projects.knmi.nl/scatterometer/ascat_osi_25_prod/ascat_app.cgi?cmd=monitoring&period=week&day=0&flag=yes

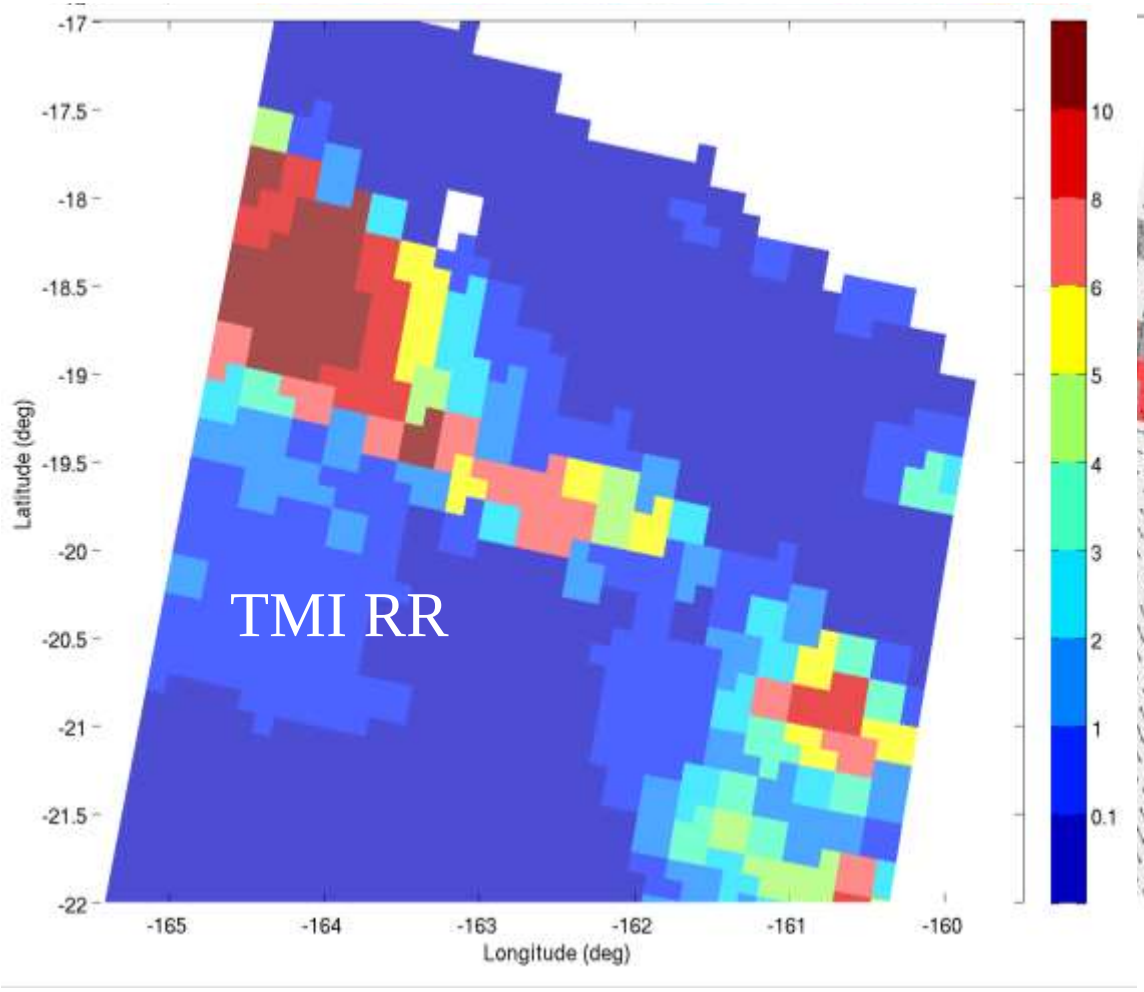
Convection


Core
Flanking line
Downdraughts
Updraughts
Gust front
Rainfall
Inflow/outflow boundary

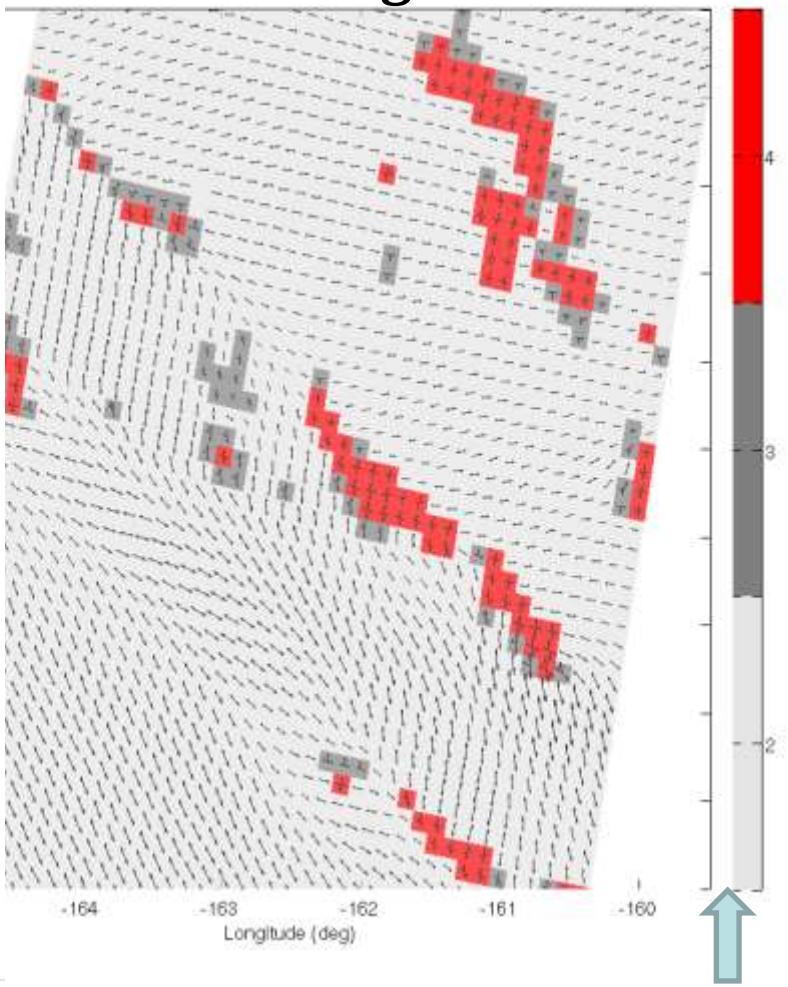
ASCAT-A and ASCAT-B come together



Wind front

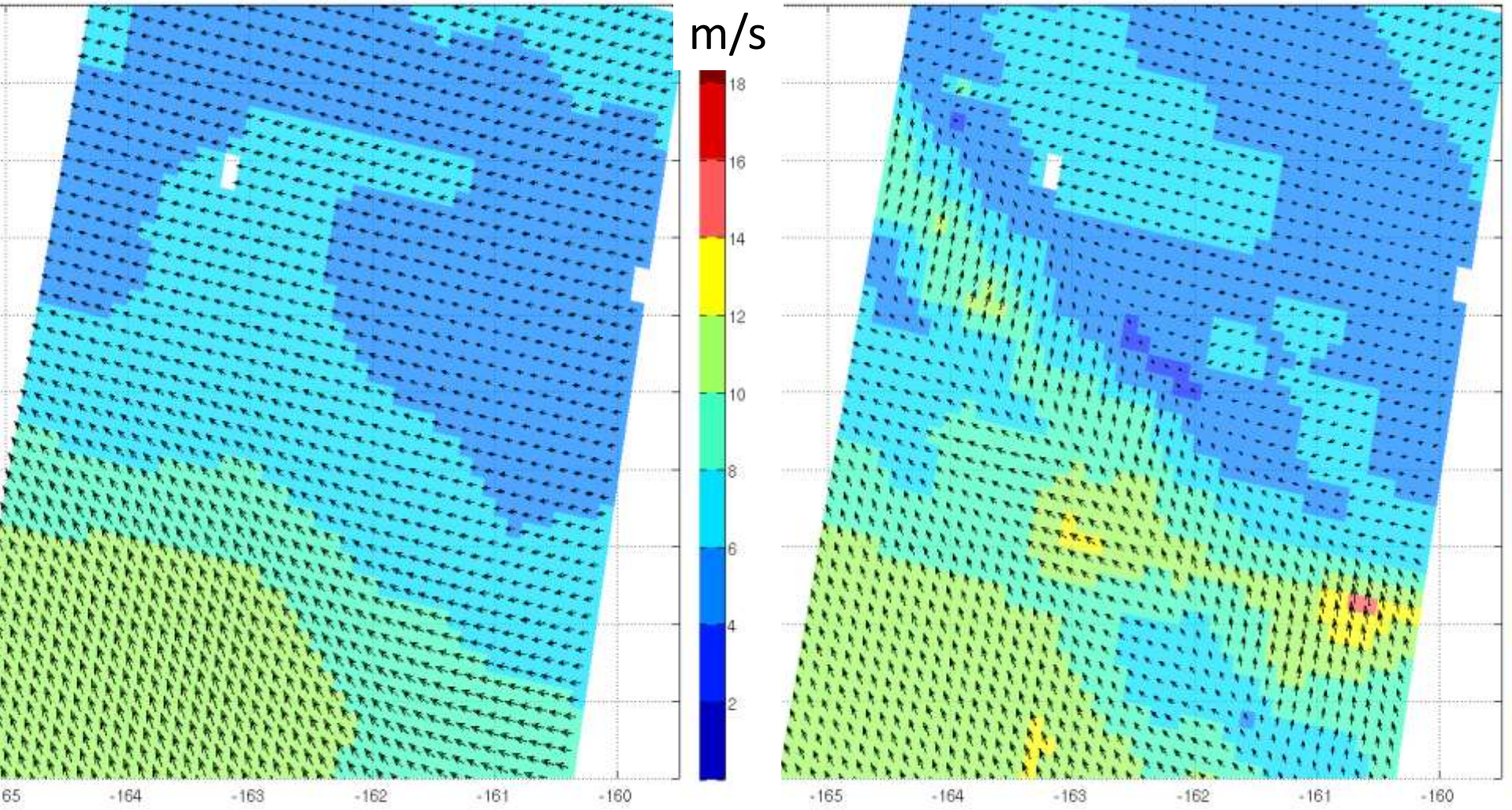


ASCAT ambiguities



Number of ambiguities

Wind front 2DVAR analysis



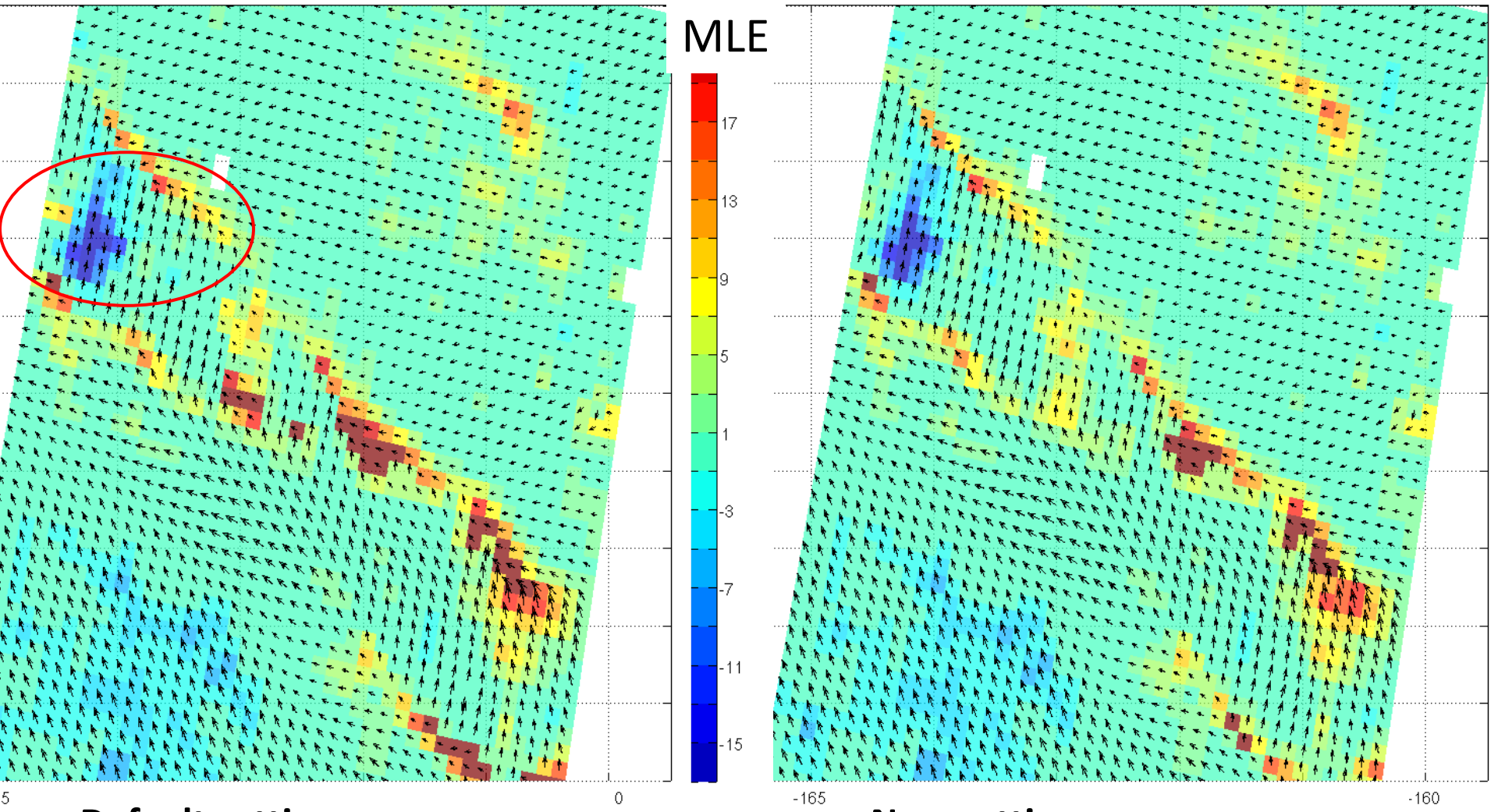
Default setting:

- Gaussian structure function
- Fixed O/B errors

New setting:

- Empirical structure function
- Flexible O/B errors

Wind front selections



Default setting:

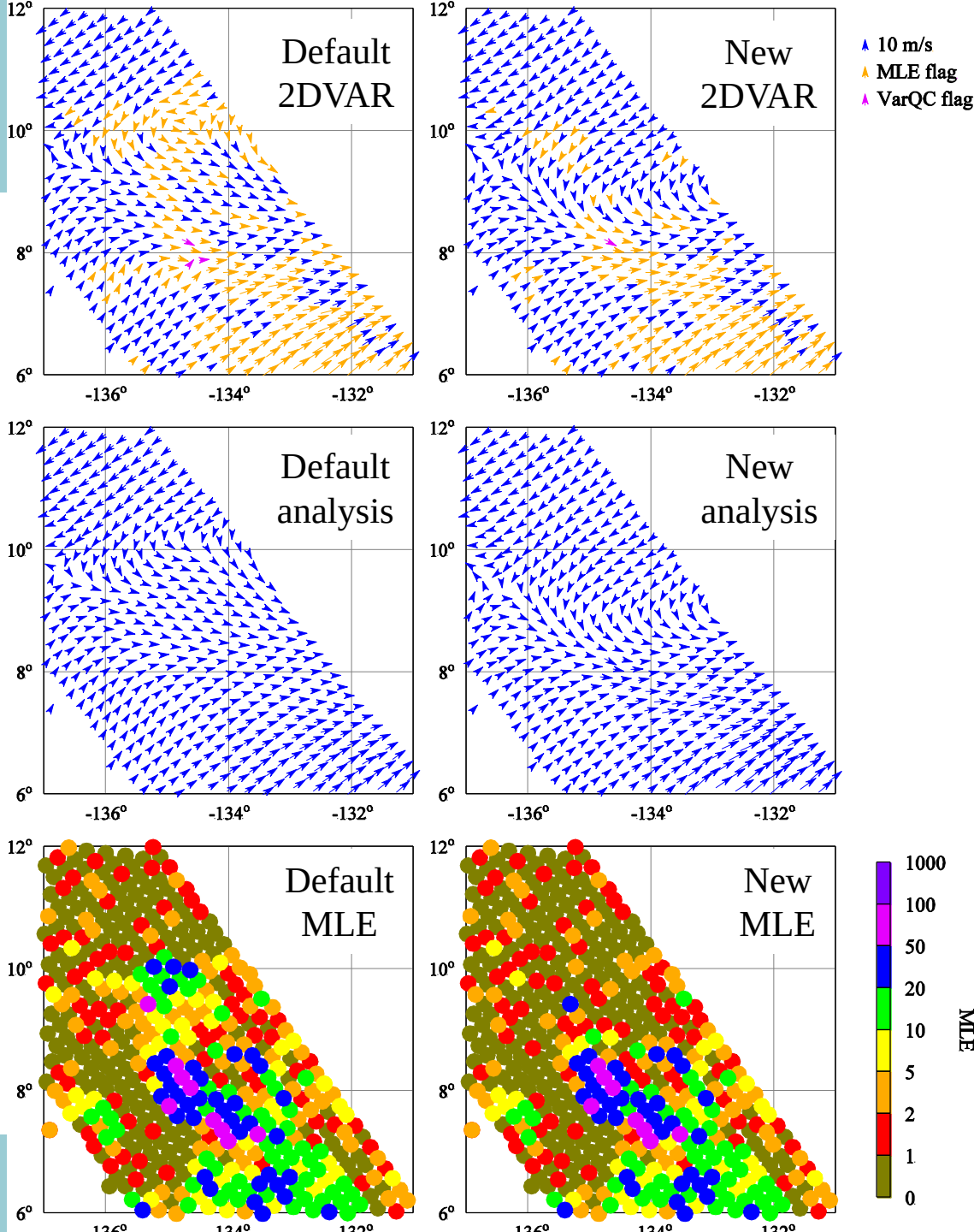
- Gaussian structure function
- Fixed O/B errors

New setting:

- Empirical structure function
- Flexible O/B errors

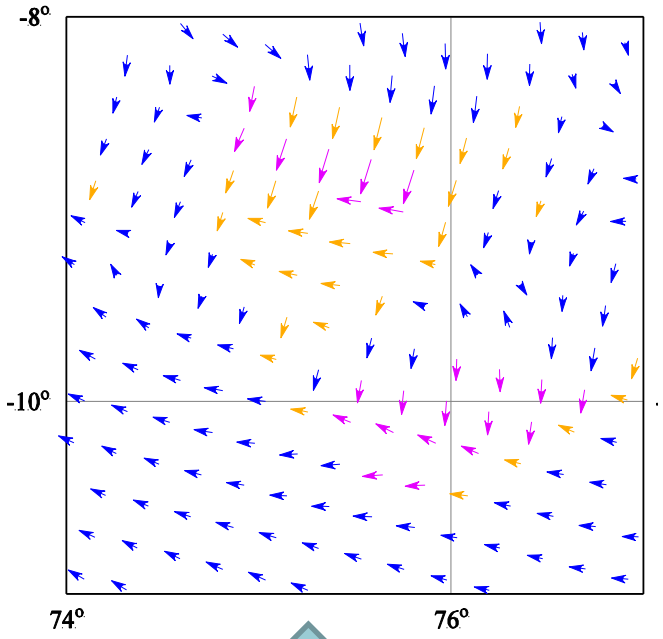
RapidScat

- Static background error correlations based on ASCAT
- ➢ Usually similar, but
- ➢ Larger increments w.r.t background
- ➢ More mesoscale structure
- ➢ Lower MLE
- ➢ Better wind direction verification against buoys
- ➢ Works also for OSCAT



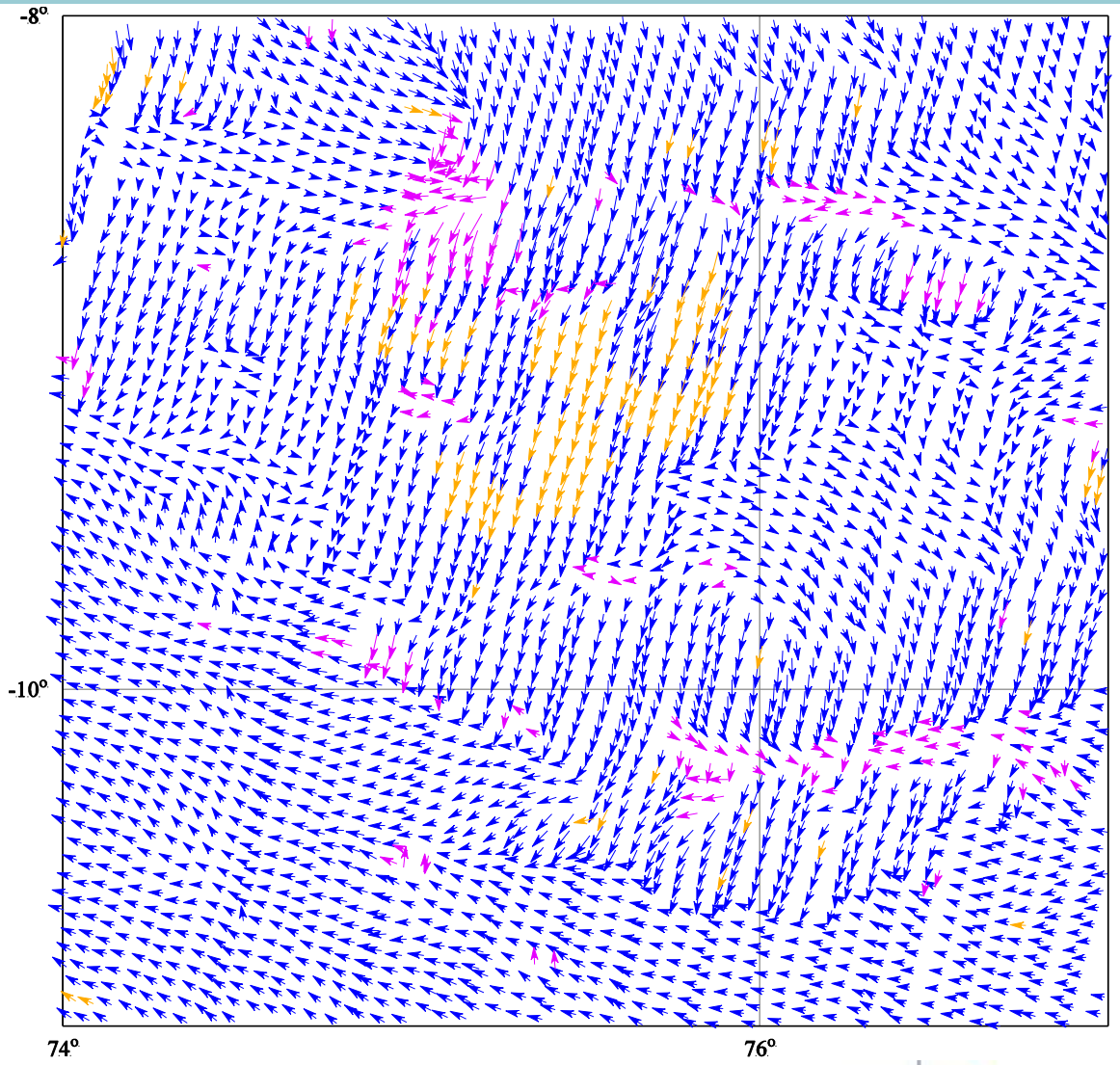
Vogelzang&Stoffelen, QJRMS

Case 01-01-2015 - comparison



From 12.5 km

to 5.6 km



Scatterometer winds

- Many more will appear soon! (HY2B, CFOSAT, ASCAT-C, OceanSat, WindRad)
- Represent the mean WVC wind
- Are provided as stress-equivalent (neutral) winds
- Verify very well with NWP model
- Verify very well with buoys
- Show spectra close to that theoretically expected for 3D turbulence for scales < 500 km
- Spatial plots show small-scale features in line with these three features: PBL rolls, moist and dry convection, subsidence, air-sea interaction

