Ocean surface currents: some aspects of model control, validation and operational applications in the marine industry

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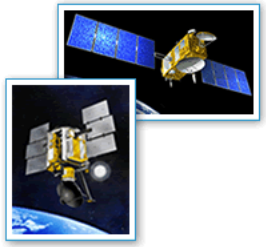
OSCAR Near realtime

www.oscar.noaa.gov

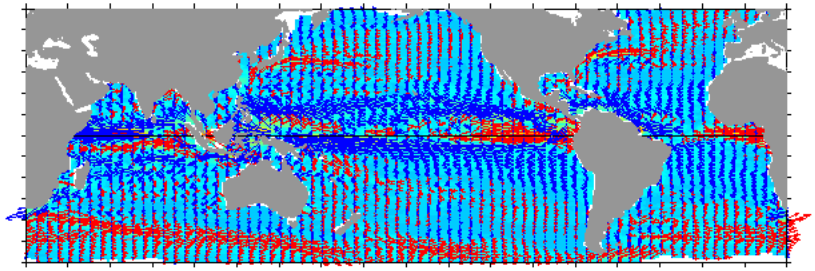
National Oceanic and Atmospheric Administration

OSCAR *Ocean Surface Current Analyses - Real time*

Home | Project Overview | Data Display & Download | Validation | General Interest



Near-realtime global ocean surface currents derived from satellite altimeter and scatterometer data



Latest realtime data

New Updates!

* High resolution 1/3 degree data available, for all plot types, with expanded latitudinal extent
* Validation graphics comparing OSCAR with moored buoys and global drifters

- **Global Dataset for Display and download at 1 degree and 1/3 degree resolution**
- **Peer-reviewed scientific publications using OSCAR data**
- **OSCAR data available through OPeNDAP/DODS**

Pilot project for a NOAA/NESDIS
Operational Surface Current Processing and Data Center
National Ocean Partnership Program (NOPP)

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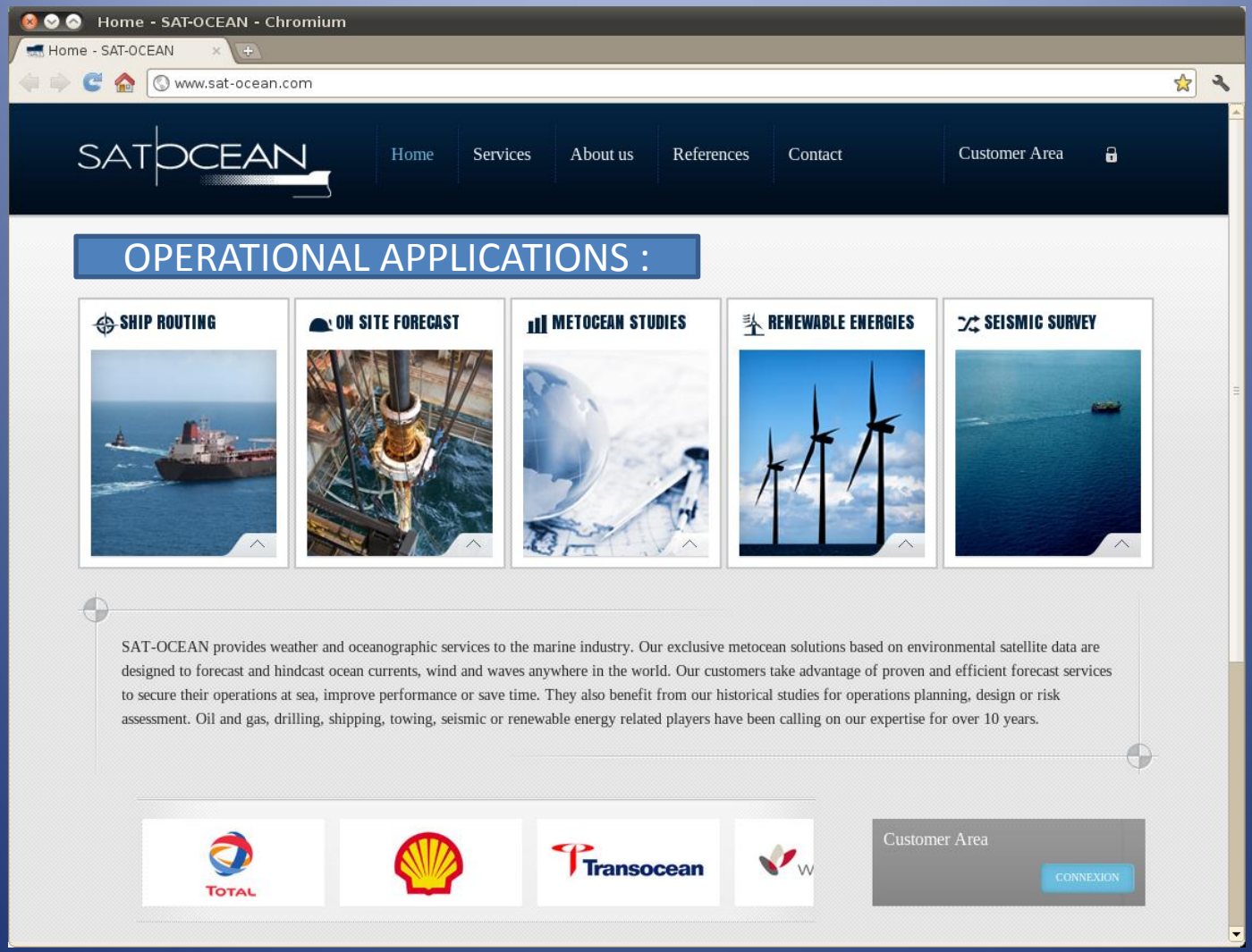


