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Supporting Information for

Relationships Between Internal Solitary Wave Surface Features in Optical and SAR Satellite Images: Insights From Remote Sensing and Laboratory

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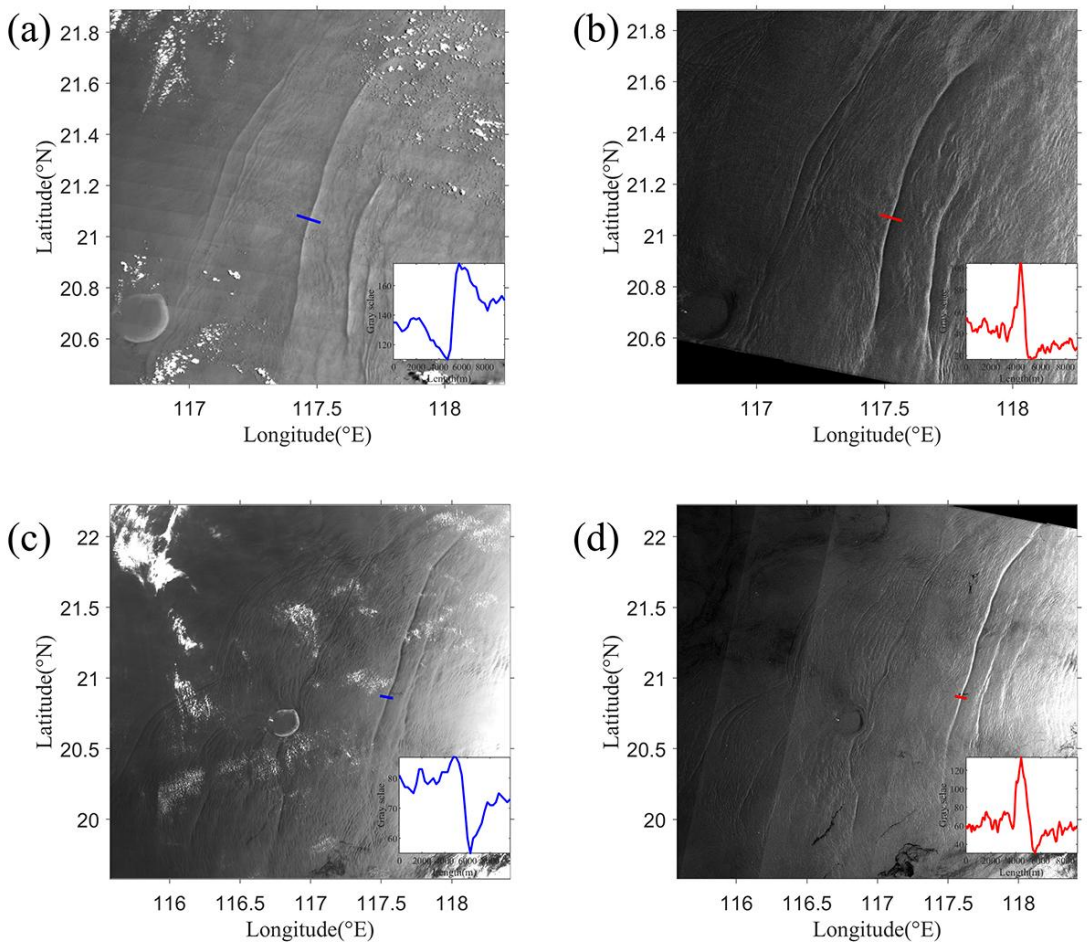

Figure S1. MODIS and SAR remote sensing images in the northern South China Sea. (a) the MODIS image was acquired at 02:55:00 UTC on June 26, 2005. (b) the SAR image was acquired at 02:07:57 UTC on June 26, 2005. (c) the MODIS image was acquired at 02:50:00 UTC on April 22, 2007. (d) the SAR image was acquired at 02:07:45 UTC on April 22, 2007. The blue or red diagonal lines represent the positions where the grayscale profiles are extracted in the opposite direction of ISWs propagation. The insert is the grayscale profile at those positions.