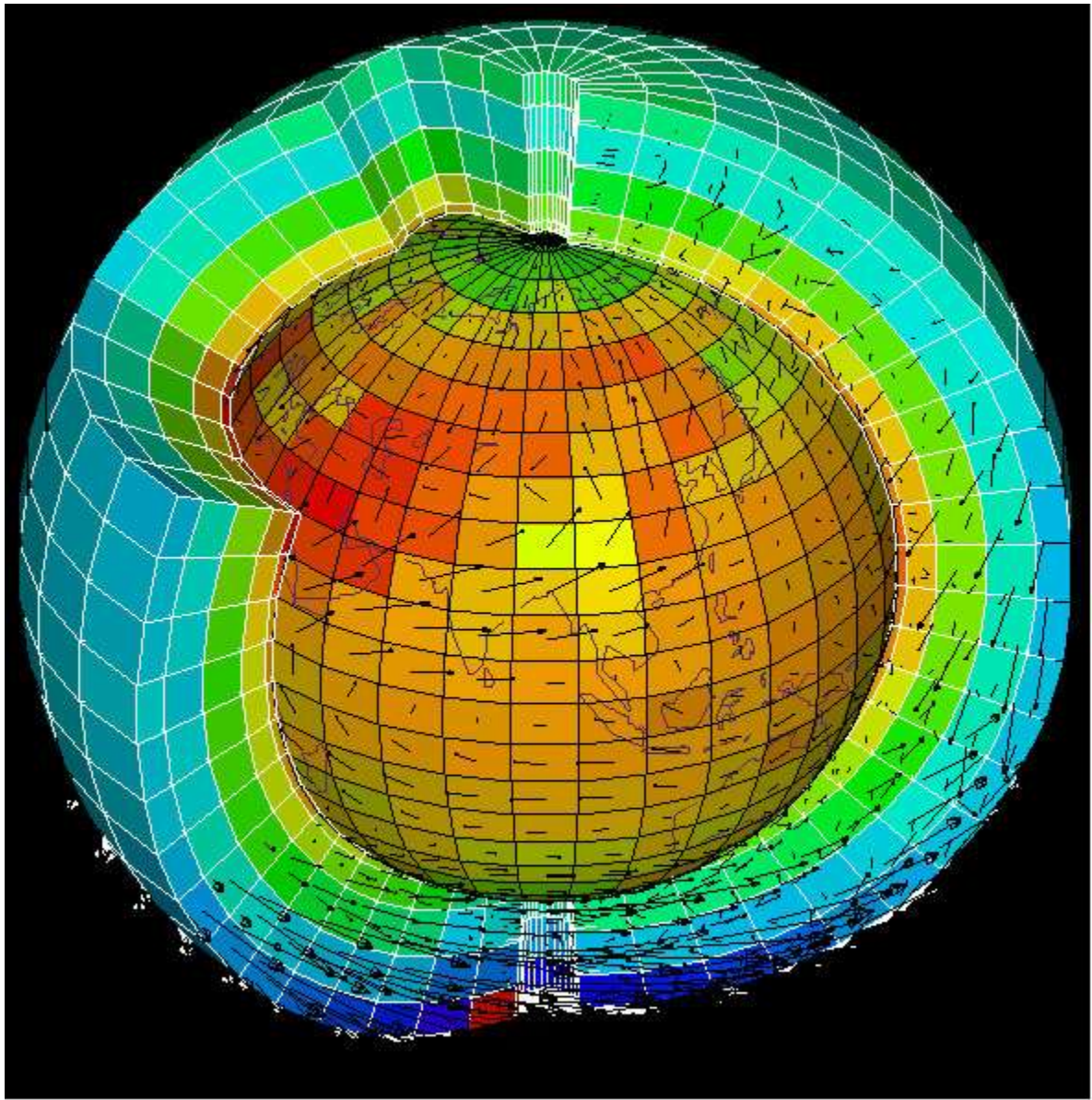
- Are screened for land, sea ice and rain
- Winds > 30 m/s are difficult to measure/calibrate
- Are ambiguous

Scatterometer Winds for NRT Support to Mesoscale Forecasting

- Introduction
- Scatterometer wind observations
- NWP model winds
- Mesoscale forecasting

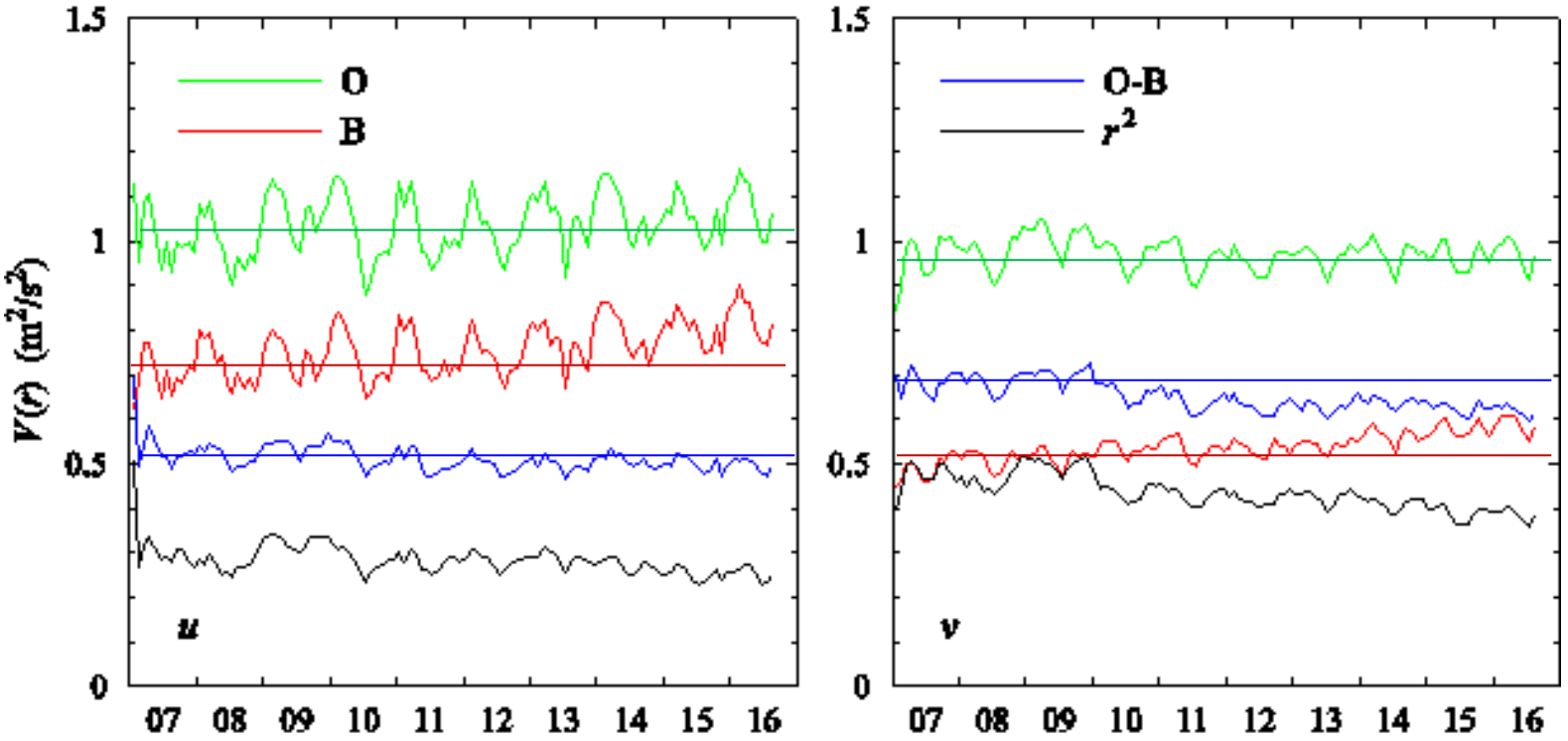
Global Circulation Models

- Used for transient weather prediction and climate scenarios
- ~ 100 x 1000^2 boxes with ~10 variables (p, T, u, v, w, CC, H2O+fase, O3, ..)
- Interaction between boxes and variables, new state every ~15 minutes; 100x a day
- Interaction with ocean and land surfaces
- Largest available supercomputers are used



ECMWF OPS improves over time

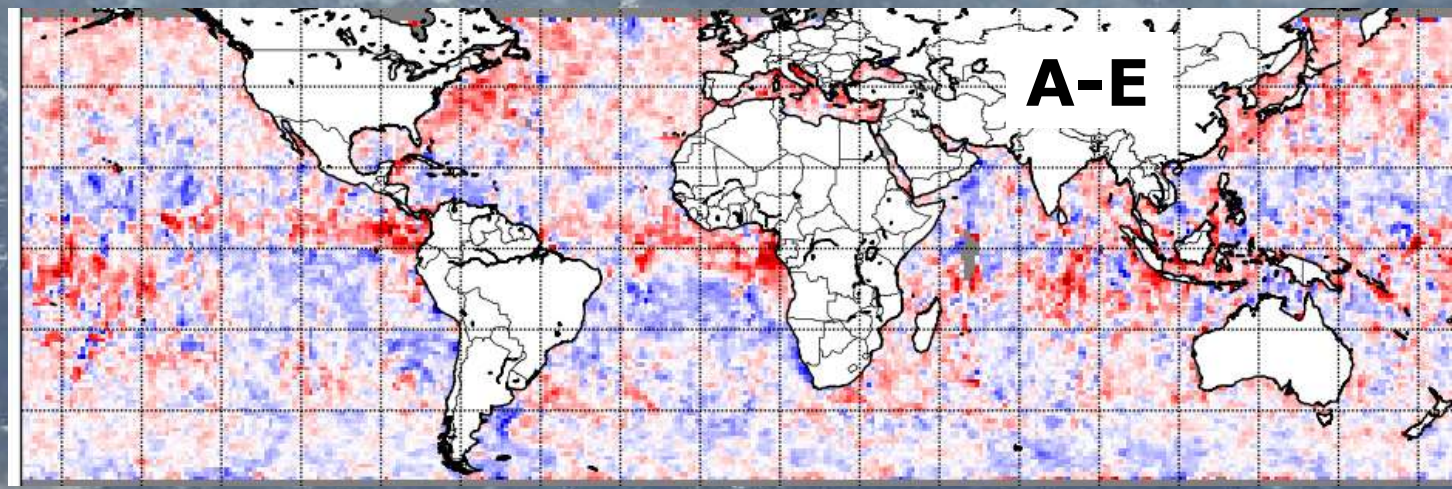
- Variances on scales < 200 km only
- Scatterometer O variance under 200 km constant
- < 200-km variance B increases to
  80% (u), resp. 60% (v) of O
- O-B decreases, particularly for v, thus reducing B error

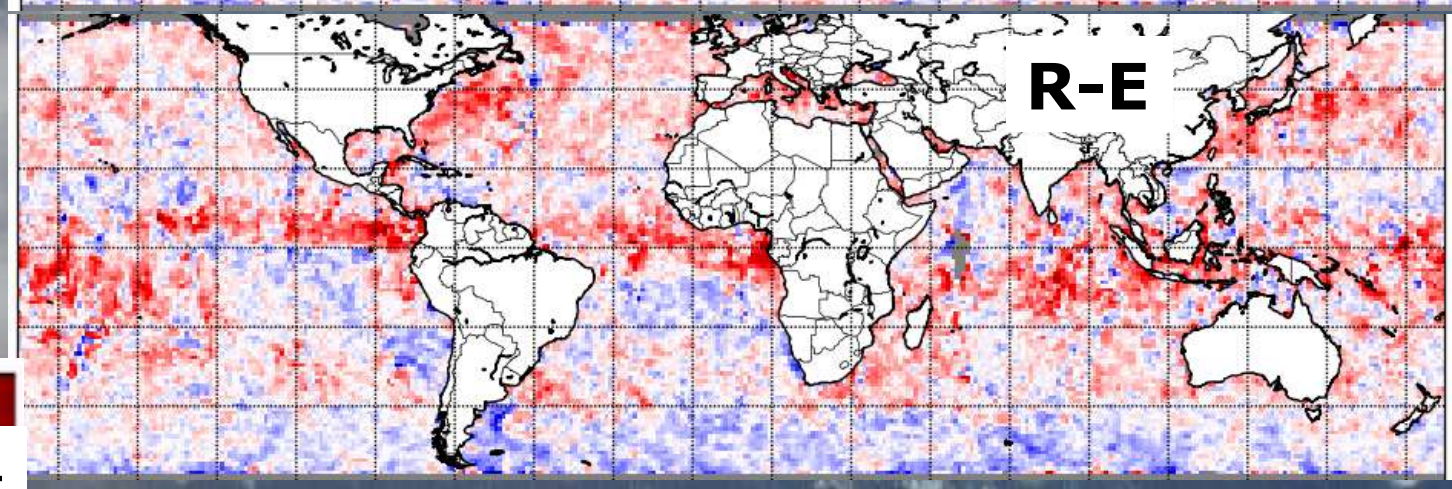


Bias patterns with NWP

- Systematic wrong ocean forcing in the tropics
- Violates BLUE in data assimilation systems (DAS)
- Similar patterns every day, due to convection, parameterisation, ocean current

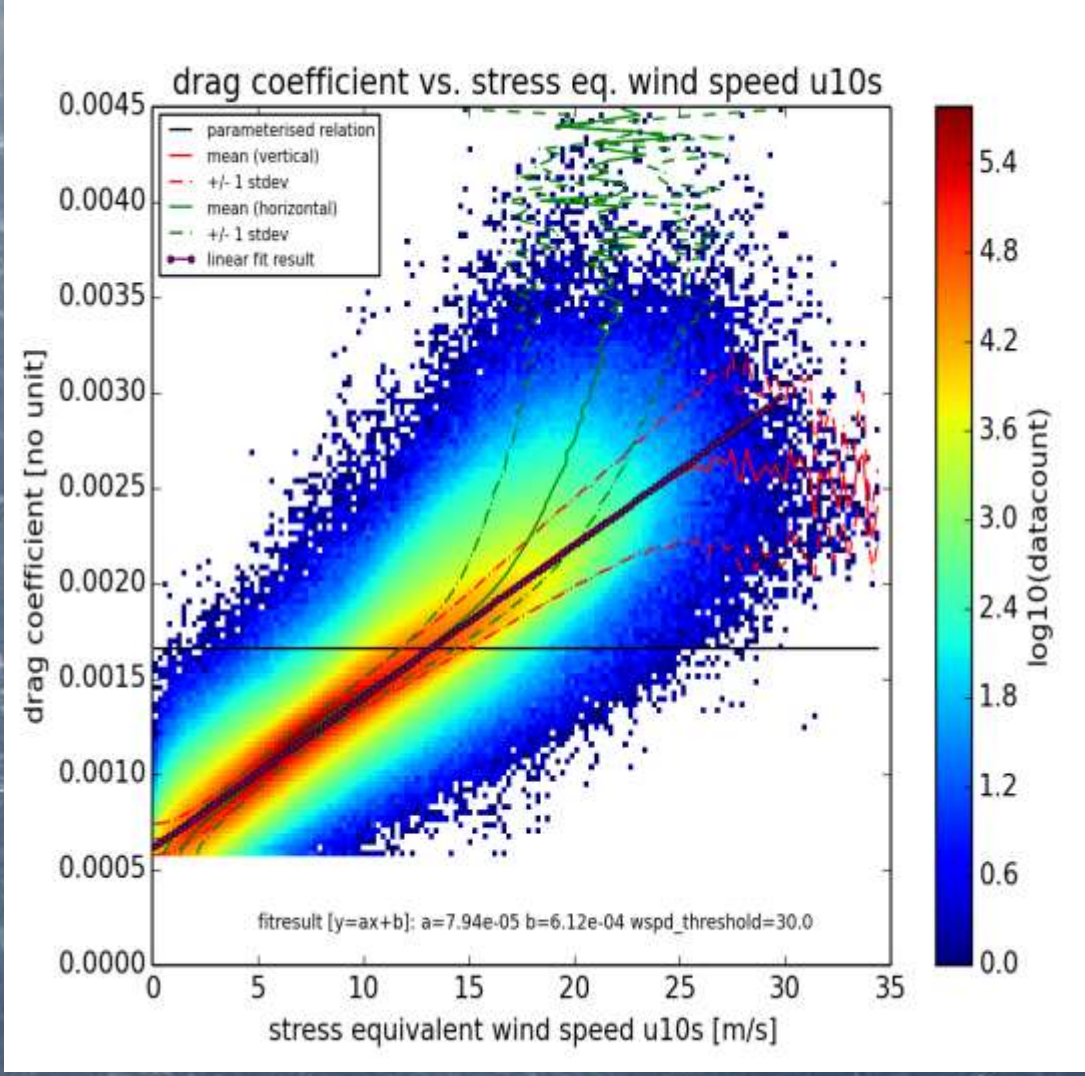
- Correct biases before DAS
- Correct ocean forcing in climate runs
- Investigate moist convective processes
- Correct NWP for currents to obtain stress



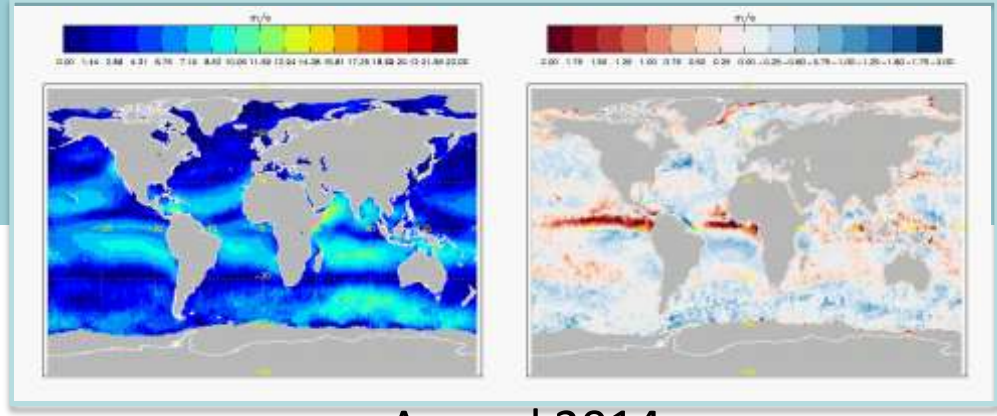


From U10S to stress: drag

- Stress-equivalent winds are computed for validation of scatterometer wind vectors: independent of atmospheric stratification and incl. air mass density
- Obtain drag to compute stress
- Is the NWP model drag correct ? If not, speed biases occur !