OPERATIONAL APPLICATIONS

Surface currents: real-time and forecast

Speed gains, time and **fuel savings**
Towing (rig/FPSO mobilization, moves, new builds), heavy lifters, tankers or container-carriers…

OPERATIONAL APPLICATIONS

Surface currents: real-time and forecast

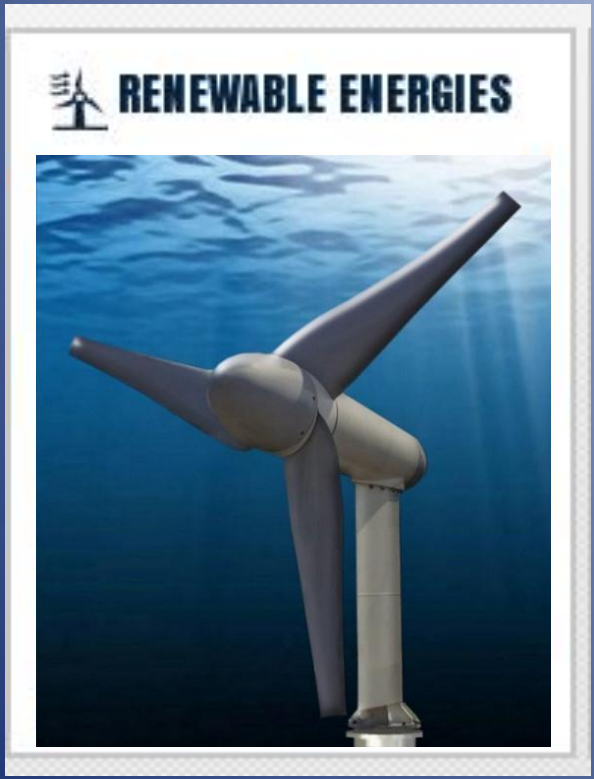
24/7 metocean forecast services worldwide.
Real-time reports include 2D or 3D current, wind and wave forecasts.
Operators and contractors assess their risk and optimize operations in real time.
Drill-ship, FPSO, rig, barge , oil-spill monitoring

OPERATIONAL APPLICATIONS

Surface currents: hindcast

Historical statistical studies (hindcast) of ocean currents.
2D or 3D current based on the most recent 2 to 10 year environmental variability.
Operators and contractors gain a thorough understanding of metocean conditions on site.
Operations planning: riser & rig design, field development studies,
pipe laying, ocean current data mining
for renewable energy related operations (site selection).

