# Sentinel-1 SARデータを用いた市街地および水田域における浸水被害の後方散乱特性解析

Flood damage analysis at built-up and rice paddy areas using Sentinel-1 SAR data

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#### **Research Background**

### **Research Objectives**

・2019年10月6日午前3時にマリアナ諸島の東海上で発生した台風19 号は12日に日本に上陸し,関東地方や東北地方では記録的な大雨とな り甚大な被害をもたらした

・福島県郡山市においても,阿武隈川,笹原川,逢瀬川等が氾濫を起こ し,床上浸水6542件および床下浸水847件が発生した.

Extraction of flood damaged area

本研究で解析する浸水被害領域は住宅 地を含む都市部(Built-up area)と水田域 (Paddy field)とした。郡山市の阿武隈川 および支流周辺は広い領域で浸水被害が 発生した.

Built-up areaとPaddy fieldは浸水被害 により異なる後方散乱係数の変化が見ら れるため,浸水被害の有無の違いも解析 するために、合計9箇所の領域のデータを 解析した.

site no.	flood or non-flood	land cover	area (ha)	area name	
1	flood	built-up area	234	Chuo-Kogyo-Danchi	
2	flood	paddy field	52	East of Chuo-Kogyo-Danchi	
3	flood	built-up area	133	Shokuhin-Danchi	
4	flood	paddy field	25	North of Fukuyama-Clean-Center	
5	flood	built-up area	31	Teikyo Asaka	
6	non-flood	built-up area	38	West of Koriyama station	
7	non-flood	paddy field	40	South of Nihon University	
8	non-flood	built-up area	127	Asaka-machi	
9	non-flood	paddy field	68	South of Asaka-machi	



本研究では、郡山市内の台風19号による水田や都市域での浸水被害領域について、

Sentinel-1のCバンドSARデータに現れる浸水被害の影響を明らかにすることを目的とする.



### Procedure of data pre-processing for Sentinel-1 SAR data

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Table 2 Cha	aracteristics of S	entinel-1 SAR IW mode	Backscattering approach(Gamma-naught)	Interferometric approach(Coherence)	]
Satel	lite(Sensor) rvation mode	Sentinel-1A/1B IW mode	(1) Download Ground Range Detected(GRD) data from Open Access Hub.	(1) Download Slant Range Complex (SLC) data from Open Access Hub.	
Center frequ	ency (wave length)	5.405 GHz(5.6 cm)	(2) Apply accurate orbit data.	(2) Apply TOPS co-registration to each sub-swath in the	
Ground	range coverage	251.8 km	(3) Calibrate SAR data to get gamma-naught.	(2) Apply Do burst procedure to fill the gap in the burst data to	Backscattering mechanisms of build-up area
Incid	dence angle	29.1 - 46.0 deg.	Thermal noise removal Dediametria termina flattening with CDTM 4	get continuous sub-swath data.	
Numbe	r of sub-swath	3	Radiometric terrain flattening with SRTM-1 (4) Transform onto LITM coordinates with foreshortening	(4) Calculate Initial fringe and coherence in the interferometric	
Spatial resolut	tion (range x azimuth)	20.3 · 20.5 m x 22.5-22.6 m	(4) Transform onto o twi coordinates with foreshortening	formation procedure.	
Number of loo	ks (range x azimuth)	5×1	Range-Doppler Terrain Correction with SRTM-1	(5) Remove topographic phase using SRTM-1 DEM.	
Pixel spacing (range x azimuth)		10m × 10m	(UTM Zone54, Pixel spacing=10.0m)	(7) Transform onto UTM coordinates with foreshortening	A REAL PROPERTY AND A REAL
Noise Equival	lent Sigma-0 (NESZ)	-22 dB		correction	
Po	larization	VV+VH		Range-Doppler Terrain Correction with SRTM-1	Bane Bear Selling - Bear Selling - Status and Selling - Status and Selling - Status
		-Oct. 7 5:43(Sentinel-1A)		(UTM Zone54, Pixel spacing=10.0m)	Conduct successy forface appendix the grant success address addres
Observation	date and time(JST) escending	·Oct. 13 5:42(Sentinel-1B)	0 4km	04km	Setametry meno
	-	·Oct. 19 5:43(Sentinel-1A)	the she was a	and the second sec	
Table List of InSAR dataset				+ The second second	Backscattering mechanisms of paddy fields
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dataset	(perpendicular base	line) Acquisition time	2	The The A	
pair-1	+14.20 m	·Oct. 7 5:43(Sentinel-1A)		Start Dres J. Start Start	
Descensing		·Oct. 13 5:42(Sentinel-1B)	Company and a second second		Contraction of Contra
pair-2	-29.65 m	·Oct. 13 5:42(Sentinel-1B)	and the second se		Paripana, Mangadop, Japan Property and Committee
Descending	20100111	·Oct. 19 5:43(Sentinel-1A)	Right of 2019	Pi0+107-12-2010	Denny Loning Boling Splang State Patron Splang - Mare approva
pair-3	05.00 m	·Oct. 7 5:43(Sentinel-1A)	George 112019	GOCt.13-19.2019	Bakeogawa
Descending	·20.23 III	·Oct. 19 5:43(Sentinel-1A)		B:Oct.07-19,2019	charge :
			(a)	(b)	
			Fig.1 Gamma-naught and cohere	nce images covering Koriyama city area.	
			(a)RGB colored gamma-naught im	age, and (b)RGB colored coherence image.	
Re	sults of	data analvs	is		
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	Days from Oct.	1	Days from Oct.1 InSAH	dataset InSAR dataset	· · · · · · · · · · · · · · · · · · ·
	(a)		(b) (C	(a)	
					04133018
			Fig.2 Change of gamma-naught and coherence cause	d by flooding.	Veliazona
	(;	a)gamma-naught in bui	It-up area, (b)gamma-naught in paddy field, (c)coherence in	built-up area, and (d)coherence in paddy field.	WZRAN
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- 00	initial y				Get.07,2019

・浸水被害が発生した都市域では後方散乱係数が上昇し水田領域では減少した.

・浸水被害が発生すると都市域および水田ともにInSARコヒーレンスは減少するが、水田における減少量は非 常に小さい.

・都市域および水田の浸水被害を両方とも検出する方法として時系列後方散乱画像の主成分分析が有効である ことがわかった.

### Acknowlegements

・Sentinel-1データはESAから提供を受けた. ・本研究の一部は千葉大学環境リモートセンシング研究 一共同利用研究の支援を受け実施した。 センタ

## (on Oct.13 VV gamma-naught image)