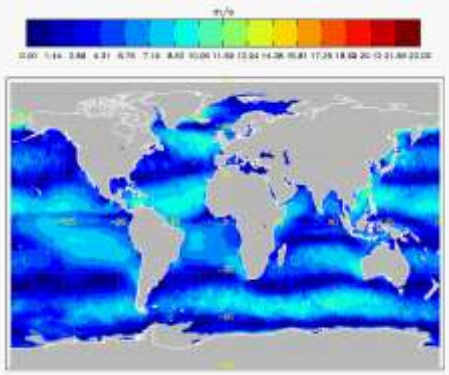


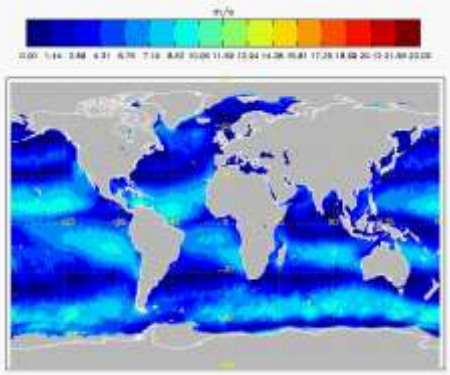
Wind Speed

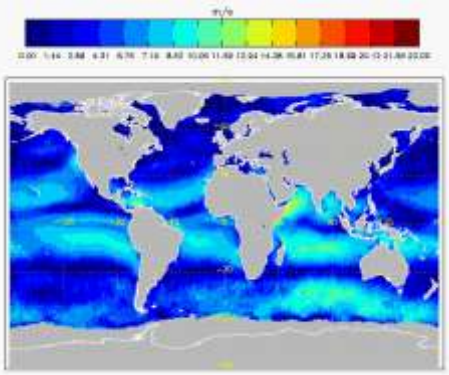


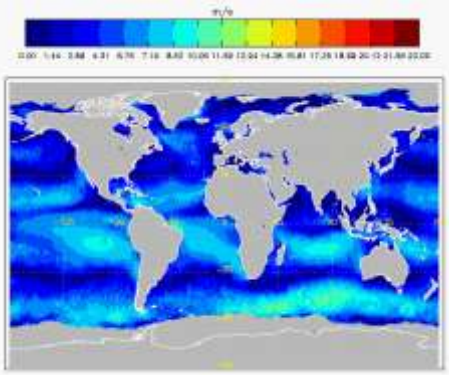
ASCAT

Annual 2014







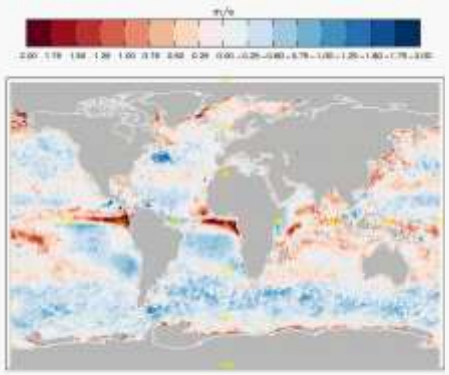


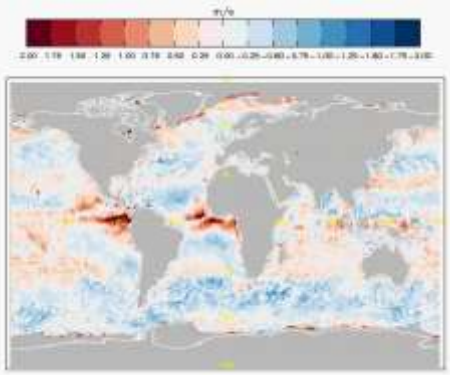
DJF

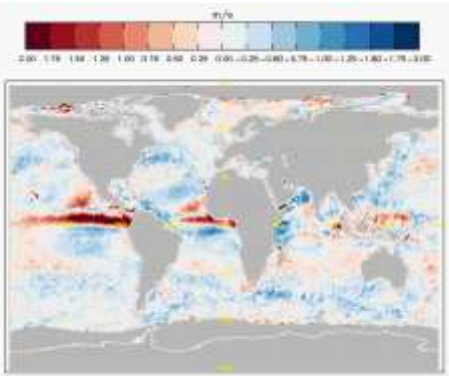
MAM

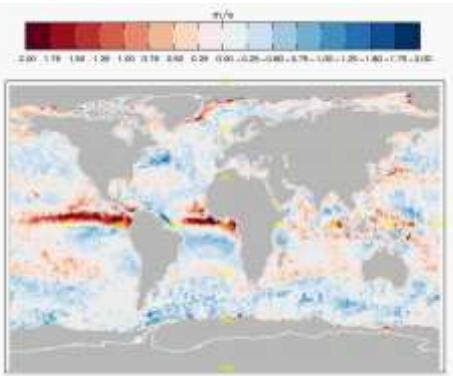
JJA

SON



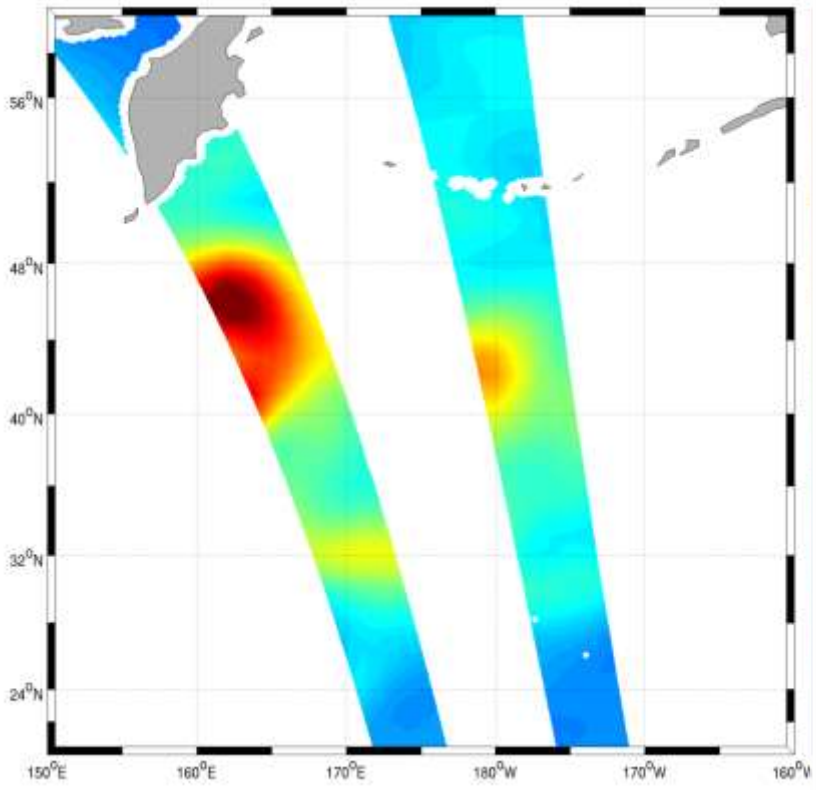




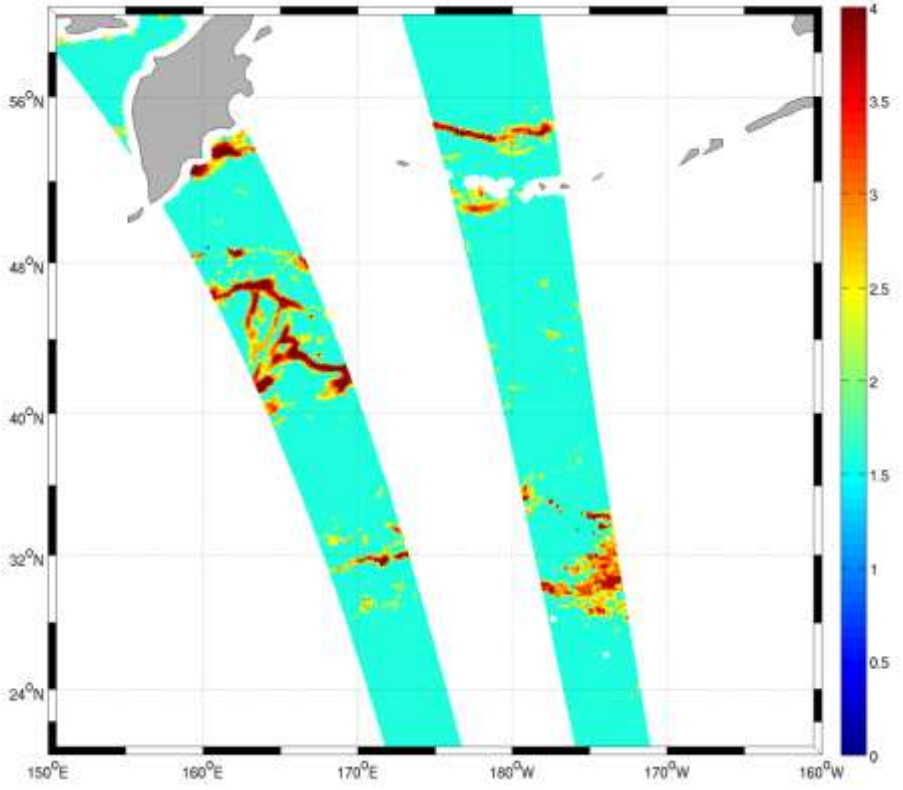


Anomaly (ASCAT-NWP)

Estimated B error variances



ECMWF Ensemble Data Assimilation (EDA background error)



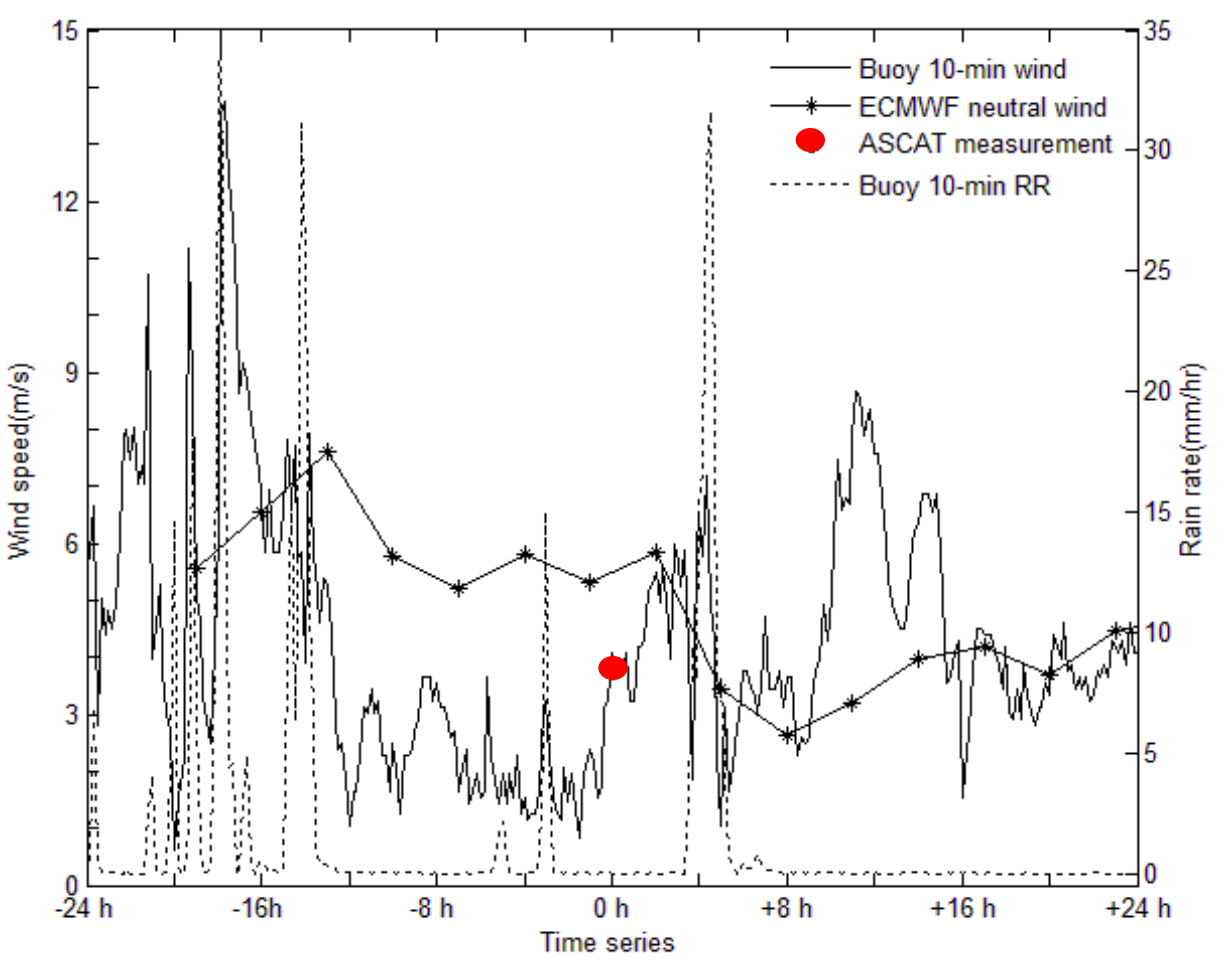
ASCAT-derived ECMWF background error by triple collocation in QC classes

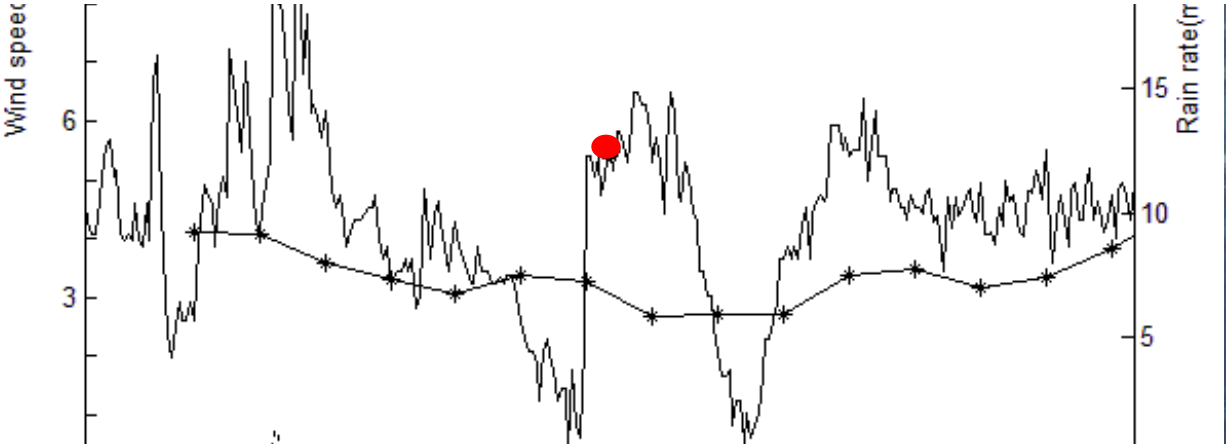
- The structure and location of ECMWF errors is not well resolved in EDA

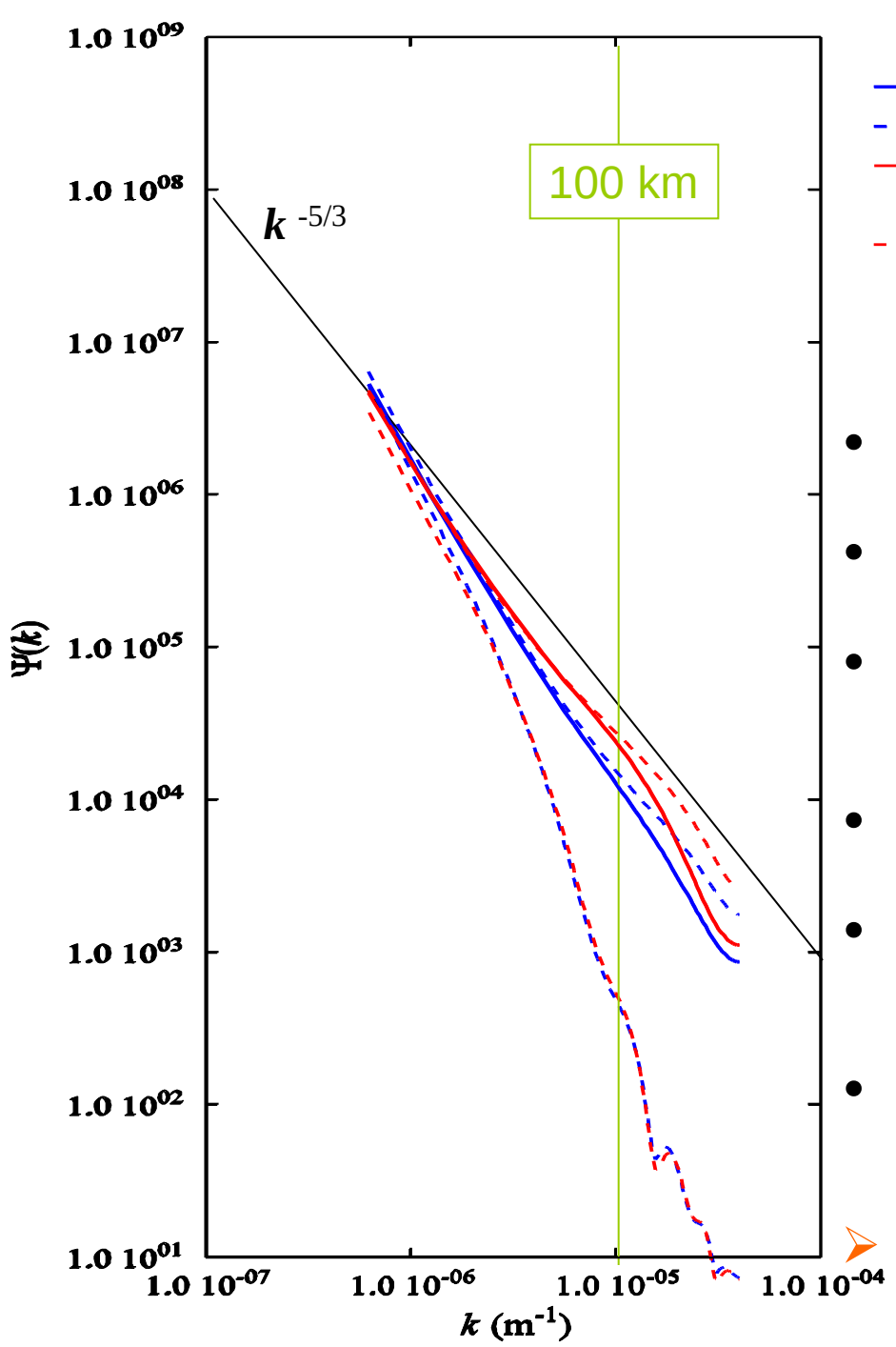
Tropical variability

- Dry areas reasonable
- NWP models lack air-sea interaction in rainy areas
- ASCAT scatterometer does a good job near rain
- QuikScat, OSCAT and radiometers are affected by rain droplets

Portabella et al., Lin et al.







u ASCAT OPS

u ASCAT EXP, *u* ECMWF (lower)

v ASCAT OPS

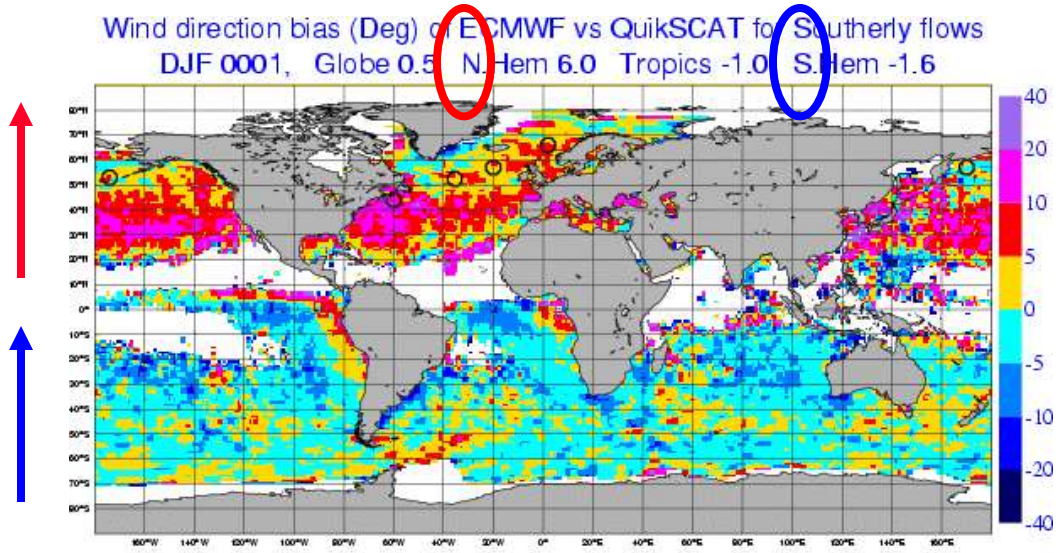
v ASCAT EXP, *v* ECMWF (lower)

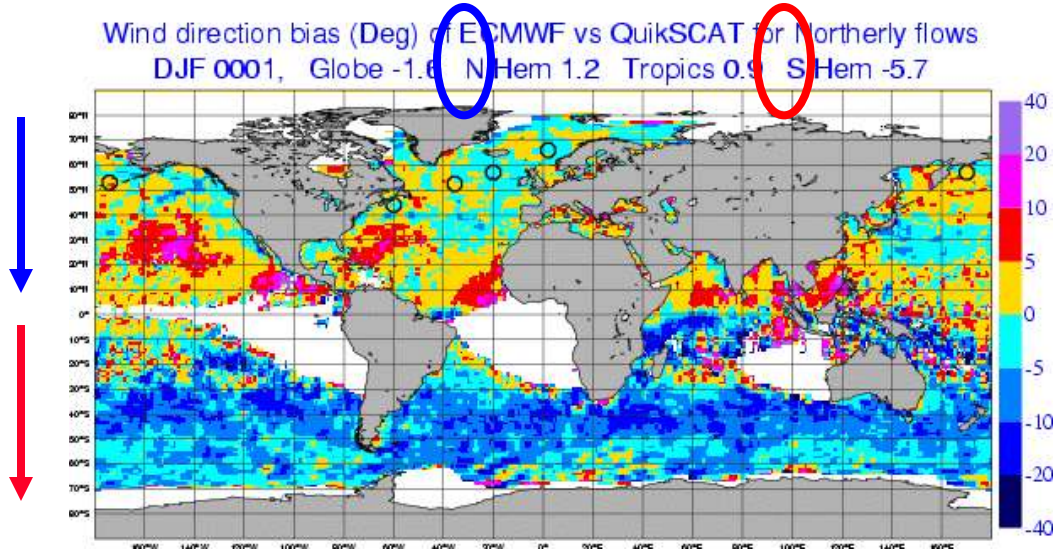
Upscale ?

- Literature provides $k^{-5/3}$ 3D turbulence spectra on scales < 500 km
- ASCAT winds follow such behavior down to 25 km scales
- Global NWP models contain an order of magnitude less variance on scales of 100 km
- Regional NWP models contain noise above sea (weak forcing)
- Developments in 3D turbulence regime from small to large scales are not well described
- Small scale wind information is particularly relevant in cases of dynamical developments (upscale)

➢ Watch scatterometer winds above sea

Lack of cross-isobar flow in NWP





QuikSCAT vs model wind dir
Stratify w.r.t. Northerly, Southerly wind direction.
(Dec 2000 – Feb 2001)

- **Large effect warm advection**
- **Small effect cold advection**
- **Similar results for NCEP**

A. Brown et al., 2005

I. Sandu et al., ECMWF (2013)

Does Dynamical Downscaling With Regional Climate Models add Value to Surface Marine Wind Speed From Reanalyses?

Jörg Winterfeldt[1*], Ralf Weisse[1], Matthias Zahn[1]

[1]Institute of Coastal Research, GKSS Research Centre, Geesthacht, Germany

*joerg.winterfeldt@gkss.de

Simulations with RCMs REMO and CLM: *(available from* coastDat *Database)*

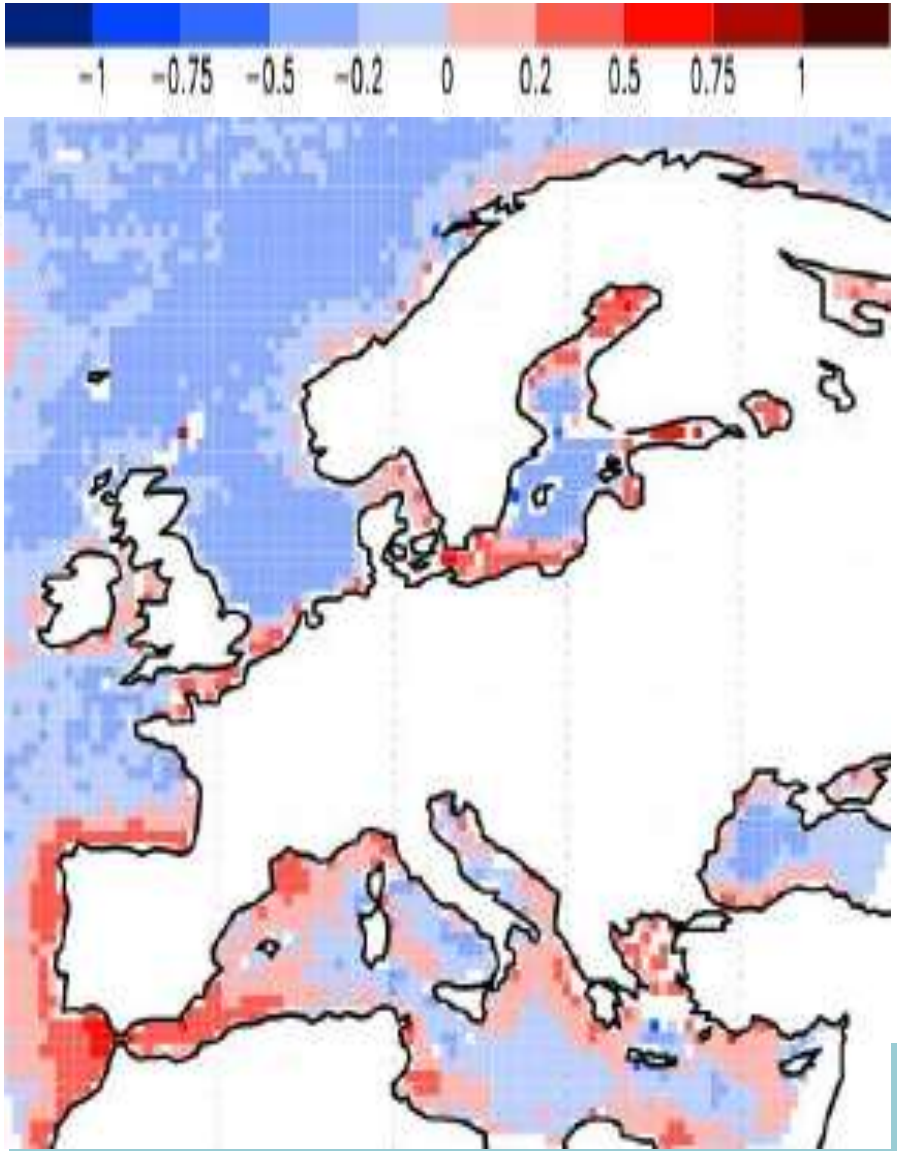
- Three hindcasts with RCMs REMO (Jakob and Podzun, 1997) and CLM (Böhm et al. 2006)
- Initialization and forcing at lateral boundaries: NCEP/NCAR-Reanalysis (NRA), ~1.875° resolution,
- SN-REMO & CLM hindcasts are additionally forced by spectral nudging (von Storch et al., 2000)

Hindcast	*STD-REMO (Standard)*	*SN-REMO*	*CLM*
Based on:	EM	EM	LM
	Hydrostatic	Hydrostatic	Non-hydrostatic
Forcing:	NRA	NRA	NRA
Spectral Nudging:	No	Yes	Yes
Resolution:	0.5°	0.5°	0.44°

- For that purpose a gridded QuikSCAT Level 2B 12.5 km swath (L2B12) data set is produced on SN-REMO grid (rain flagged L2B12 data discarded)
  co-location with SN-REMO: QuikSCAT wind speed retrieval max. 12.5 km and +/- 10 min from SN-REMO grid point / time step

- Modified BSS = $\begin{cases} 1 - \sigma_F^2 \sigma_R^{-2} & \text{if } \sigma_F^2 \le \sigma_R^2 \\ \sigma_R^2 \sigma_F^{-2} - 1 & \text{if } \sigma_F^2 > \sigma_R^2 \end{cases}$