OPERATIONAL APPLICATIONS



Surface currents: hindcast

Ocean surveys around the world dedicated to the assessment of energy production potential using the **ocean currents and hydrokinetic devices.**

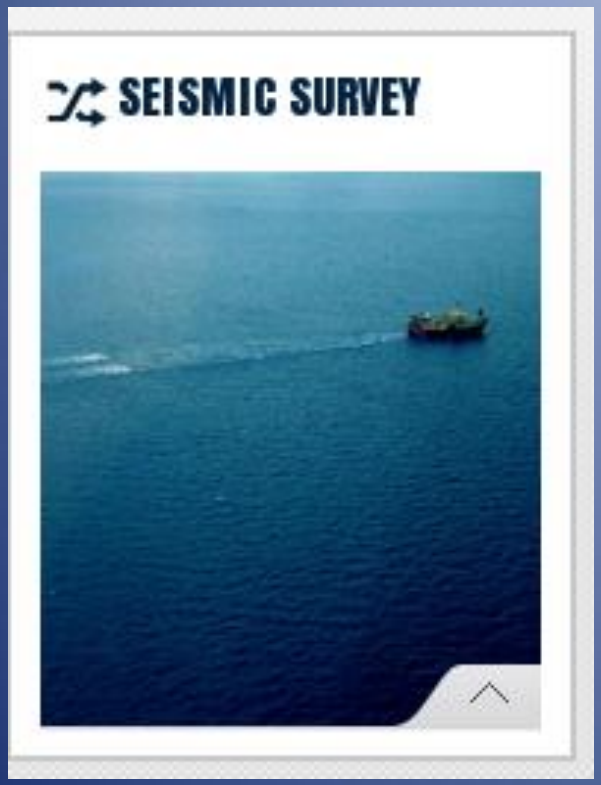
Detailed reports down to 1/64th of a degree resolution.

"Big picture" (through maps and animations) of the presence of strong and steady horizontal currents.

Customers get the capability of forecasting potential business earnings in the future, and anticipating engineering requirements, from site locations to worst case scenario events.

Points of major interest are selected that provide the best spots in terms of current strength, steadiness, distance to coast, bathymetry, and any other constraint required.

OPERATIONAL APPLICATIONS



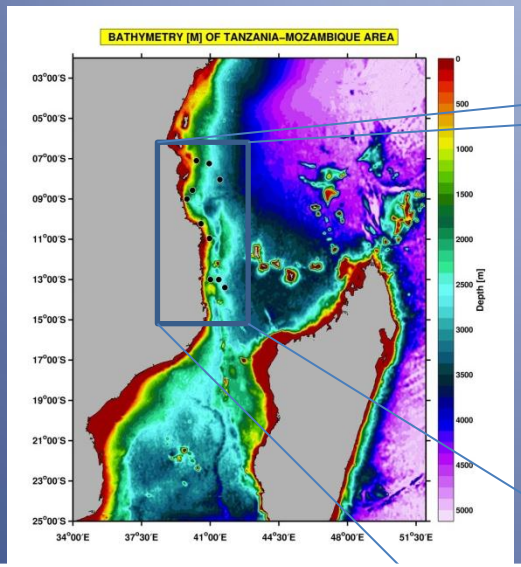
Surface currents: real-time and forecast