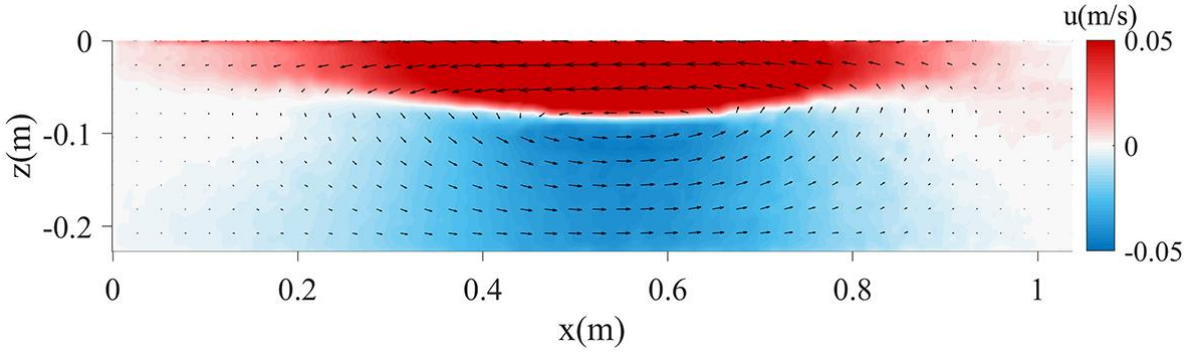

Figure S2. Current velocity field of ISWs measured by PIV. The background color represents horizontal velocity, the black arrows represent the resultant velocity combining horizontal and vertical velocities.

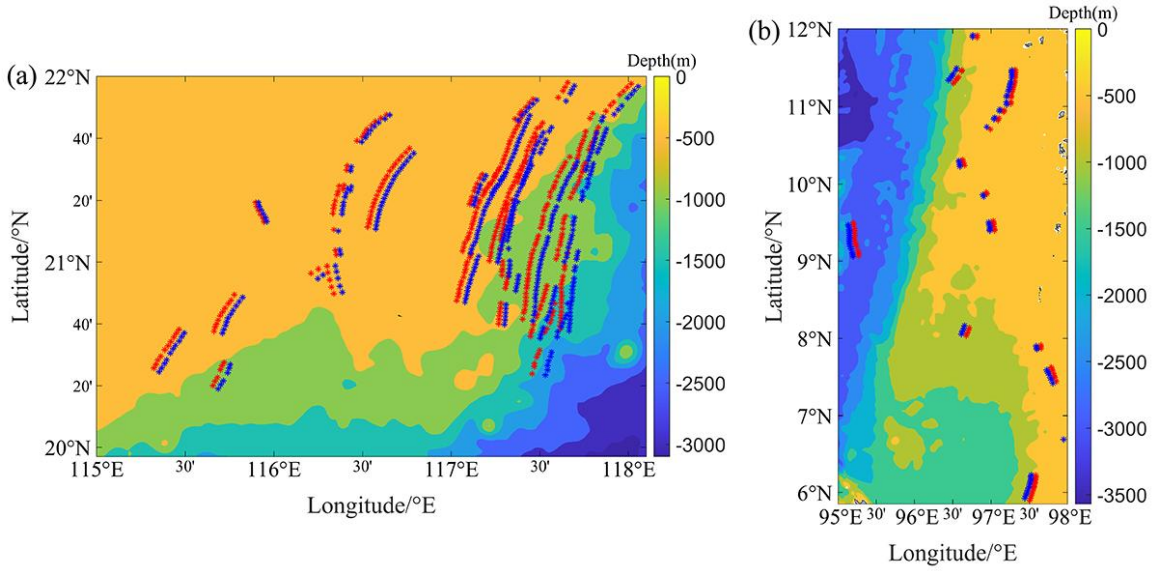

Figure S3. (a) Spatial distribution of ISWs extraction positions in the South China Sea. (b) Spatial distribution of ISWs extraction positions in the Andaman Sea. The red asterisks denote the extraction positions of ISWs in the MODIS images. The blue asterisks denote the extraction positions of ISWs in the SAR images.

