







# Singularity analysis for the estimation of rain impact on ASCAT winds

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## Outline

- The idea is to propose a method which complements current operational ASCAT QC
- Singularity analysis concept
- Singularity analysis application and preliminary results



### 1. Why complementary QC method?



Validation: ASCAT-TMI

Validation: ASCAT-Buoy

2.Singularity analysis

#### Concept

Given a wavelet  $\Psi(\mathbf{x})$ , we define the wavelet projection of the gradient of a two-dimensional scalar signal *s* at the point  $\mathbf{x}$ , and the scalar *r*, as

$$T_{\Psi}|\nabla s|(\mathbf{x},r) = \int d\mathbf{y}|\nabla s|(\mathbf{y})\frac{1}{r^2}\Psi(\frac{\mathbf{x}-\mathbf{y}}{r})$$

where the wavelet projection depends on the scale resolution parameters as a power law, characterized by the local singularity exponent  $h(\mathbf{x})$  in the way

$$T_{\Psi}|\nabla s|(\mathbf{x},r) = \boldsymbol{\alpha}(\mathbf{x})r^{h(\mathbf{x})} + o(r^{h(\mathbf{x})})$$

Fast numerical computation of singularity exponents is available now (Pont, Turiel and Yahia, 2010)

3. Singularity analysis

# Application

- Apply SA on the scene of U and V components respectively, take the singularity exponents h(x)=min{h(x)<sub>u</sub>, h(x)<sub>v</sub>} for further analysis
- Take two specific cases for example ...









# 3. Singularity analysis

- General study: two month ASCAT-12.5km winds collocated with TMI rain data & buoy winds are examined.
- Note that the singularity exponents can be tuned to reject less or more WVCs
   Preliminary filtering based on SA

			<u> </u>					
TMI-RR	o mm/hr		[0.1 3)mm/hr		[3 6)mm/hr		>6 mm/hr	
	WVC number	VRMS (m/s)	WVC number	VRMS (m/s)	WVC number	VRMS (m/s)	WVC number	VRMS (m/s)
Filtered WVCs	66758	3.35	50298	4.49	12107	5.85	10424	7.16
Kept WVCs	2998650	1.97	218080	3.42	16183	4.77	7093	6.03
Filtering Pecent	2.18%	2.01	18.7%	3.65	42.8%	5.26	<b>59.5</b> %	6.73

				Operatio	nal filterin	ng based o	on MLE		
TMI-RR	o mm/hr		[0.1 3)mm/hr		[36)mm/hr		>6 mm/hr		
	WVC number	VRMS (m/s)	WVC number	VRMS (m/s)	WVC number	VRMS (m/s)	WVC number	VRMS (m/s)	
Filtered WVCs	1069	4.24	2243	4.99	1994	5.55	3586	6.73	
Kept WVCs	3064338	2.01	266136	3.63	26296	5.23	13929	6.72	
Filtering Pecent	0.035%	2.01	0.84%	3.65	7.05%	5.26	20.47%	6.73	
	Reduce the operational filtering threshold from +18.6 to +4.0								
				thresho	ne operation and from +1	onal filteri <u>8.6 to +4.</u>	ng o		
TMI-RR	o mi	m/hr	[0.1 3)[	thresho nm/hr	ne operation and from +1 [3 6)m	onal filteri <u>8.6 to +4.</u> m/hr	ng o >6 m	m/hr	
TMI-RR	o mi WVC number	m/hr VRMS (m/s)	[0.1 3)r WVC number	thresho nm/hr VRMS (m/s)	ne operation old from +1 [3 6)m WVC number	8.6 to +4.0 m/hr VRMS (m/s)	ng o >6 m WVC number	m/hr VRMS (m/s)	
TMI-RR Filtered WVCs	o m WVC number 63821	m/hr VRMS (m/s) 2.67	[0.1 3)1 WVC number 27661	thresho nm/hr VRMS (m/s) 4.99	ne operation old from +1 [3 6)m WVC number 9851	$\frac{8.6 \text{ to } +4.0}{\text{m/hr}}$ $\frac{\text{VRMS}}{(\text{m/s})}$ 5.22	ng >6 m WVC number 8597	m/hr VRMS (m/s) 6.74	
TMI-RRFiltered WVCsKept WVCs	0 m WVC number 63821 3001557	m/hr VRMS (m/s) 2.67 1.99	[0.1 3)1 WVC number 27661 240710	Reduce thresho       thresho       nm/hr       VRMS       (m/s)       4.99       3.63	ne operation old from +1 [3 6)m WVC number 9851 18437	5.28	ng >6 m WVC number 8597 8919	m/hr VRMS (m/s) 6.74 6.71	

# 3.Singularity analysis

• Due to the lack of collocations with buoy winds, we cannot split the analysis by rain rate intervals (as performed with TMI collocation dataset).



# 4. Conclusions and outlooks

- Singularity exponents are sensitive to irregularities in the ASCAT retrieved wind field caused by increased sub-WVC wind variability and/or rain contamination effects (splashing);
- Although separating rain-induced singularity fronts from windinduced ones is challenging, preliminary results show the technique's potential to assess the quality of the scatterometer retrieved wind fields;
- Besides the retrieved wind vector, other ASCAT-derived parameters, such as the backscatter measurements and the inversion residual (MLE) can be used to generate singularity maps;
- Furthermore, a combined MLE-based and SA-based QC algorithm is envisaged.



# Thank you for your attention