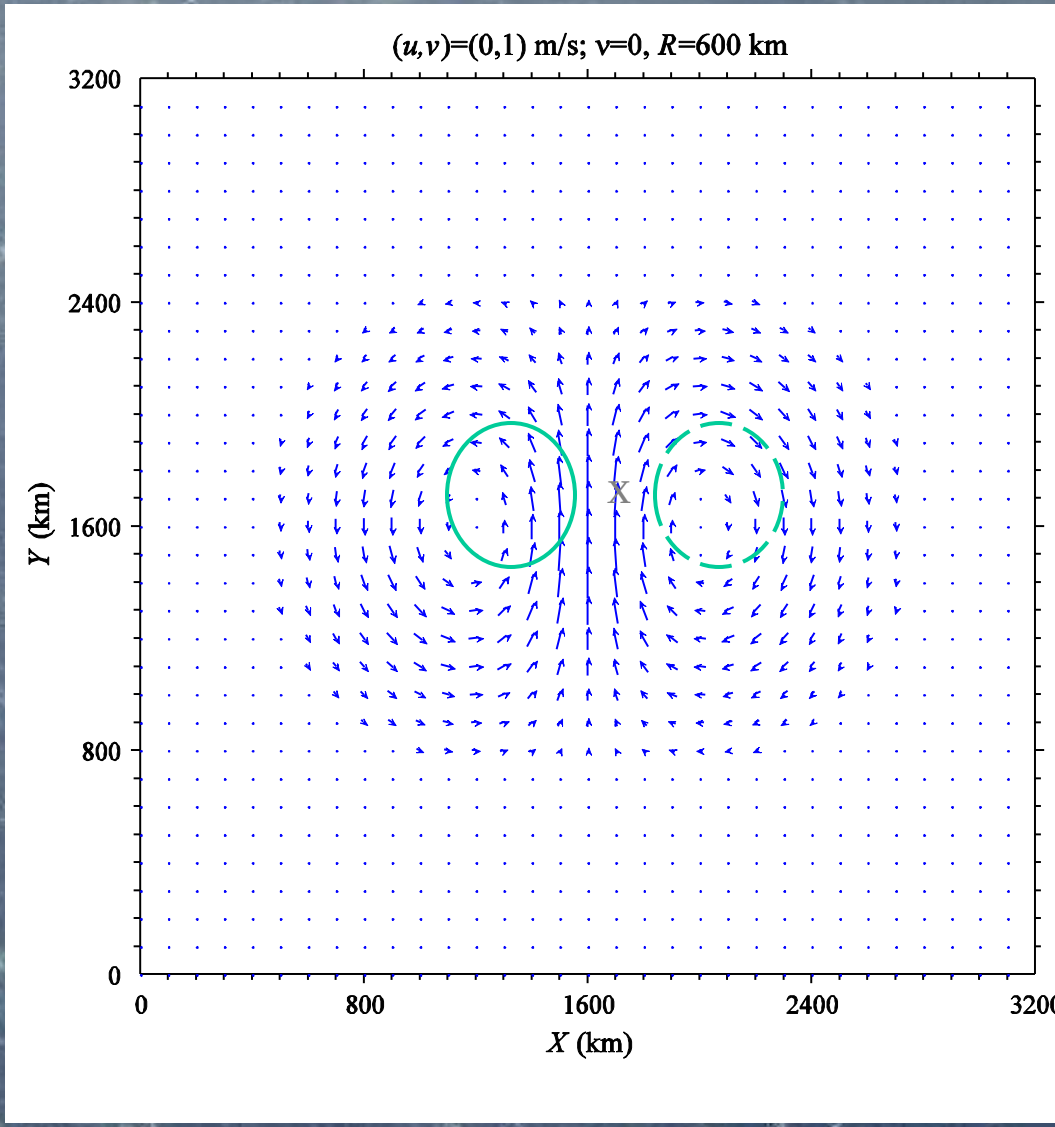
- "Forecast" F: SNREMO, reference "forecast" R: NRA, predictand/observation: gridded QuikSCAT L2B12 data



Using observations in NWP

- Use of short-range forecast containing all observed information from the past
- One new observation influences a large area
- A change in the wind field by an observation implies a change in the mass field (balance mass/wind)
- Relatively few 4D observations determine the weather evolution

➢ Small scales remain the most difficult to determine due to the limited global observing system



HARMONIE from ECMWF

- HSCAT scatterometer 50 km
- HARMONIE effective resolution 25 km, grid 2.5 km

(m/s)	bias u_{10m}	stdev u_{10m}	bias v_{10m}	stdev v_{10m}
HSCAT	(23.961 collocations); $\overline{\Delta t} = -0.29$; $\overline{\lvert\Delta t\rvert} = 0.85$			
$(o - b)$	-0.46	1.61	-0.24	1.57
$(o - b_t)$	-0.46	1.36	-0.22	1.29
$(o - \bar{b}_t)$	-0.45	1.25	-0.22	1.18

Temporal interpolation:

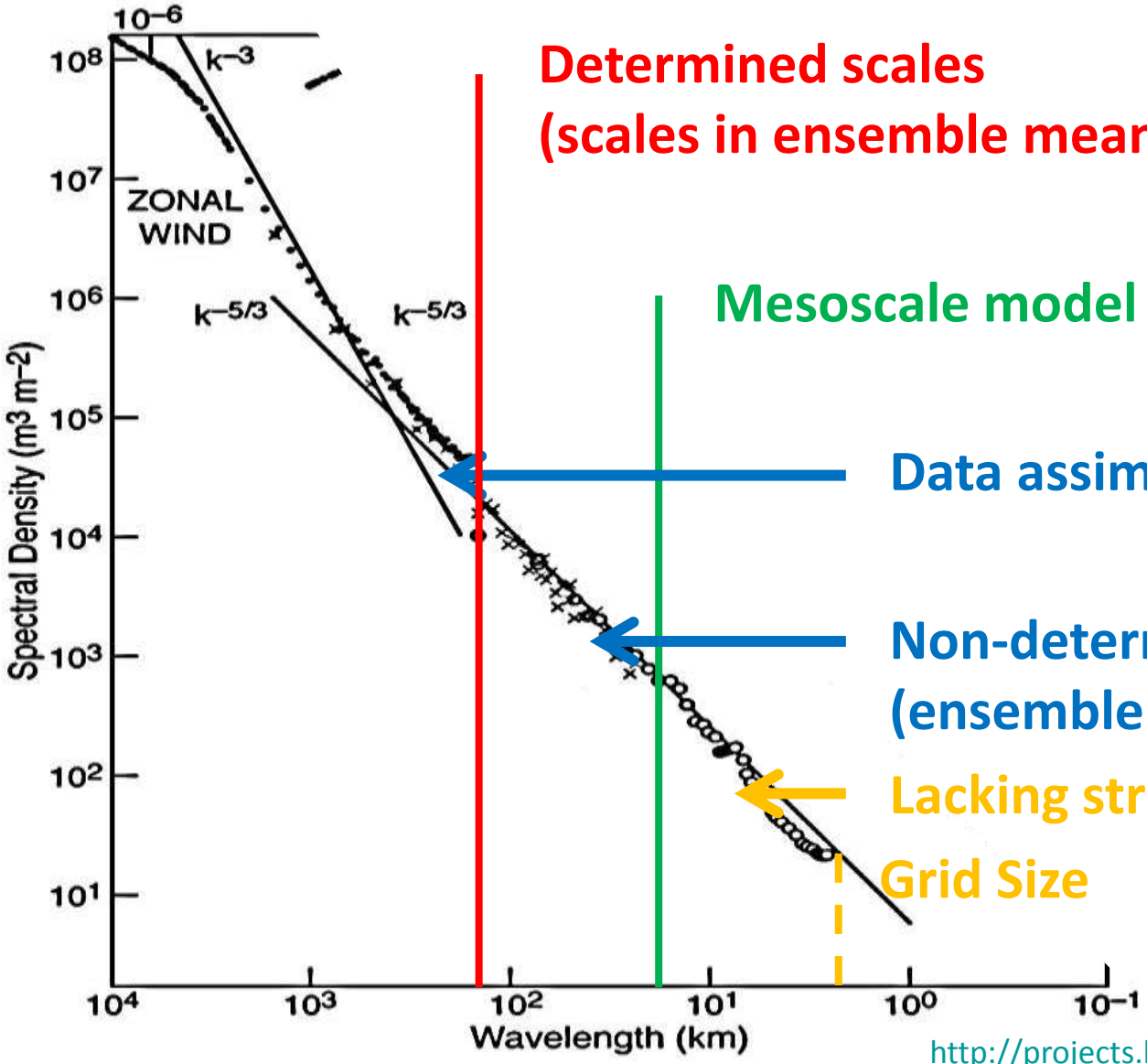
+ spatial averaging:

- ECMWF:

	t_f	bias u_{10m}	stdev u_{10m}	bias v_{10m}	stdev v_{10m}
HSCAT	5.6	-0.11	1.09	0.05	1.15

- ECMWF 6-hour forecast better than matched 50-km scale time-interpolated HARMONIE background
- ECMWF resolution is ~150 km over the open ocean
- Deterministic resolution HARMONIE ≈ ECMWF over sea

Mesoscale Data Assimilation Strategy



Determined scales
(scales in ensemble mean)

Mesoscale model resolution

Data assimilation (B)

Non-determined scales
(ensemble spread)

Lacking structure (model closure)

Grid Size

http://projects.knmi.nl/scatterometer/training_material/

Model winds

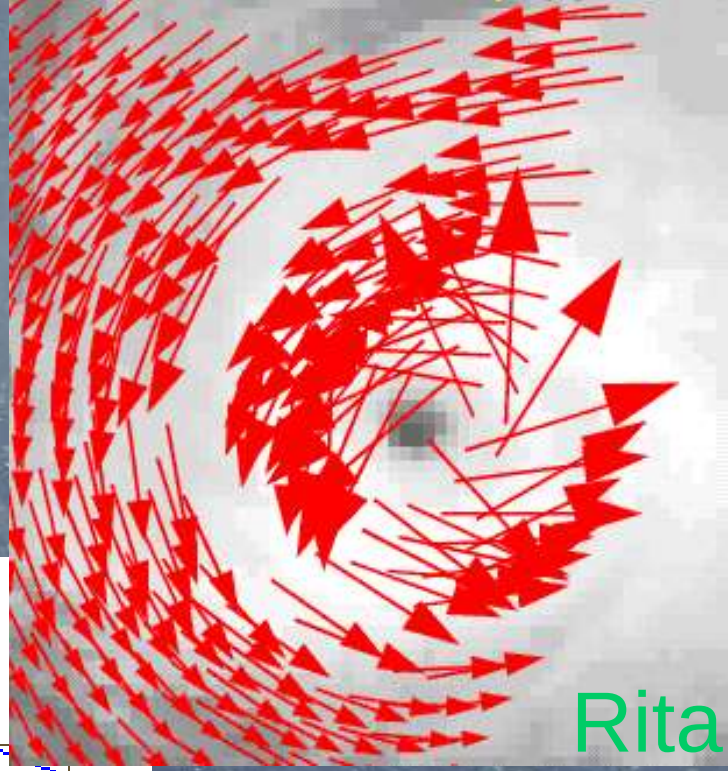
- Are initialized from observations in a DAS
- Are improving and are the forecasters' reference
- New observations are not used in models (up to 12 hour lag)
- A lot can happen in 12 hours on the mesoscale
- Differences between new and timely observations and short-range model forecasts affect the forecasters warnings, either current ones or in future
- Lack true mesoscale variability, since poorly observed in 4D
- Are not so good in the tropics or elsewhere near convection (e.g., polar lows)
- Have some systematic wind biases (in stable air, ocean currents, diurnal cycle, ..)

Scatterometer Winds for NRT Support to Mesoscale Forecasting

- Introduction
- Scatterometer wind observations
- NWP model winds
- Mesoscale forecasting

Scatterometer

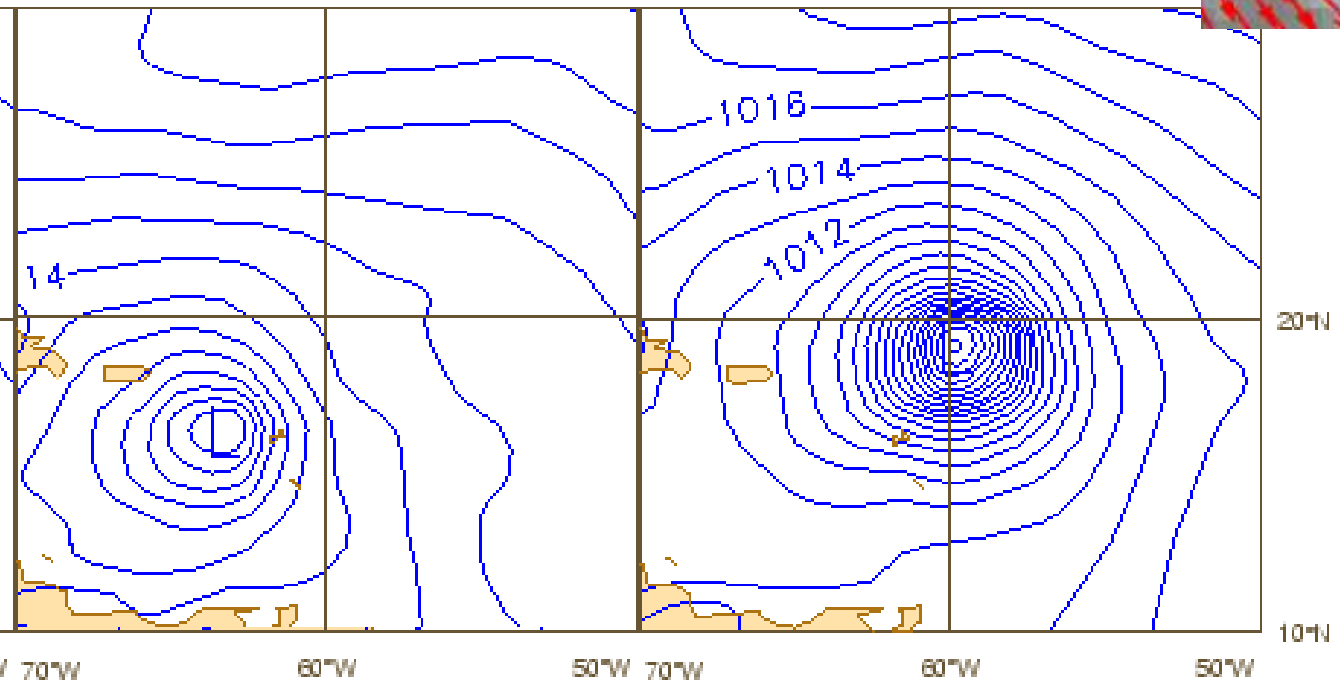
- Improved forecasts of tropical hurricanes



Isaksen & Stoffelen, 2000

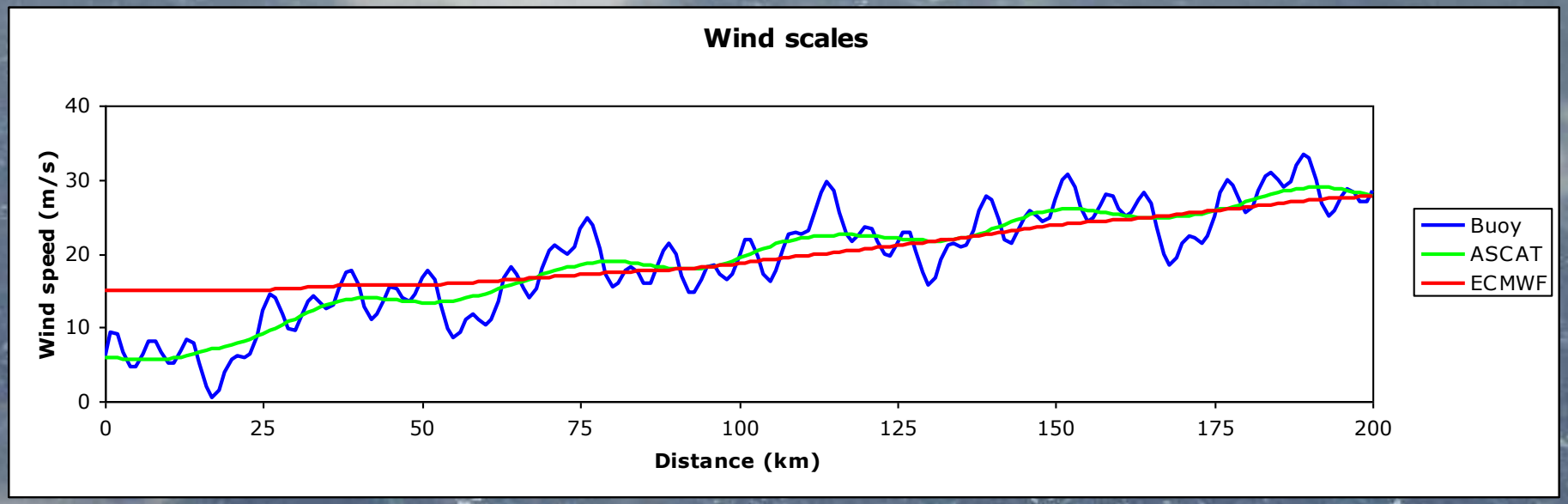
No ERS Scatterometer

With ERS

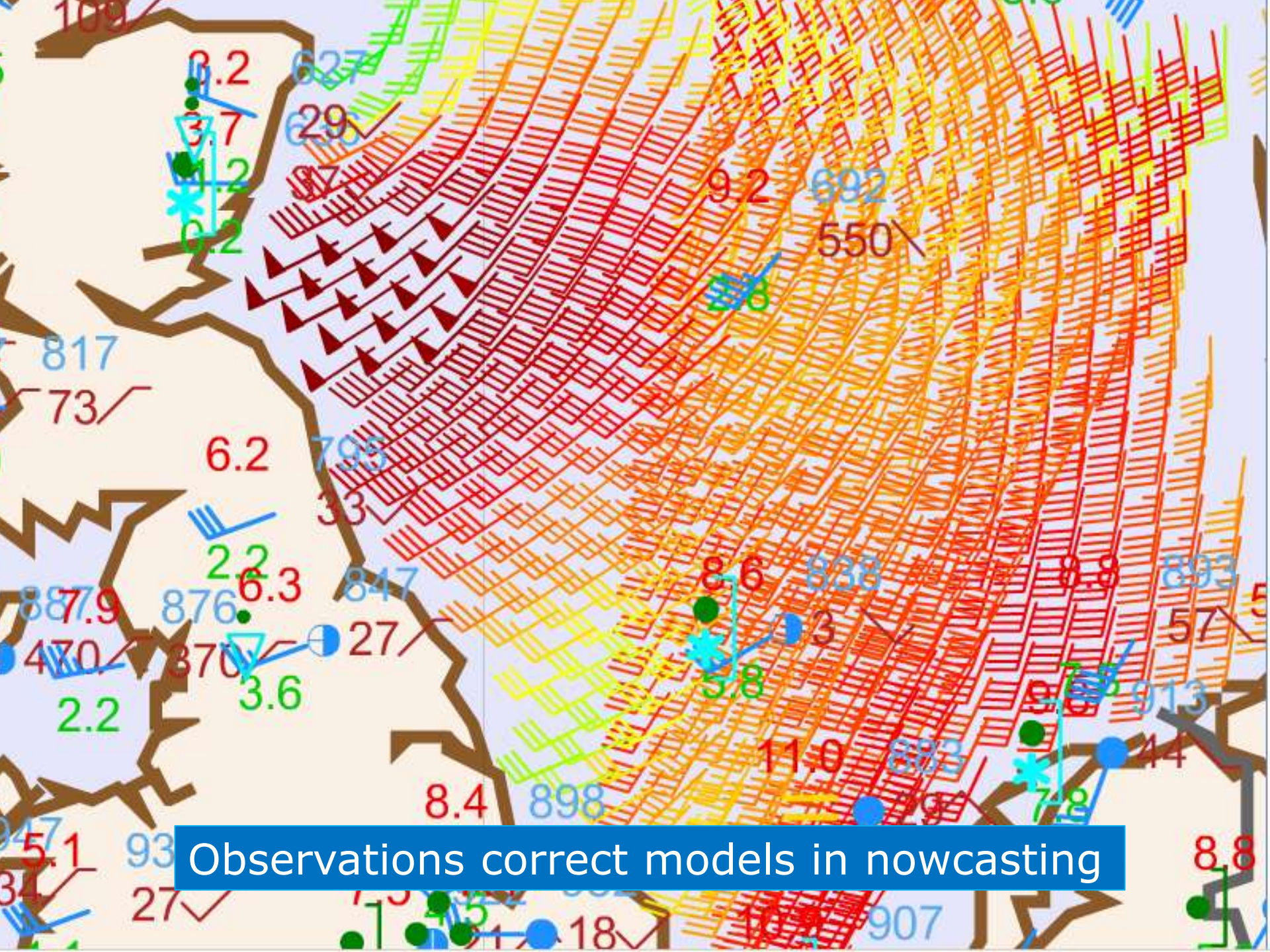


Mainly by improved vertical projection in 4D-VAR

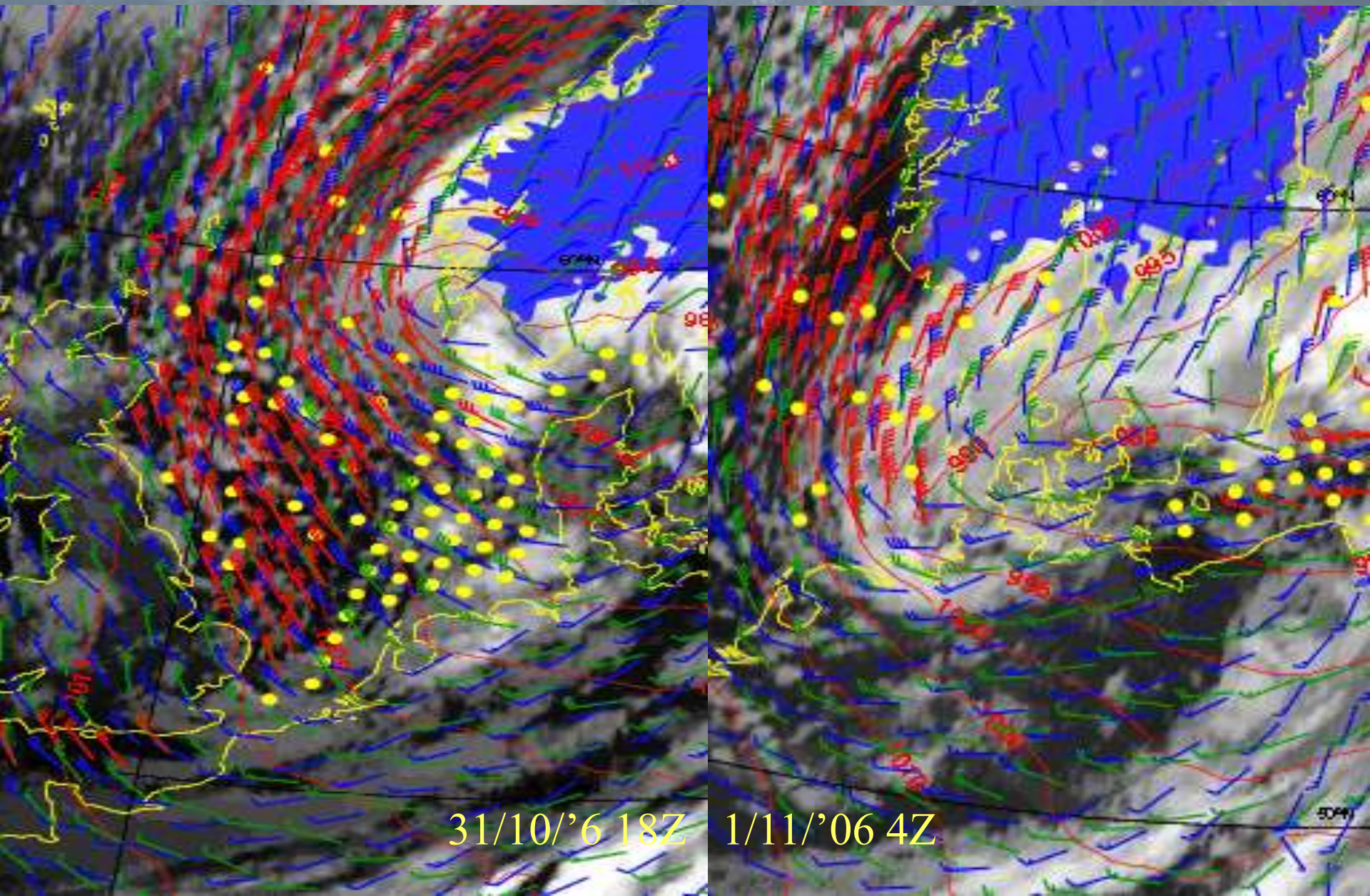
Spatial representation



- We estimate area-mean (WVC) winds using the empirical GMFs
- 25-km areal winds are less extreme than 10-minute sustained in situ winds (e.g., from buoys)
- So, extreme buoy winds should be higher than extreme scatterometer winds (allow for gustiness factor)
- Extreme global NWP winds are again somewhat lower due to lacking resolution ; all have different PDFs!