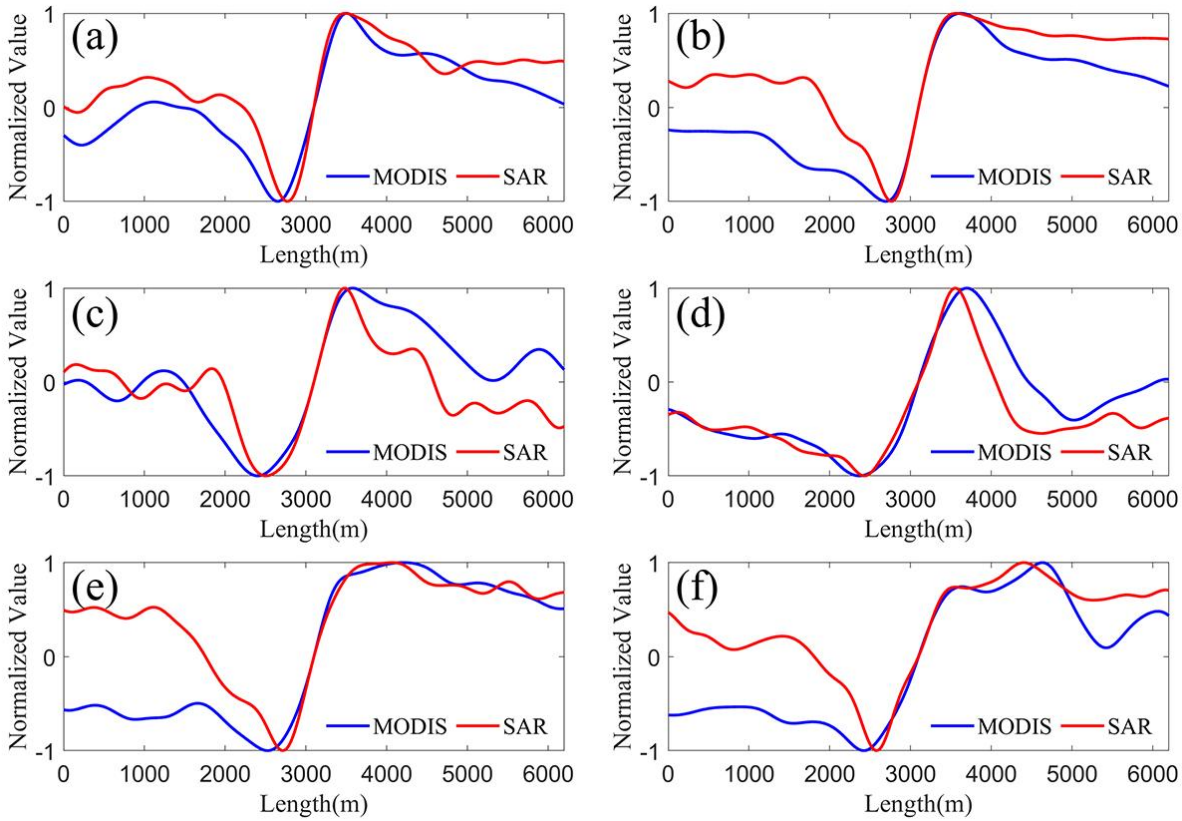

Figure S4. (a-f) are grayscale profile comparison analysis of the same ISWs on MODIS and SAR remote sensing images at different PP distances. The blue curve is the grayscale

profile of the MODIS images, with a PP distance range of 853-2213 m.The red curve is the grayscale profile of the SAR images, with a PP distance range of 714-1823 m. The PP distances of ISWs gradually increases from (a) to (f).