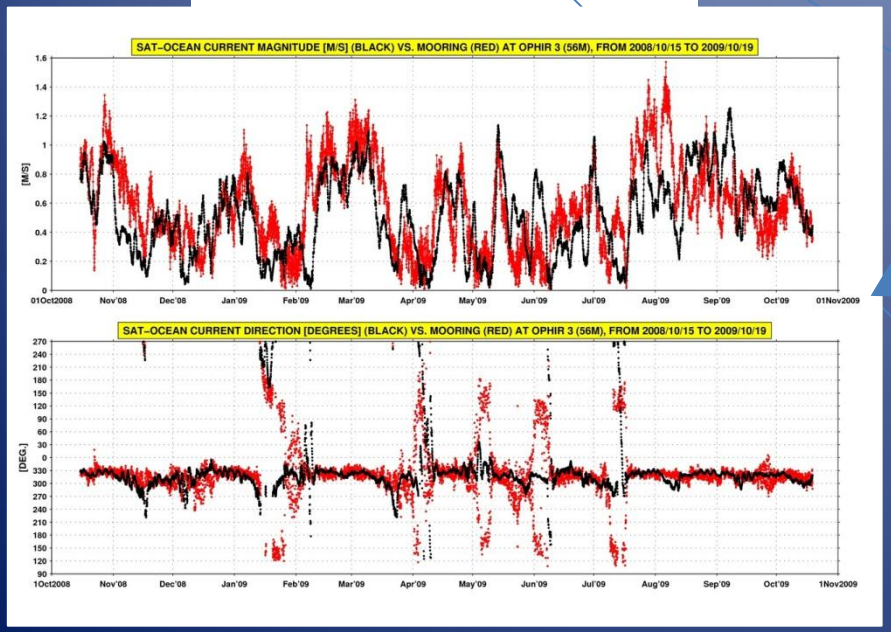
Very high resolution ocean currents required (down to 1/64th of a degree).
High level real-time forecast service dedicated to offshore seismic surveys optimization.
Provide streamer depth ocean current and feather forecast.
Operators calibrate their racetrack strategy on current forecast trend, optimize their infill, anticipating currents and consequent feather, reduce time filling “holes”, secure close-passes

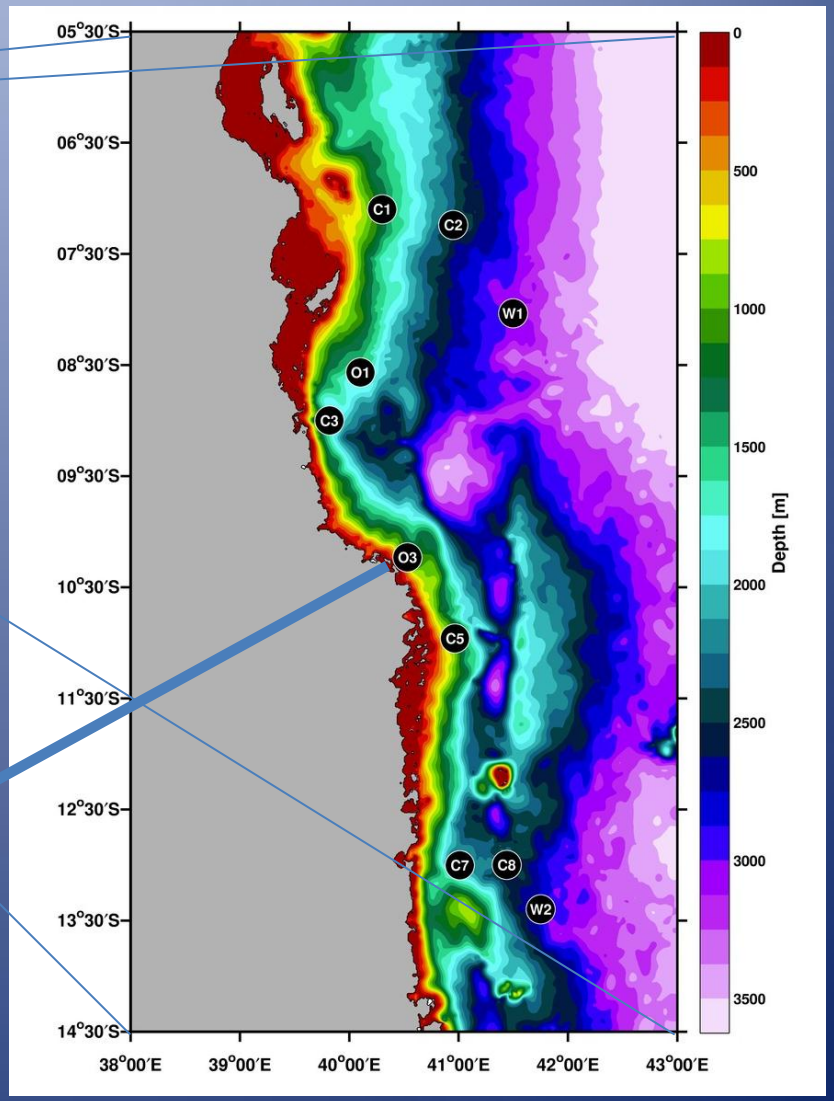
PRODUCT VALIDATION

- Often O&G operators build an in-situ database over a specific target area and time period.
- Most often: mooring data at their location of interest, or shipboard ADCP data
- Data available after hindcast dataset delivery.
- Sometimes competition between providers.
- Comparisons to observations are also carried out in real-time