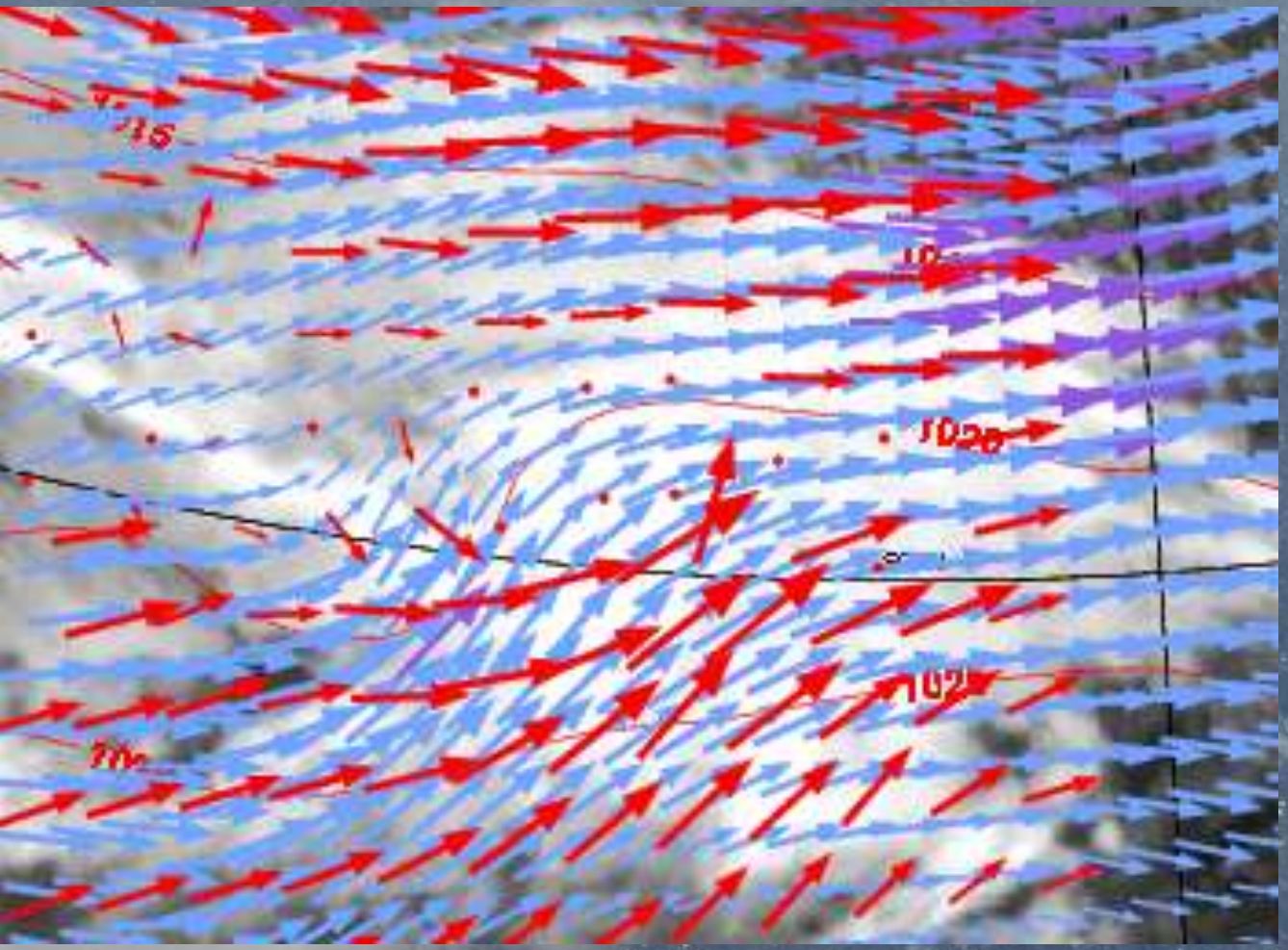

Observations correct models in nowcasting

Storm surge Delfzijl



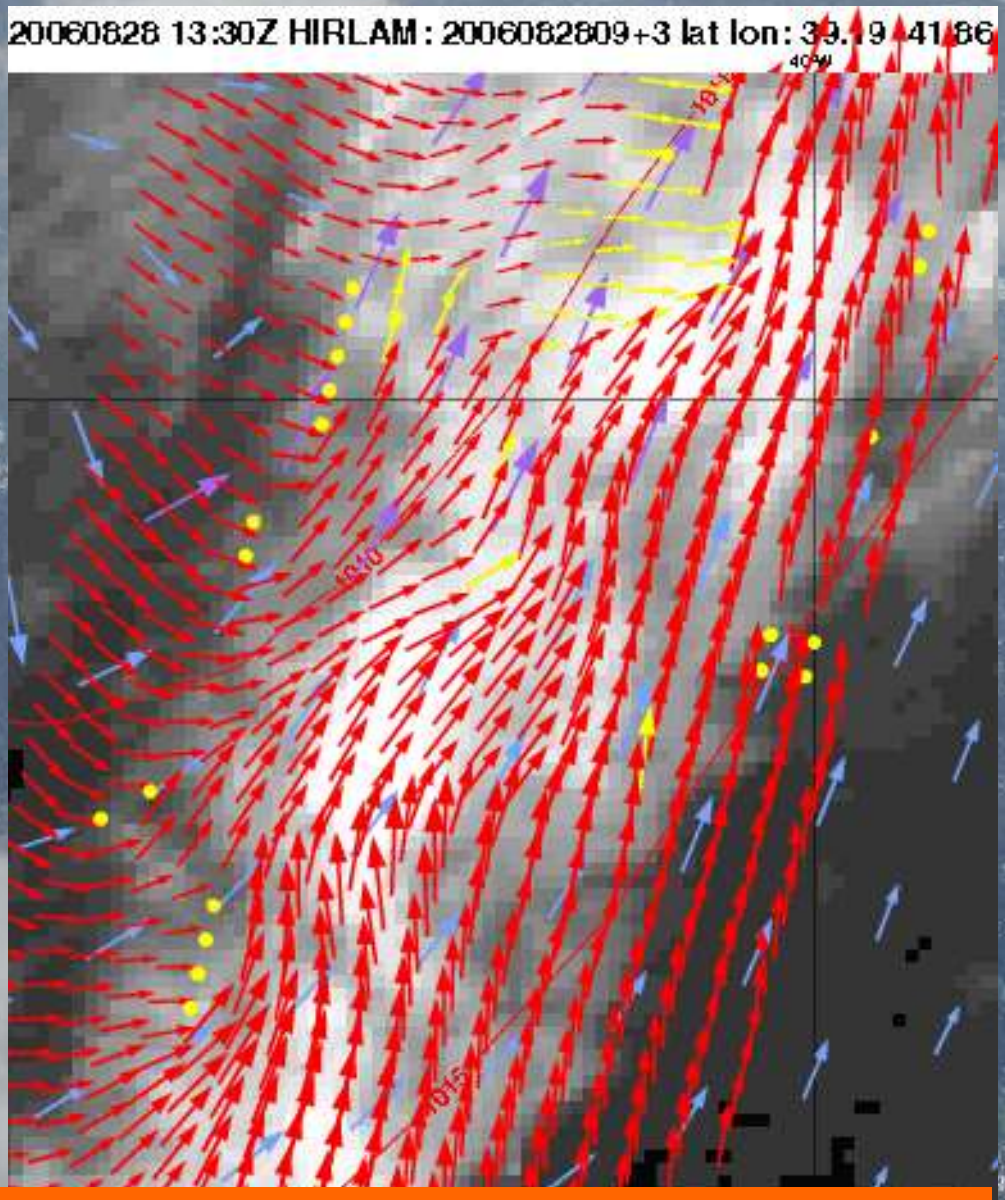
NWP Impact @ 100 km

29 10 2002

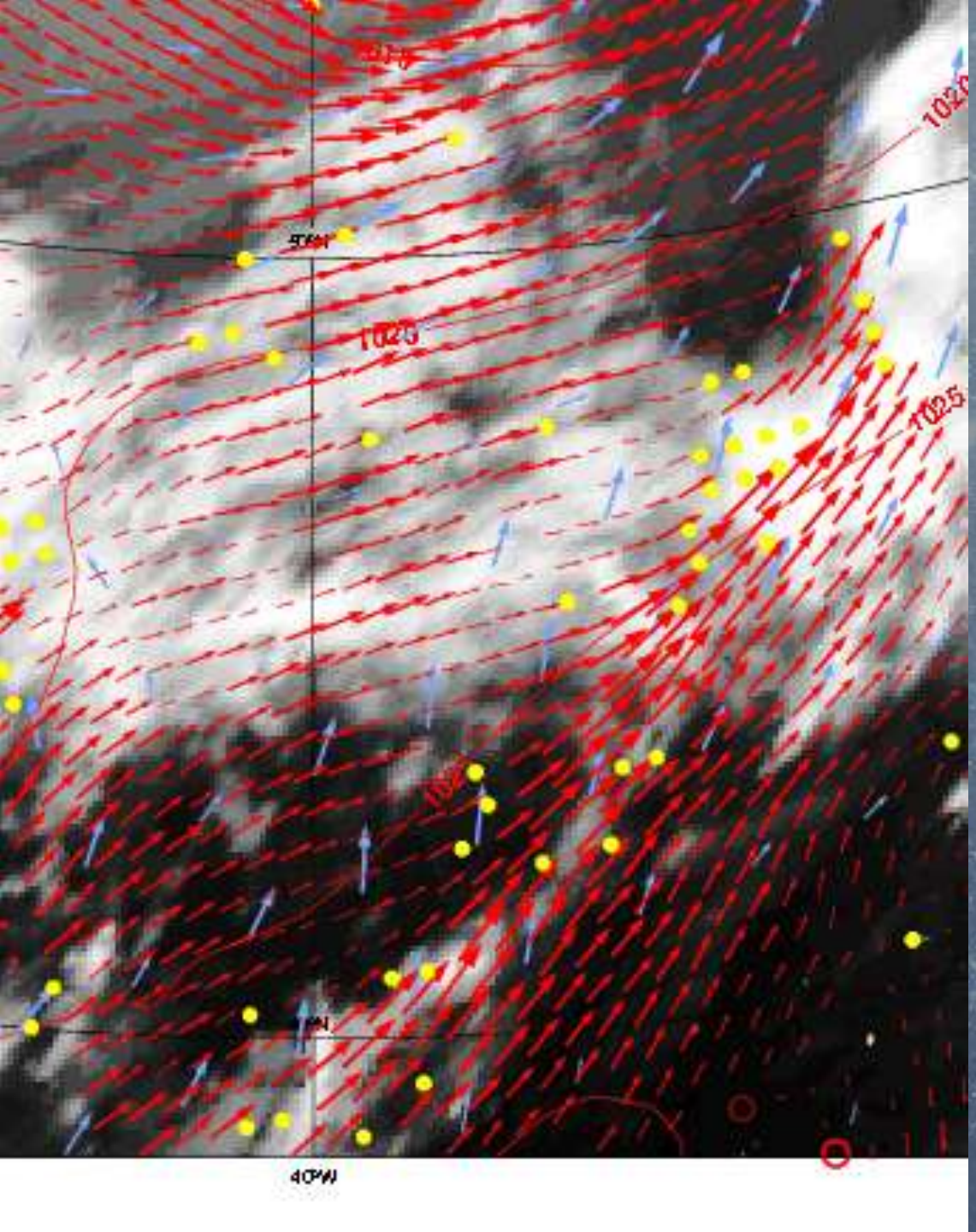


Storm near

HIRLAM misses wave; SeaWinds should be beneficial!



ERS-2 scatterometer wave train; missed by HiRLAM



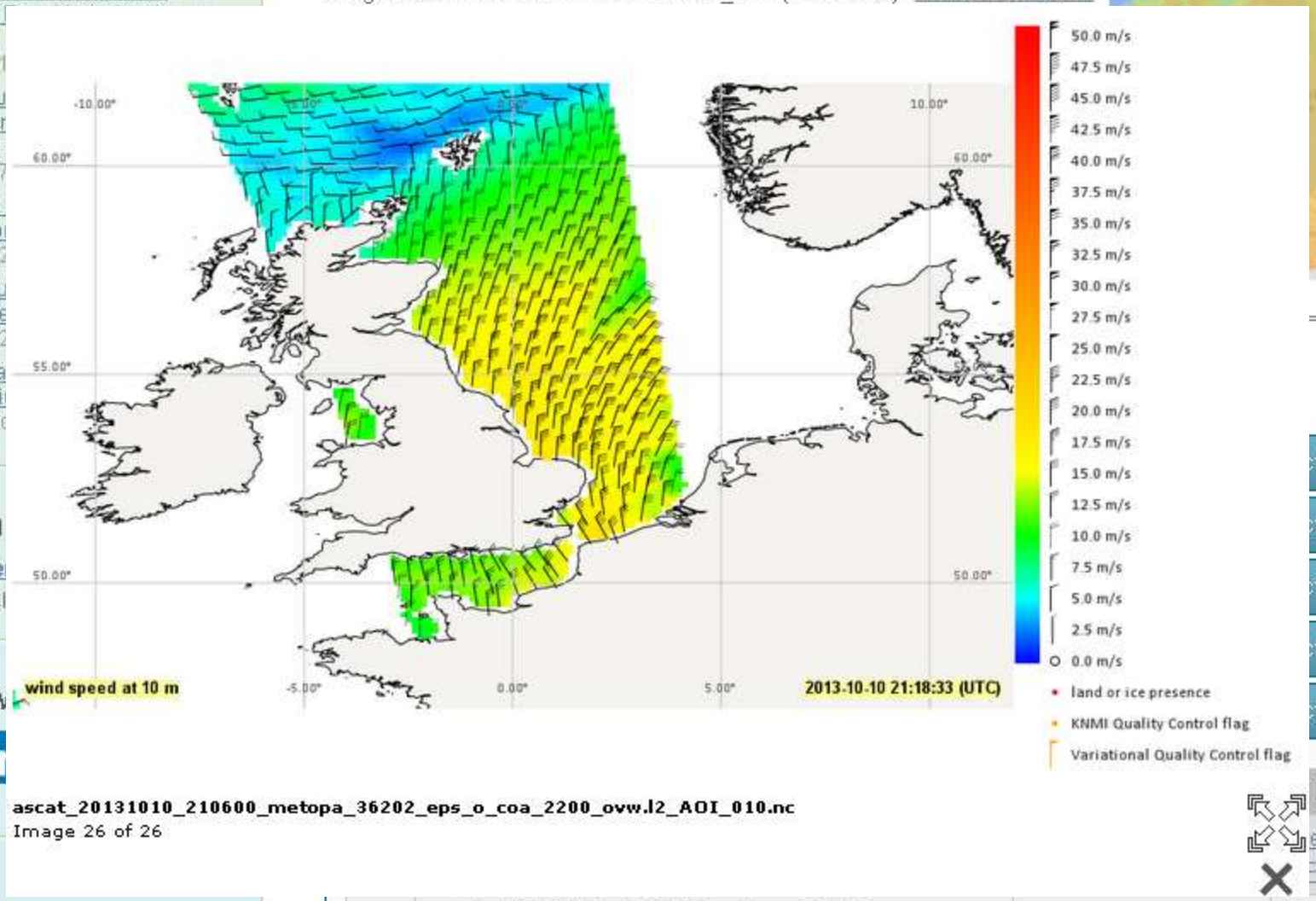
Missed wave train in QuikScat

www.storm-surge.info/sev-data-access?sev=/sears/SEV/135

North Sea surge 10 Oct 13 (2013-10-10)

SEV ID: eS_SEV20131010/AOI_010.

Surge event dated 2013-10-10 in AOI_010 (North sea). More information



ascat_20131010_210600_metopa_36202_eps_o_coa_2200_ovw.l2_AOI_010.nc

Image 26 of 26

Project News

Applications for eSurge's Training
Open
Monday 1

Storm su
significar
altimetry
Monday 7

Typhoon
Hong Ko
Monday 2

Storm Su
2013: Pl
Monday 2

eSurge a
Symposi
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Get in

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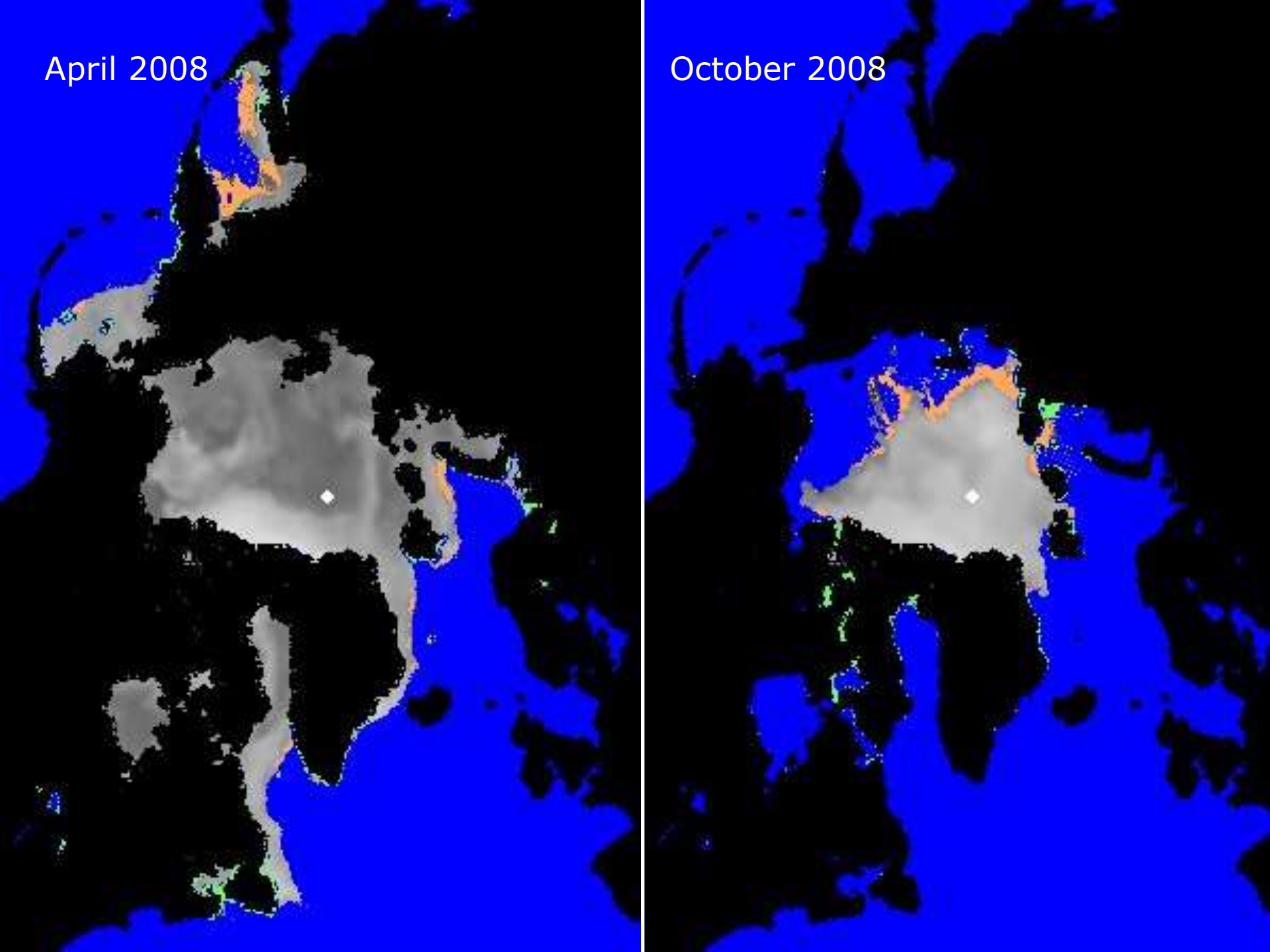
Follow

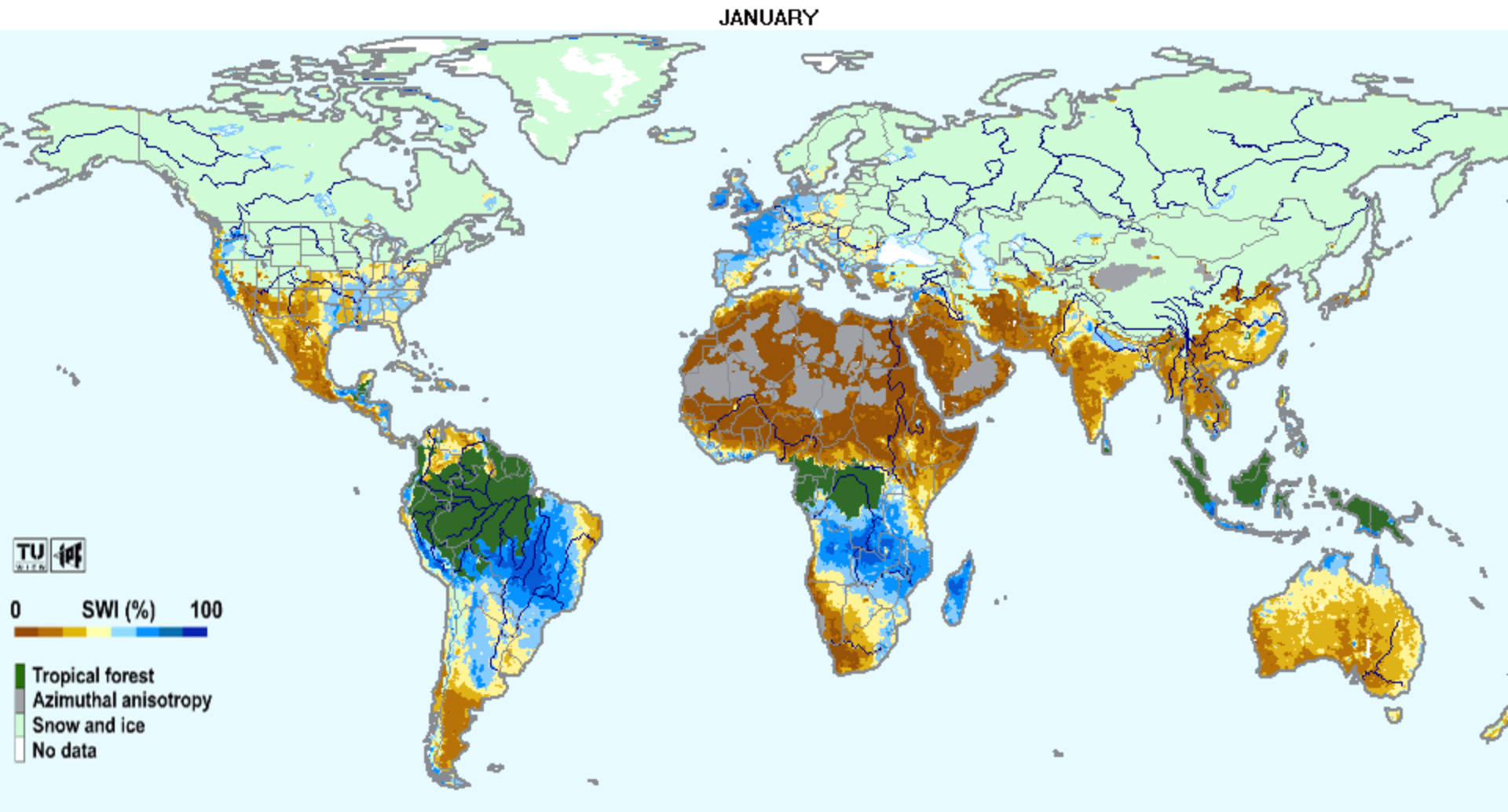
Info
Info
Info
Info
Info

Links
eview
PeNDAP

☐	ascat_20131006_104200_metopa_36139_eps_o_coa_2200_ovw.l2_AOI_010.nc	2013-10-06T11:11:37	Preview OPeNDAP
☐	ascat_20131006_190900_metopa_36144_eps_o_co	2013-10-06T19:20:50	Preview