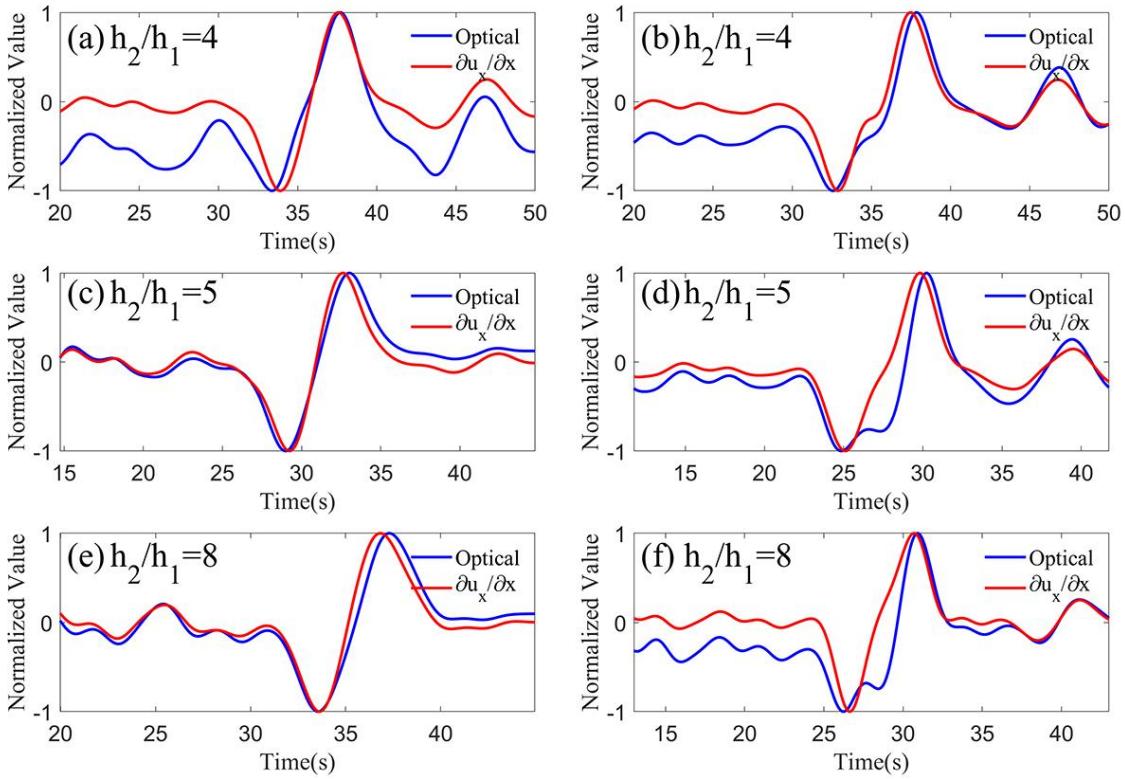

Figure S5. (a-f) are comparison analysis of the experimental optical surface grayscale profile and surface horizontal velocity divergence at different depth ratios and non-dimensional amplitudes, the blue curve is the grayscale profile of the experimental optical surface, and the red curve is the surface horizontal velocity divergence. The ISWs non-dimensional amplitudes of (a-f) are 0.86, 1.16, 0.59, 1.62, 0.54 and 1.94, respectively.