PRODUCT VALIDATION
EXAMPLE: JIP/TAMOMS



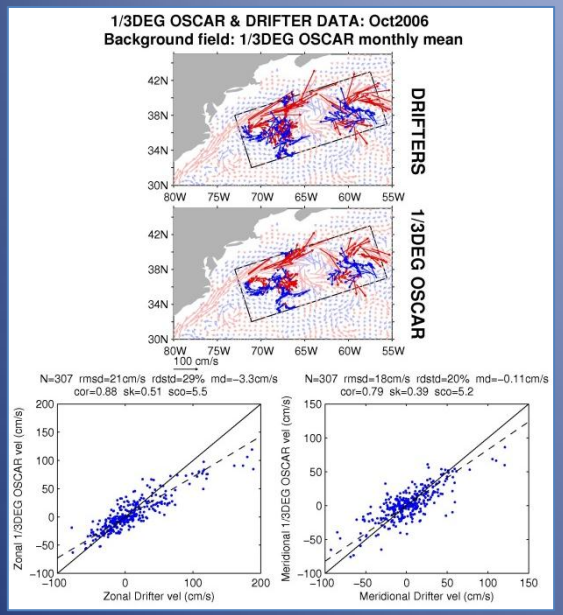


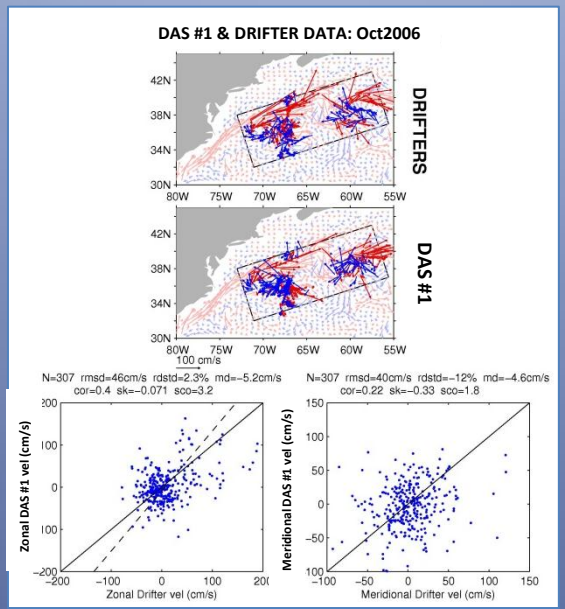


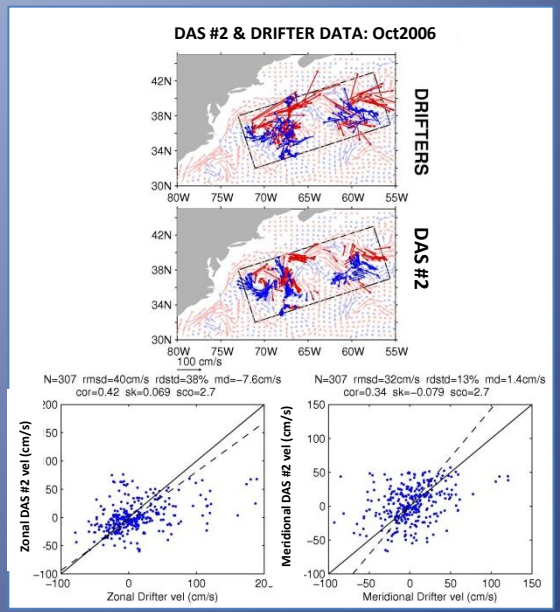
PRODUCT VALIDATION

- Pointwise validations (mooring time series)
  - Rms of difference, direction difference, correlation, spectrum comparison analysis, etc…
  - Distribution comparison analysis: joint speed & direction occurrence distribution, marginal distributions, speed cumulative distribution, Q-Q plots, etc…
  - Amplitude maximum, extreme value distribution, etc…
- Along-ship track real-time comparisons (mostly with shipboard ADCP data during seismic survey)
- Drifting buoys
- Next?