April 2008
October 2008

Soil Water Index



Vegetation and rain too

Further references

- scat@knmi.nl
  - Registration for data, software, service messages
  - Help desk
- EUMETCAST, RMDCN, KNMI FTP
- www.knmi.nl/scatterometer
  - Multiplatform viewer, tiles!
  - Status, monitoring, validation
  - User Manual
- EUMETrain forecasters forum
- NWP SAF monitoring www.metoffice.gov.uk/research/interproj/nwpsaf/monitoring.html
- Copernicus Marine Environment Monitoring Service marine.copernicus.eu/

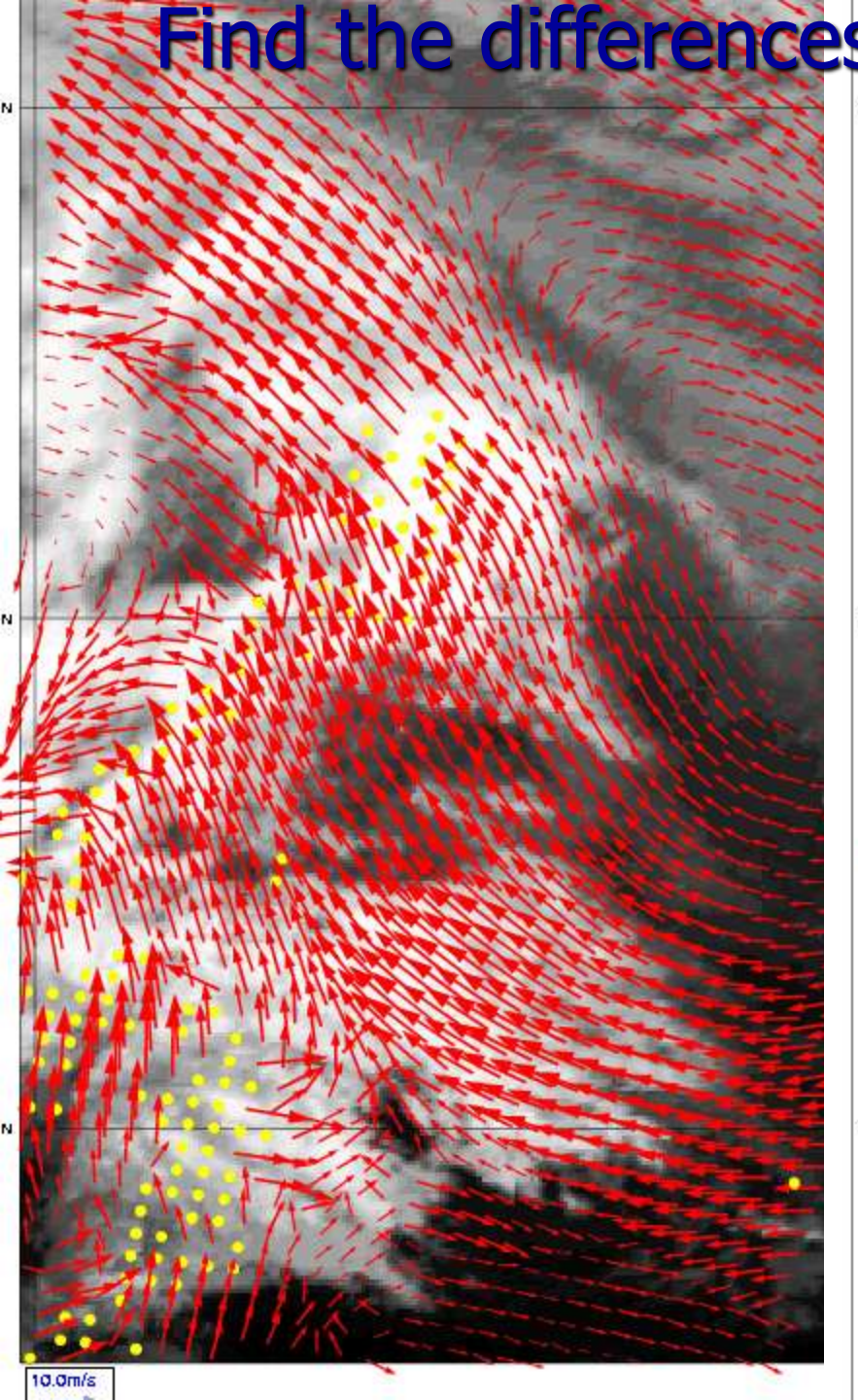
Training/interaction

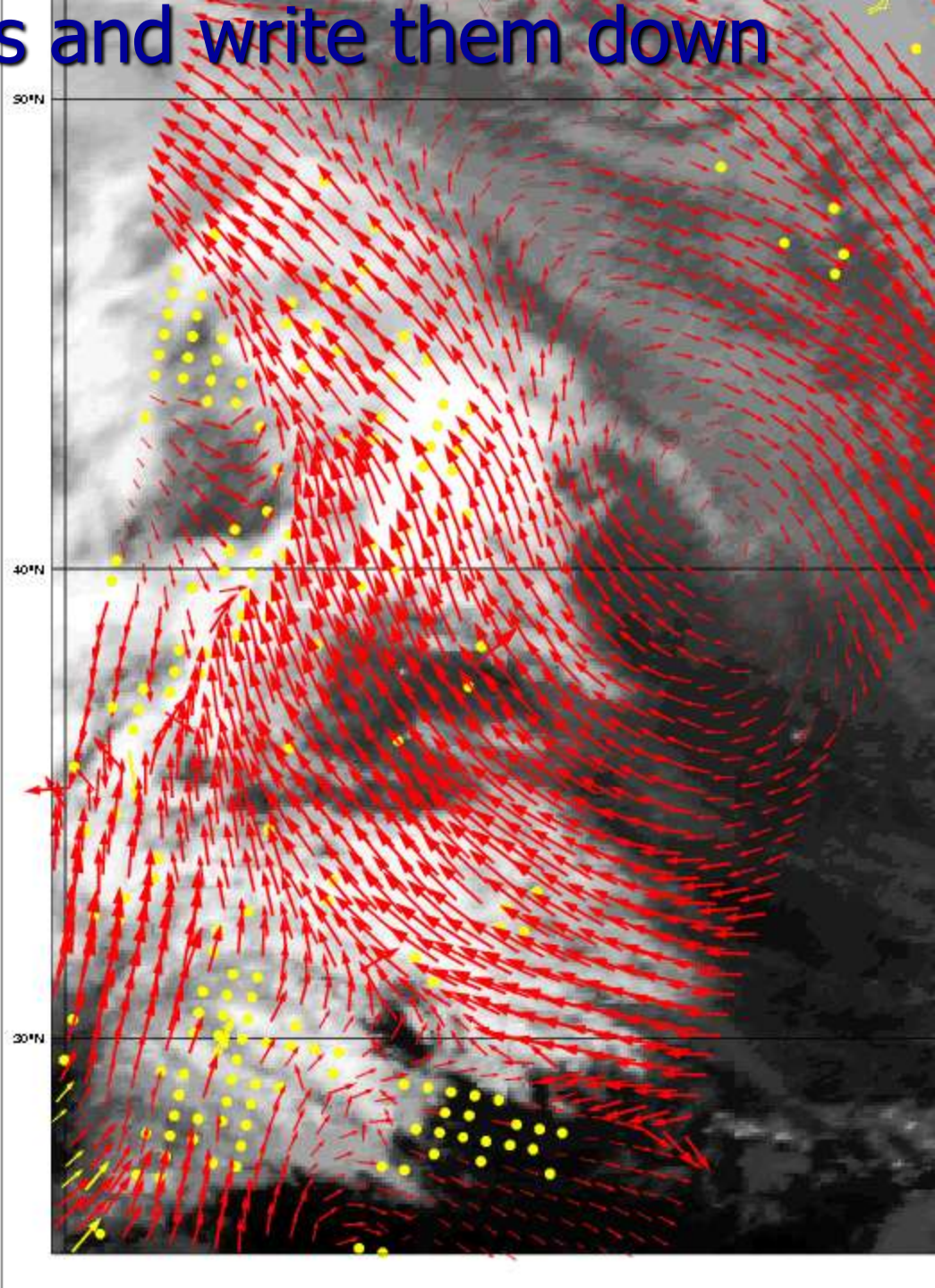
- Training Course Applications of Satellite Wind and Wave Products for Marine Forecasting vimeo.com/album/1783188 (video)
- Forecasters forum training.eumetsat.int/mod/forum/view.php?f=264
- Xynthia storm case www.eumetrain.org/data/2/xynthia/index.htm
- EUMETrain ocean and sea week eumetrain.org/events/oceansea_week_2011.html (video)
- NWP SAF scatterometer training workshop nwpsaf.eu/site/software/scatterometer/
- Use of Satellite Wind & Wave Products for Marine Forecasting training.eumetsat.int/course/category.php?id=46 and others
- Satellite and ECMWF data vizualisation eumetrain.org/eport/smhi_12.php?
- MeteD/COMET training module www.meted.ucar.edu/EUMETSAT/marine_forecasting/

Ocean references

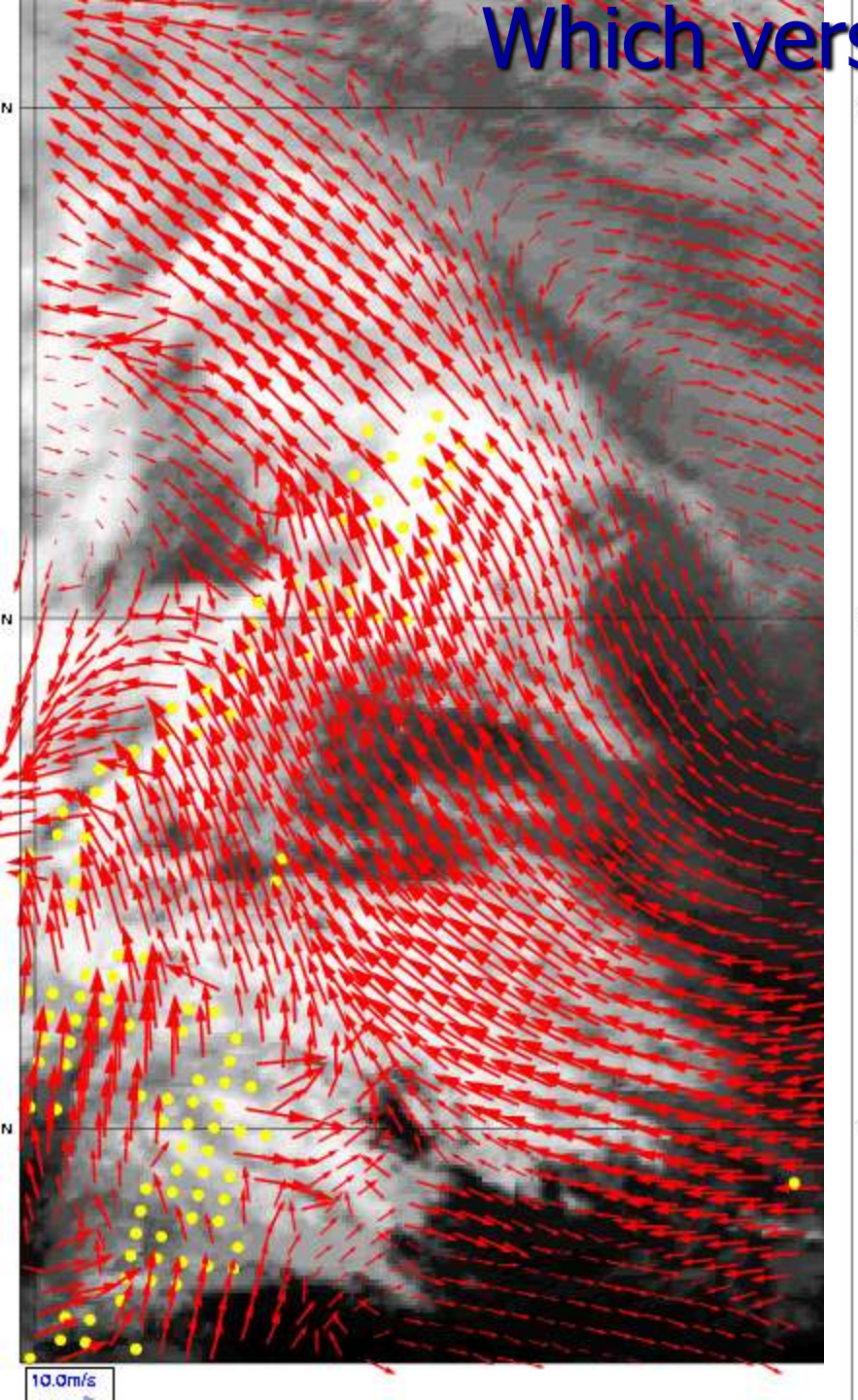
- CMEMS, marine.copernicus.eu/
- PODAAC, podaac.jpl.nasa.gov/
- eSurge, www.storm-surge.info/
- MyWave
- 2016 scatterometer conference, www.eumetsat.int/Home/Main/Satellites/Metop/index.htm?l=en
- IOVWST, coaps.fsu.edu/scatterometry/meeting/

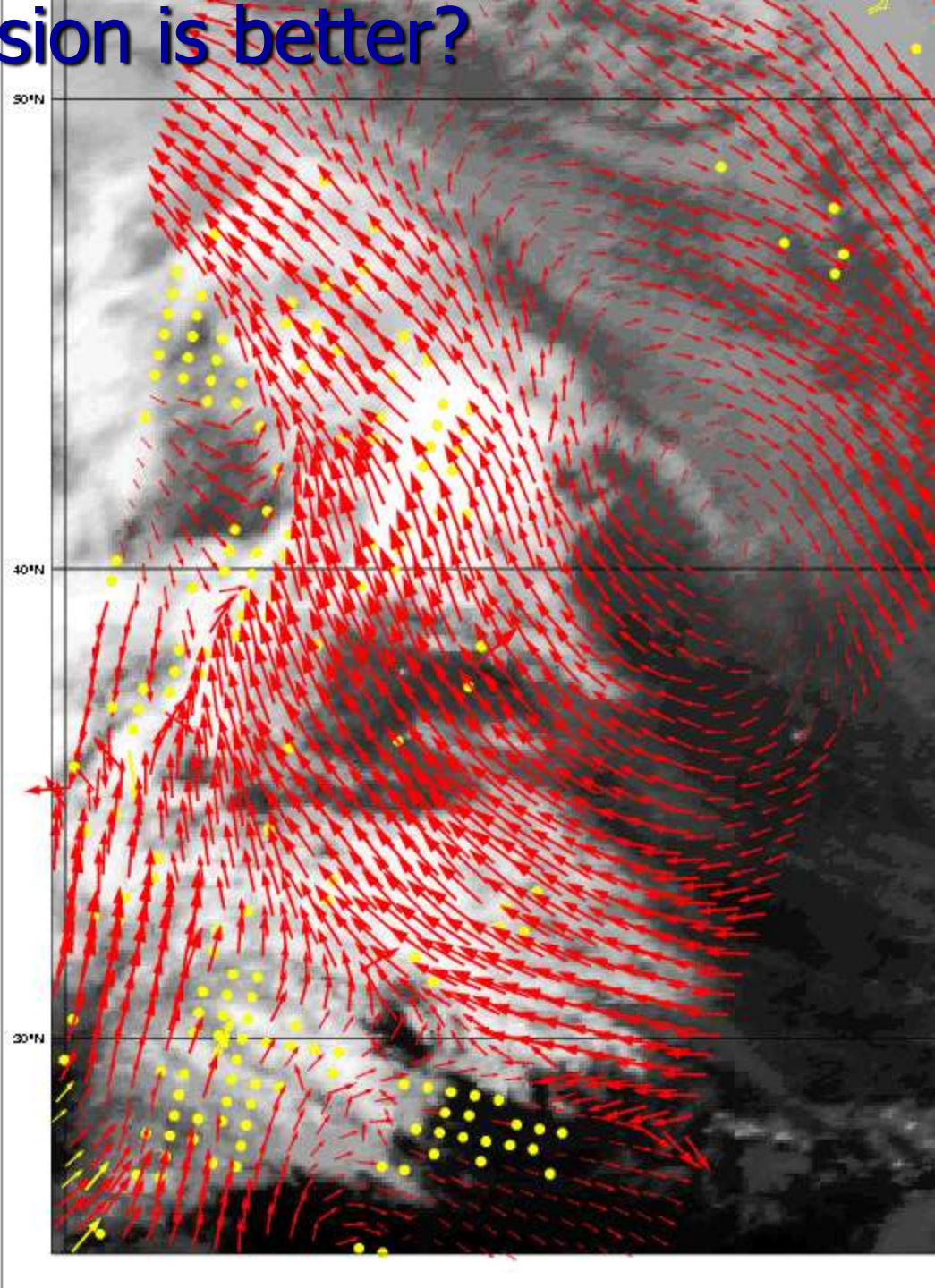
Find the differences and write them down

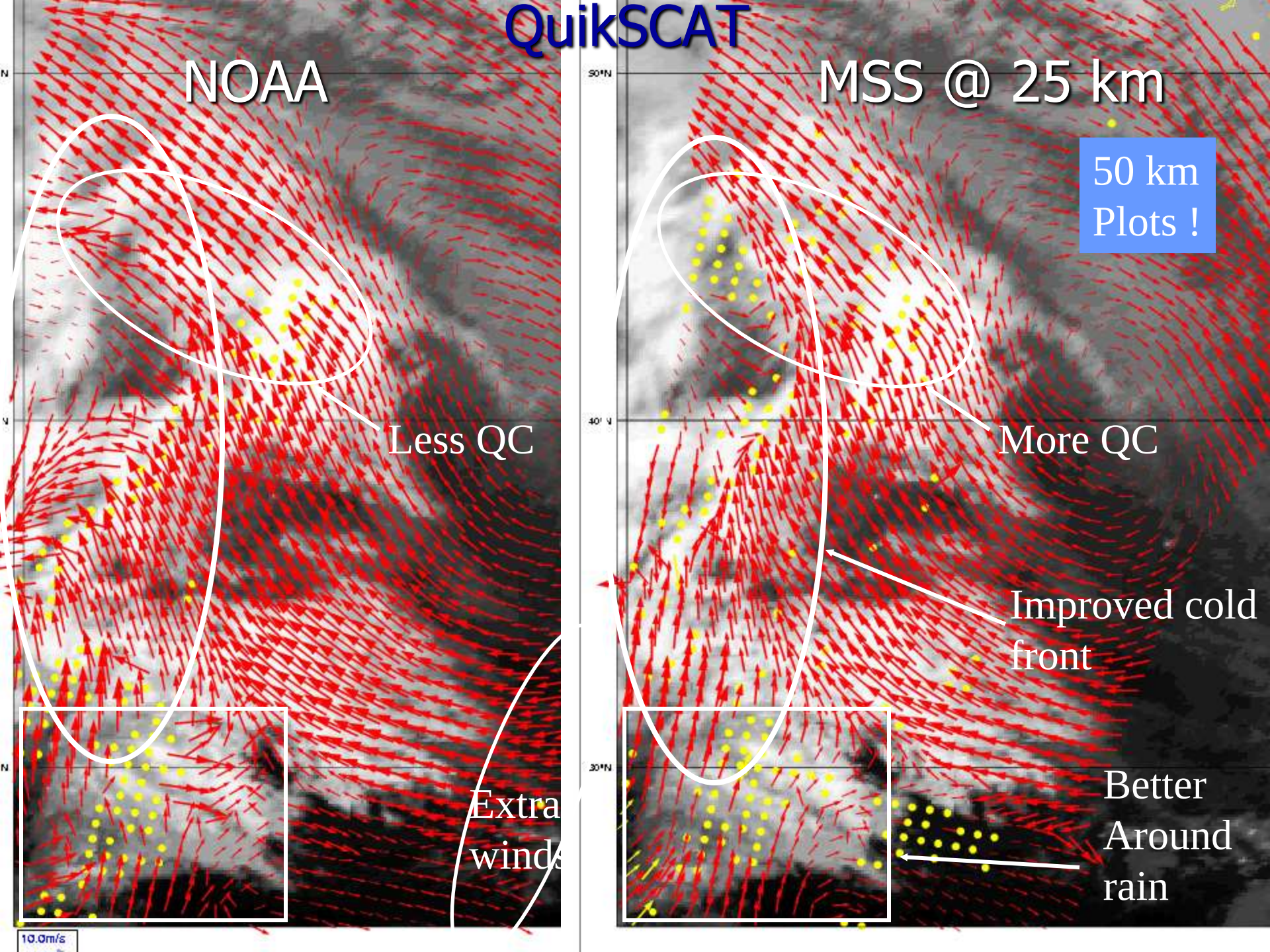


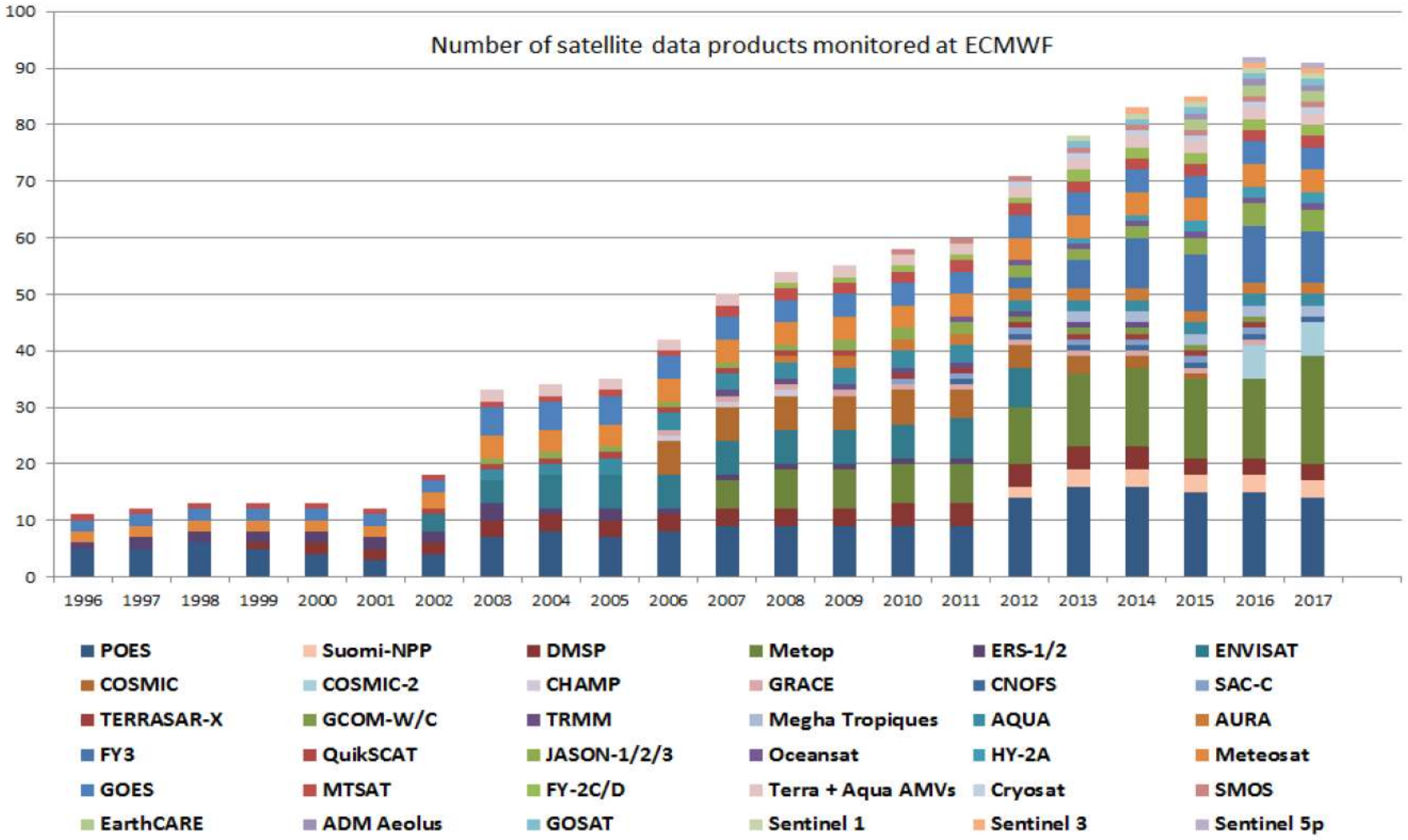


Which version is better?



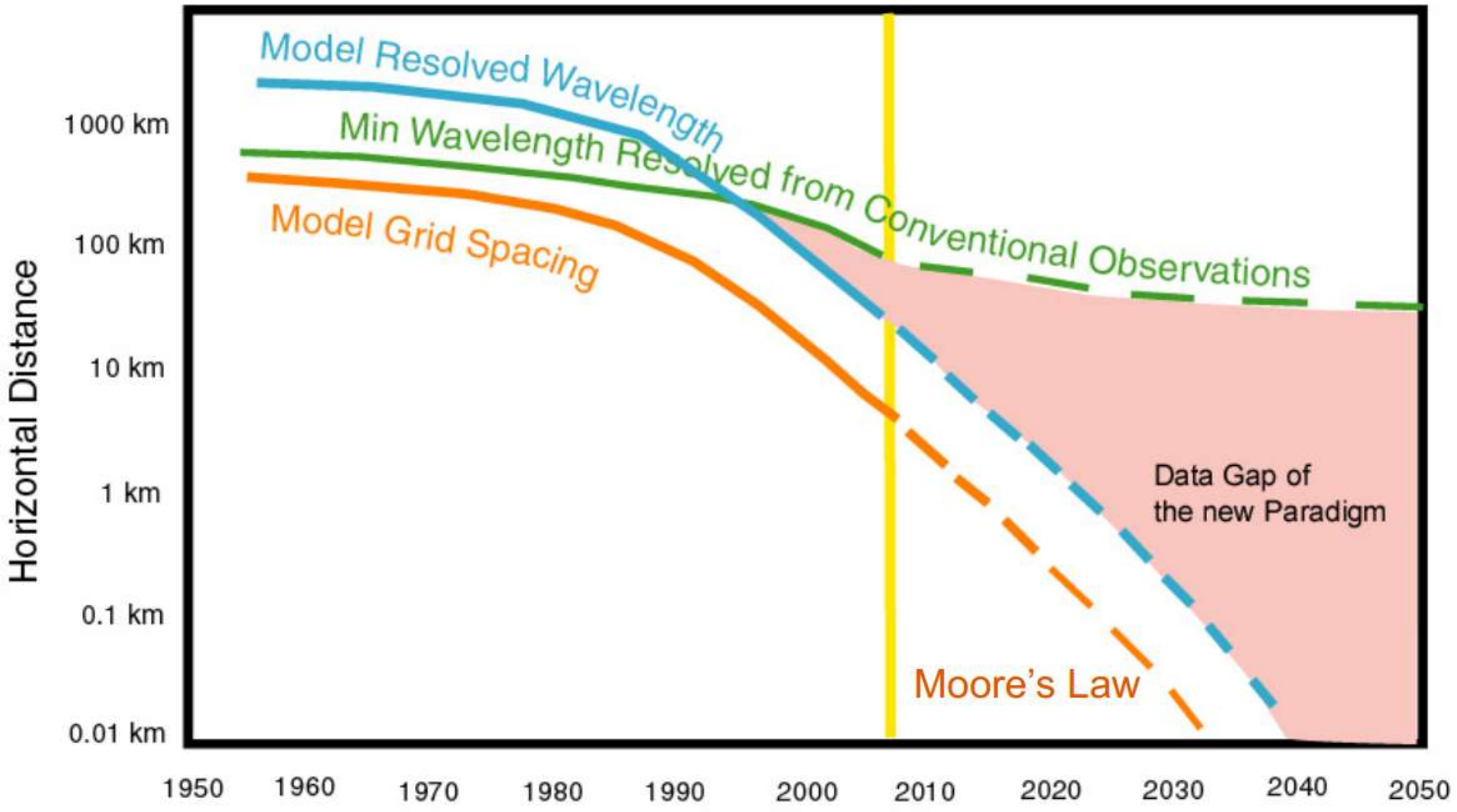


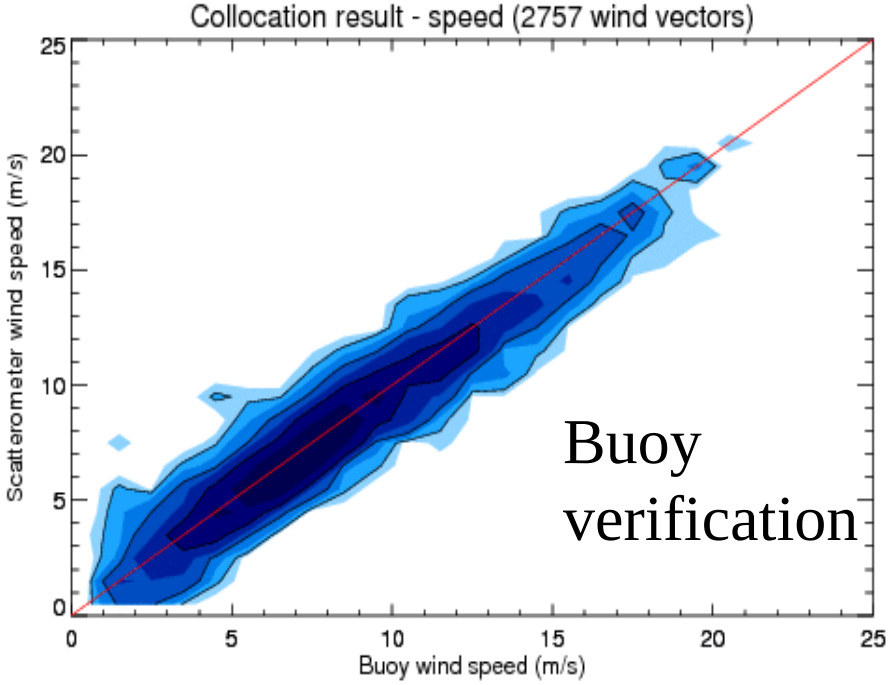

QuikSCAT
NOAA
MSS @ 25 km
50 km
Plots !
Less QC
More QC
Improved cold
front
Extra
winds
Better
Around
rain
10.0m/s



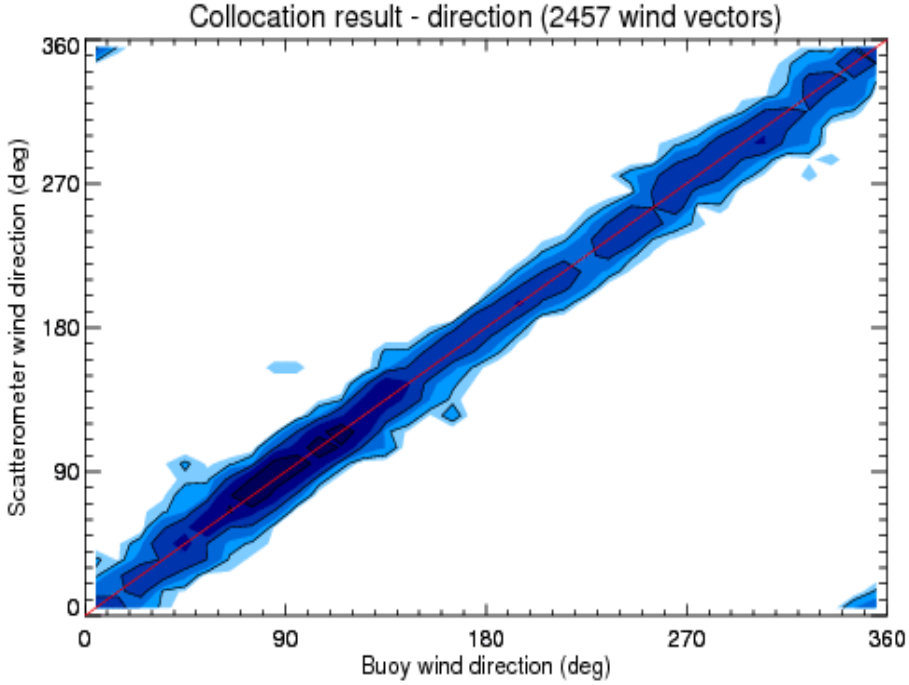
- Still new satellites with new instruments
- Are they all useful for nowcasting?
- What observations are needed ?

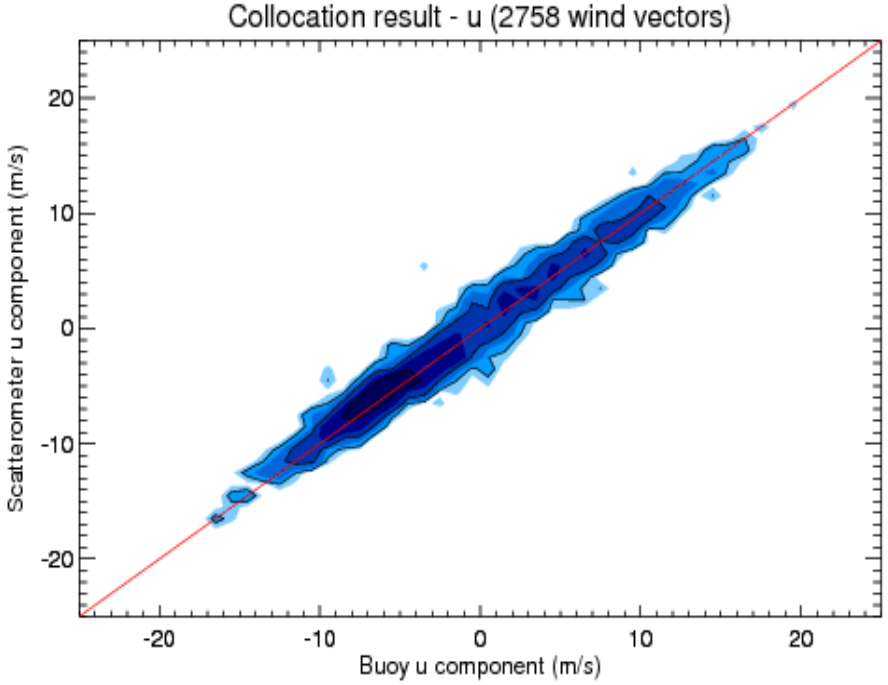
Can we still improve meteorology?

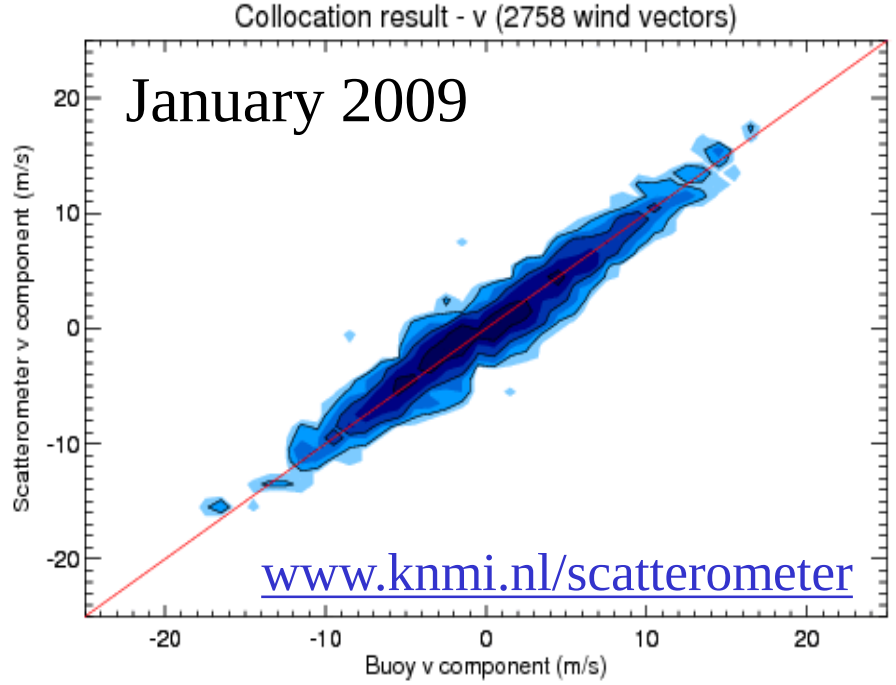




Buoy verification

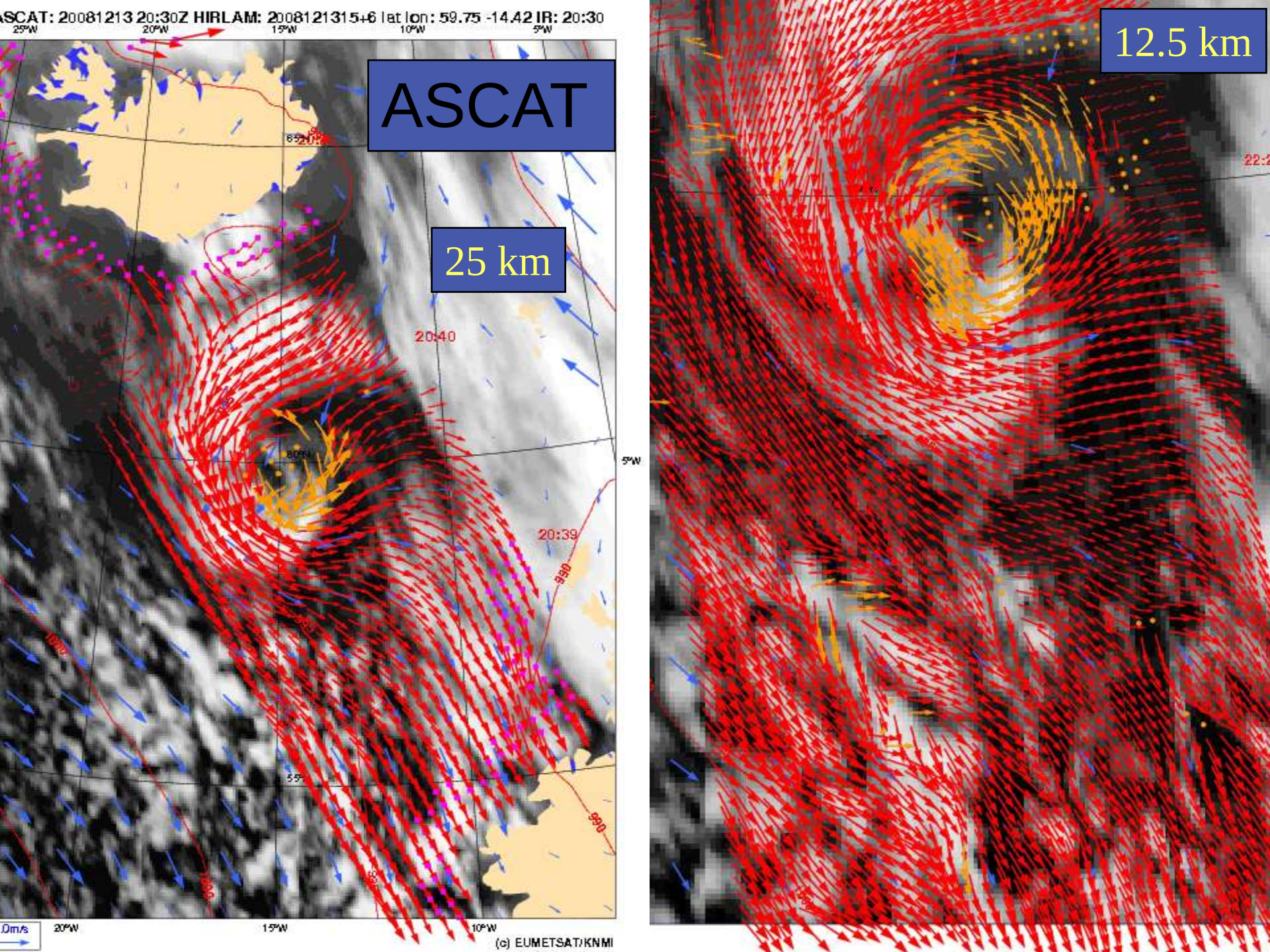




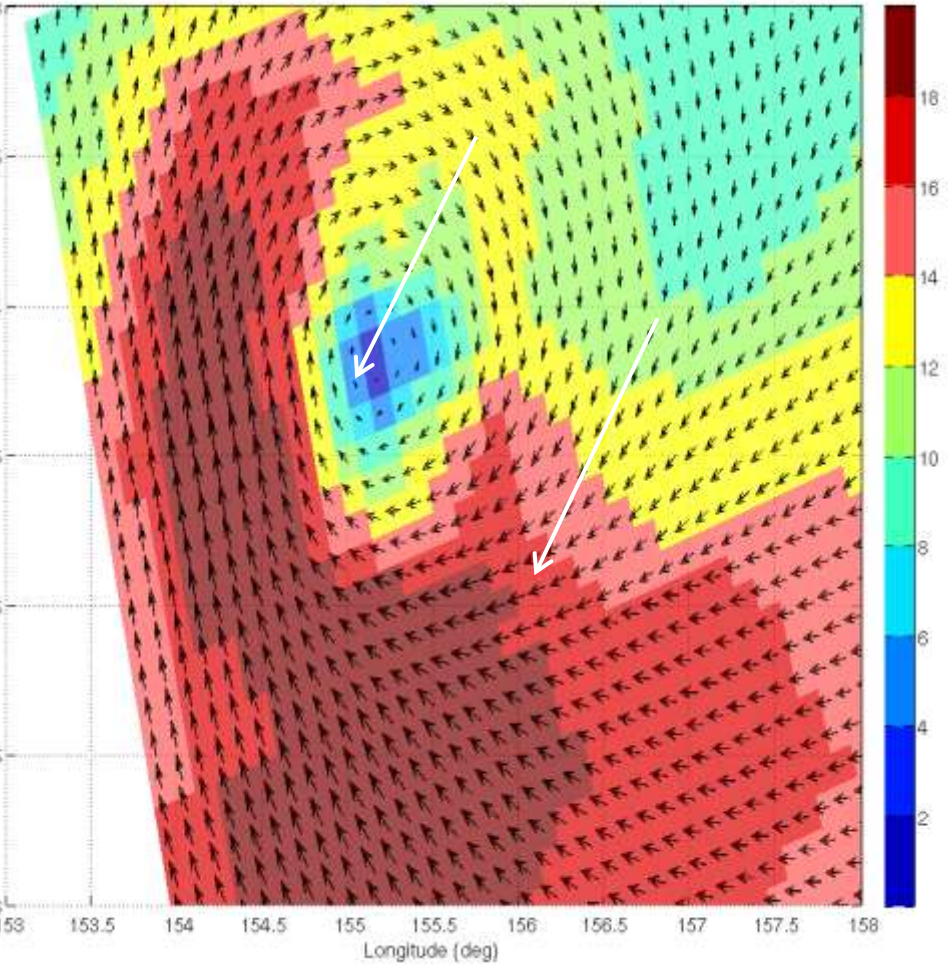


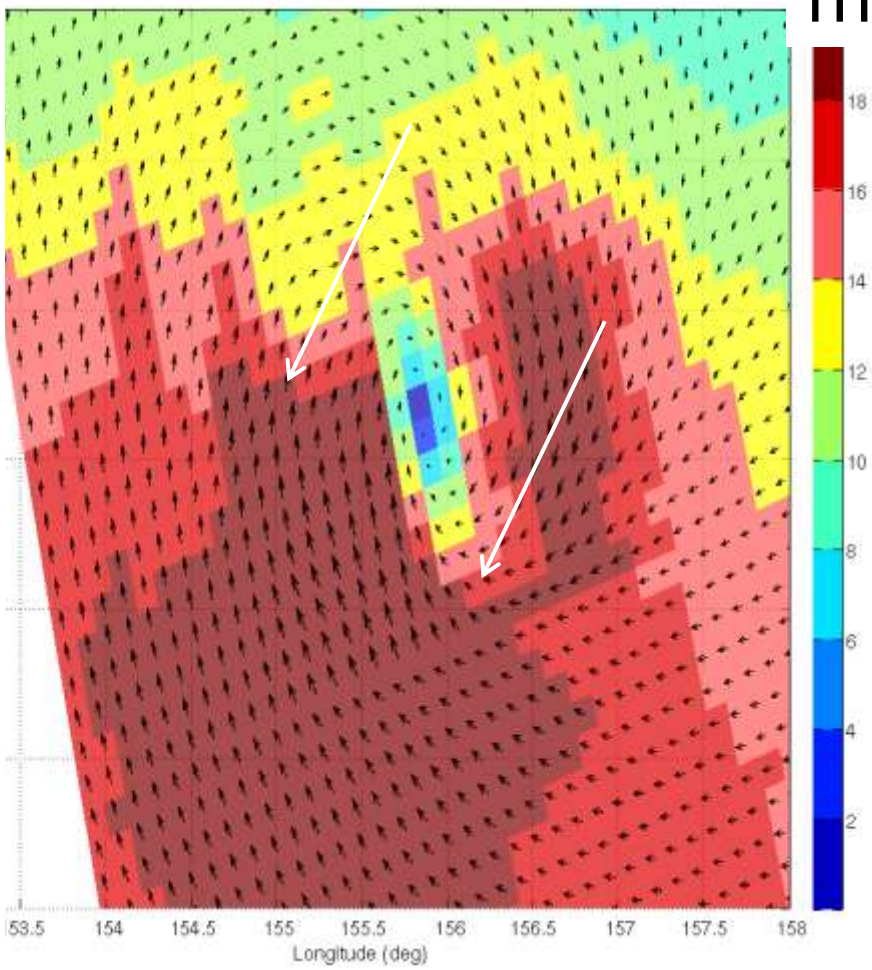
January 2009

www.knmi.nl/scatterometer


ASCAT: 20081213 20:30Z HIRLAM: 2008121315+6 lat lon: 59.75 -14.42 IR: 20:30
ASCAT
25 km
12.5 km
20:40
20:39
(c) EUMETSAT/KNMI

Cyclone SH, 2DVAR analyses





Default setting:

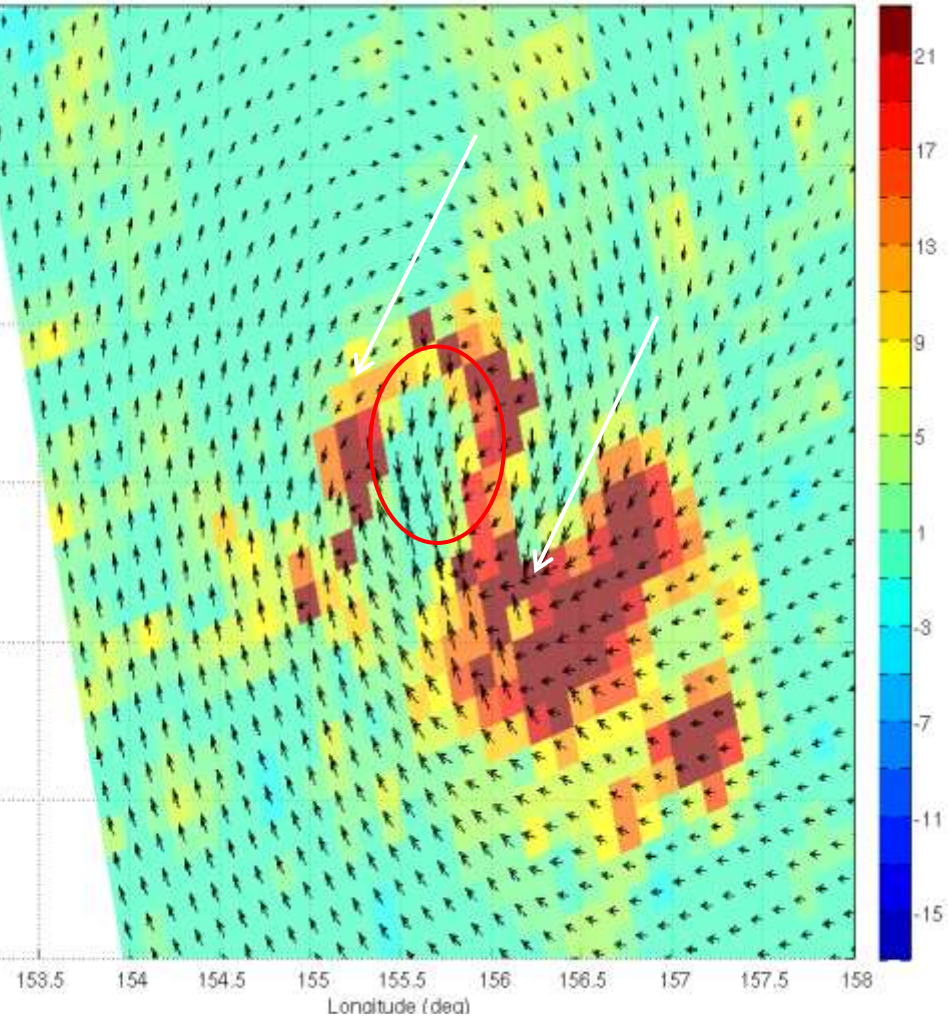
- Gaussian structure function
- Fixed O/B errors