PRODUCT VALIDATION







•GS area •Oct.05-Dec.06 •Drifters •N=3583 •ΔT=1 day	RMSD (cm/s)		RDSTD (%)		MD (cm/s)		COR		SKILL		SCORE (max=10, min=0)	
	U	V	U	V	U	V	U	V	U	V	U	V
OSCAR 1/3°	**22**	**21**	22	19	-4.4	-1.7	**0.83**	**0.78**	**0.44**	**0.37**	**5.4**	**5.1**
OSCAR 1°	26	23	44	46	-3.6	-2.1	0.77	0.73	0.34	0.29	4.1	3.8
SURCOUF	**21**	**20**	**18**	**16**	-3.2	**-1.0**	**0.84**	**0.79**	**0.46**	**0.39**	**5.7**	**5.4**
DAS #1	38	37	**-2**	**-4**	-2.4	-3.8	0.52	0.39	0.04	-0.1	3.8	2.9
DAS #2	36	33	48	45	-2.4	-1.8	0.36	0.25	0.08	-0.0	2.5	2.1
DAS #3	37	33	81	87	**1.6**	**-1.6**	0.28	0.07	0.06	0.0	1.9	1.4
DAS #4	37	33	87	92	-2.2	-2.5	0.35	0.13	0.07	0.0	1.9	1.5
DAS #5	38	32	88	89	**0.52**	-1.7	0.23	0.2	0.05	0.02	1.7	1.6

•EQPAC area •Oct.05-Dec.06 •Drifters •N=11859 •ΔT=1 day	RMSD (cm/s)		RDSTD (%)		MD (cm/s)		COR		SKILL		SCORE (max=10, min=0)	
	U	V	U	V	U	V	U	V	U	V	U	V
OSCAR 1/3°	**18**	**16**	23	42	3.8	**0.0**	**0.87**	**0.56**	**0.5**	**0.17**	**5.7**	**3.2**
OSCAR 1°	**19**	**16**	24	51	3.1	0.27	**0.87**	**0.57**	**0.49**	**0.18**	**5.6**	**3.1**
SURCOUF	**19**	**17**	20	46	**1.0**	0.77	**0.85**	0.47	0.48	0.12	**5.7**	2.8
DAS #1	24	22	**11**	**-4**	6.8	-0.4	0.77	0.42	0.34	-0.1	5.4	**3.1**
DAS #2	25	23	**-8**	**-2.4**	2.6	0.87	0.79	0.34	0.32	-0.16	5.5	2.8
DAS #3	27	19	19	60	9.9	0.9	0.74	0.25	0.27	0.02	4.6	2
DAS #4	24	19	37	62	**0.54**	**0.13**	0.77	0.26	0.35	0.03	4.4	2
DAS #5	28	19	54	60	1.9	-0.3	0.66	0.33	0.23	0.05	3.3	2.2

(DAS = GCM-based Data Assimilation System)

(GODAE – Bonjean et al, 2008)

MODEL CONSTRAINT

- Reasonable idea to constrain models using diagnostics current fields
- Geostrophic velocity: only global field directly related to surface currents and monitored in DT and NRT (from alongtrack AVISO). However not always the preeminent dynamics/diagnostics field that characterizes the total surface currents variations.
- SST

Conclusion

Suggestions (for discussion)

- Total surface current velocity (tides, Stokes drift, inertial motion, etc...), (characteristic depth)
- Needs:
  - "Pure" observational database of total current
  - Best estimate of velocity field (merging, diagnostic model etc...)
- Assessment of the EO-based product usefulness

Rmsd, correlation to , but also speed/direction distribution, extreme speed values, …