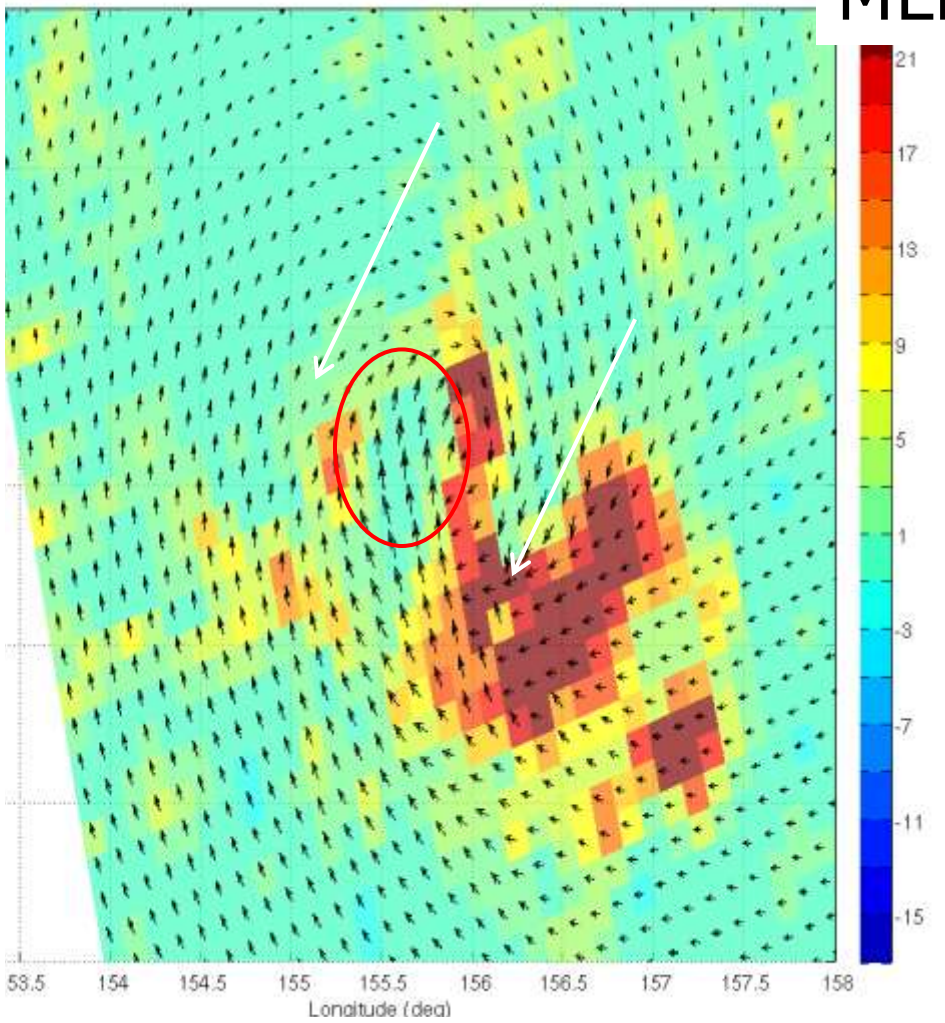
New setting:

- Empirical structure function
- Flexible O/B errors

Cyclone SH, selected solutions

MLE





Default setting:

- Gaussian structure function
- Fixed O/B errors

New setting:

- Empirical structure function
- Flexible O/B errors

Statistics

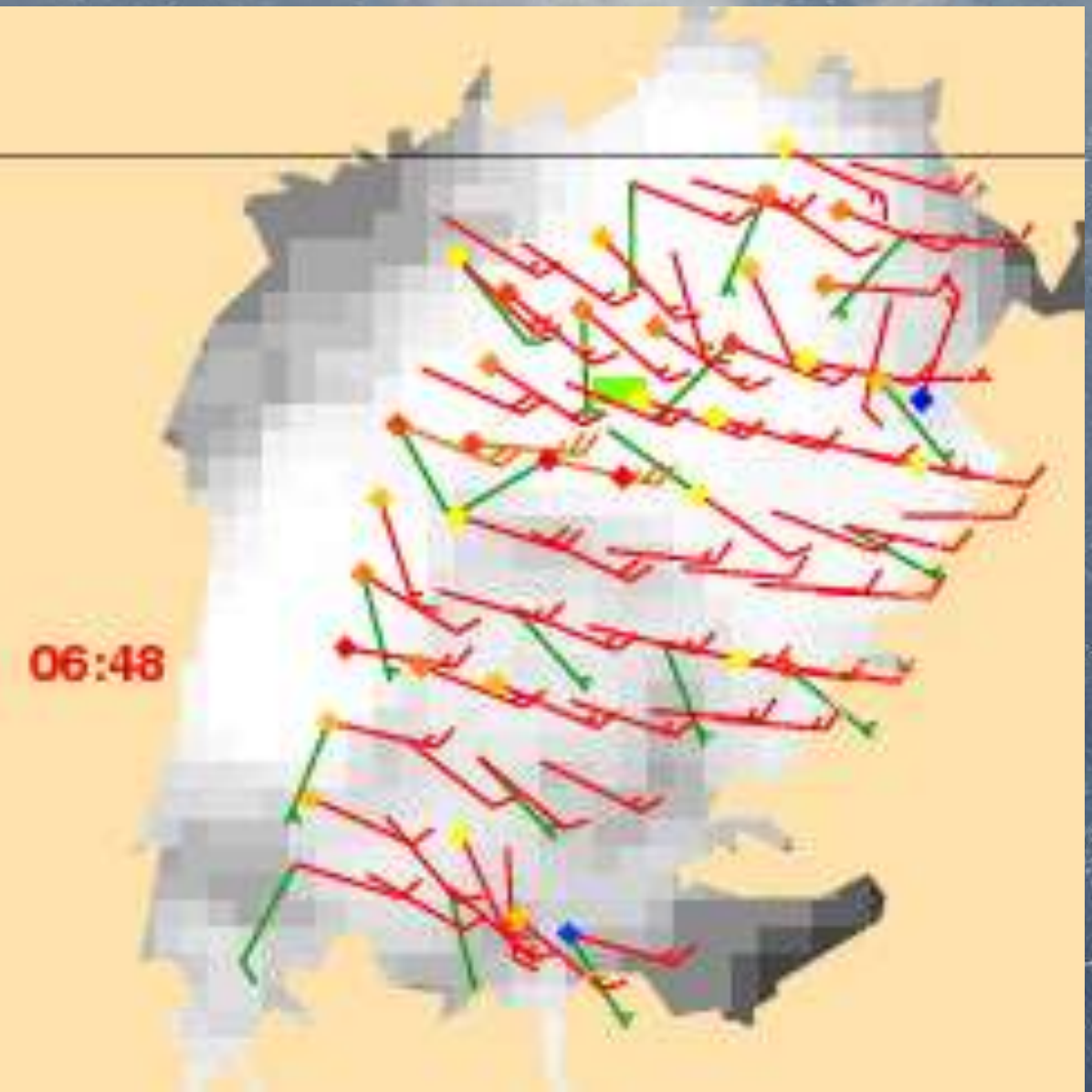
- New ASCAT winds fit buoys and ECMWF better
- New 2Dvar analysis fits ASCAT and buoys much better, but ECMWF worse

QC-ed 2-solution cases with $|MLE_1|<1$

	ASCAT-ECMWF-buoy comparison (mean buoy winds)		
	ASCAT vs ECMWF	ASCAT vs buoy point wind	N
Default	2.19	1.74	5034
New	2.17	1.71	

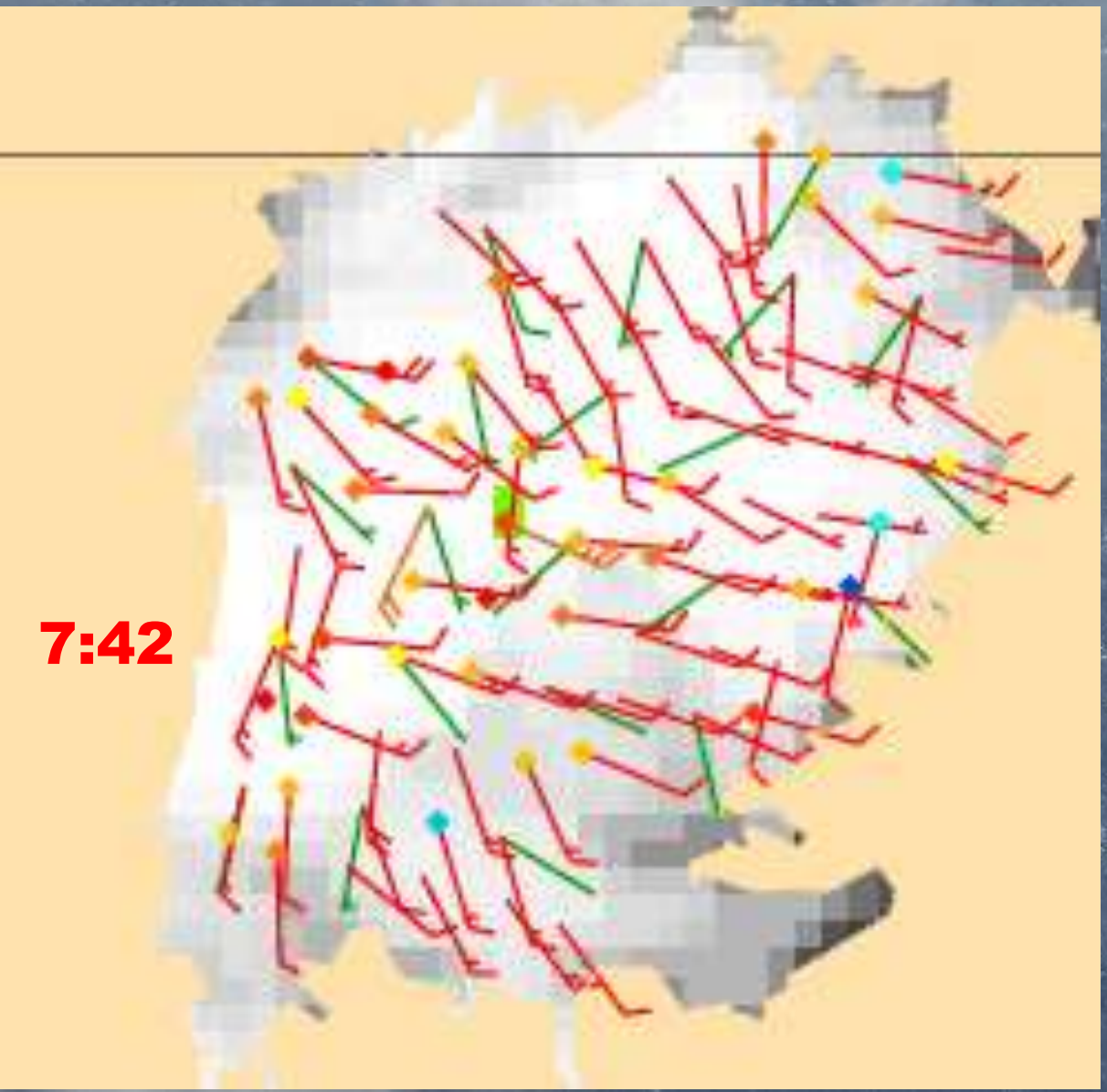
	ASCAT-ECMWF-buoy comparison (mean buoy winds)			
	2DVAR vs ECMWF	2DVAR vs buoy point wind	2DVAR vs ASCAT	N
Default	1.85	1.94	1.17	5034
New	2.00	1.76	0.74	

Lake Victoria

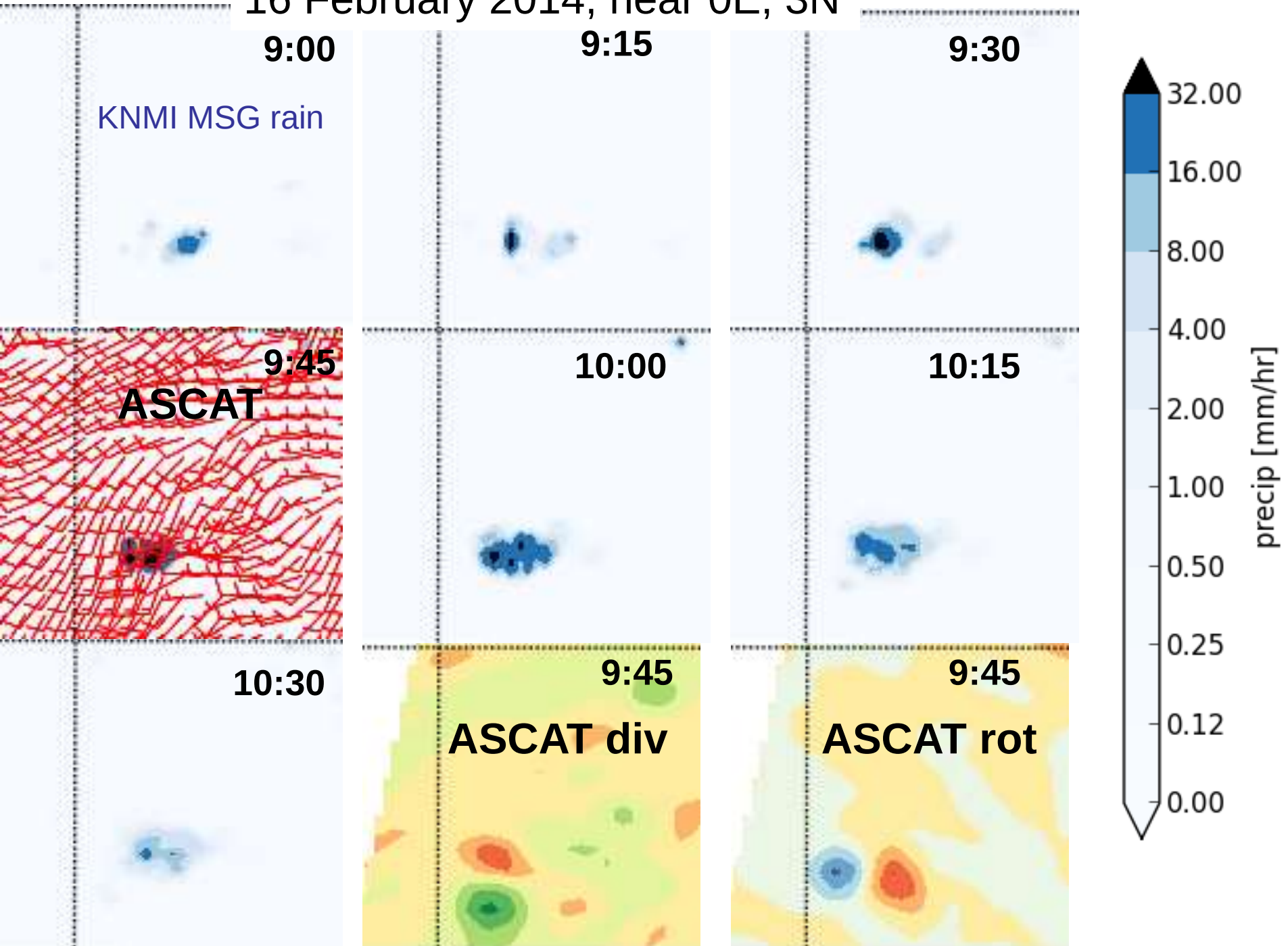


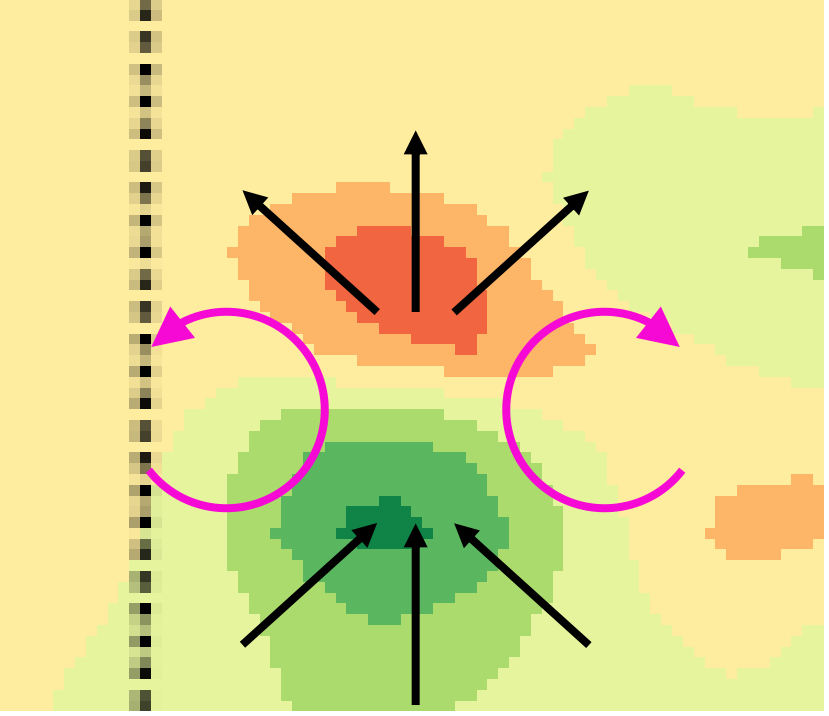
- 8 Dec 2016
- ASCAT-A
- Little wind in ECMWF (green)
- 25 knots in ASCAT (red)
- Moist convection

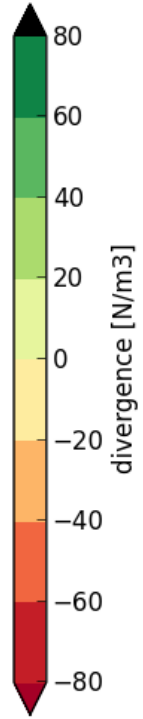
Lake Victoria

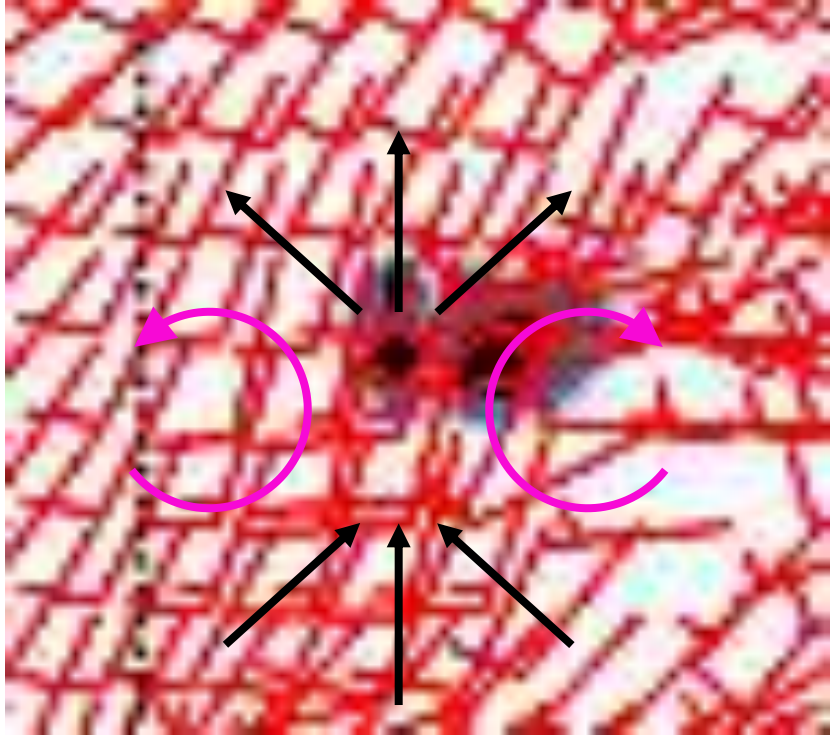


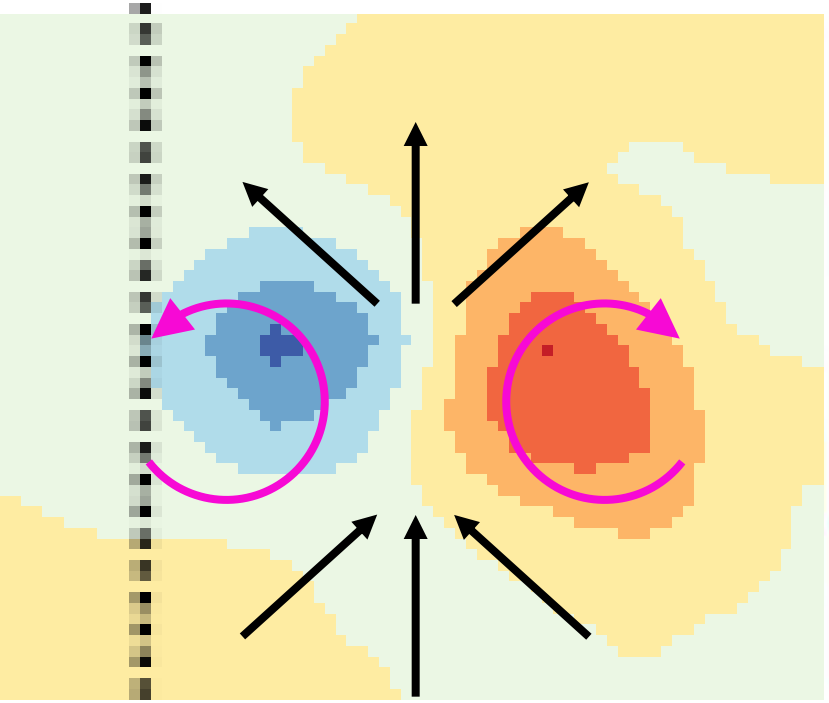
- 8 Dec 2016
- ASCAT-B, 50 min later
- Little wind in ECMWF (green)
- 25 knots in ASCAT (red)
- Moist convection
- Messy !

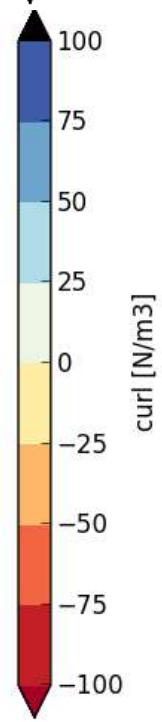

16 February 2014, near 0E, 3N
9:00
KNMI MSG rain
9:15
9:30
9:45
ASCAT
10:00
10:15
10:30
9:45
ASCAT div
9:45
ASCAT rot
32.00
16.00
8.00
4.00
2.00
1.00
0.50
0.25
0.12
0.00
precip [mm/hr]











- Convergence is well visible in ASCAT and precedes precip. by 30 minutes
- Divergence too but its peak coincides with rain peak
- Shear areas are also well visible in voriticity
- These patterns do not appear in global NWP