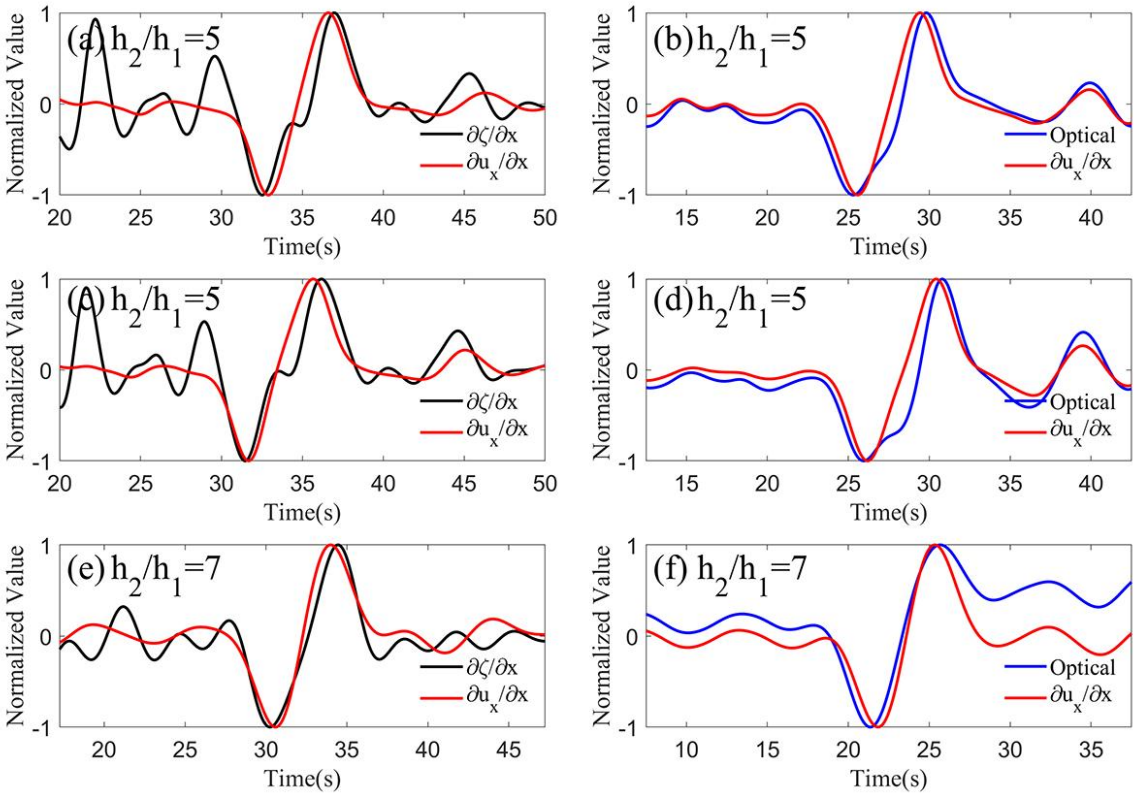

Figure S6. Panels (a), (c), and (e) are comparison analysis of free surface displacement gradient and surface horizontal velocity dispersion at different depth ratios and non-dimensional amplitudes, the black curve is the free surface displacement gradient, and the red curve is the surface horizontal velocity divergence. In (a), (c) and (e),the non-dimensional amplitudes of ISWs are 1.16, 1.41 and 1.06, respectively. Panels (b), (d), and (f) are comparison analysis of optical surface grayscale profile and surface horizontal velocity divergence in the Section 3 experiments, the blue curve is the grayscale profile of the optical surface, and the red curve is the surface horizontal velocity divergence. In (b), (d) and (f),the non-dimensional amplitudes of ISWs are 1.19, 1.37 and 1.06, respectively.

Table S1. Summary of remote sensing images

	Date/Time	Satellite and Sensors	Spatial resolution
1	08/12/2002 03:10:50	ENVISAT ASAR	150 m
	08/12/2002 04:10:00	Terra MODIS	250 m
2	14/07/2003 02:16:23	ENVISAT ASAR	150 m
	14/07/2003 03:00:00	Terra MODIS	250 m
3	15/08/2003 02:10:40	ENVISAT ASAR	150 m
	15/08/2003 03:00:00	Terra MODIS	250 m
4	19/05/2004 03:15:29	ENVISAT ASAR	150 m
	19/05/2004 04:05:00	Terra MODIS	250 m
5	01/03/2005 03:27:45	ENVISAT ASAR	150 m
	01/03/2005 04:15:00	Terra MODIS	250 m
6	01/03/2005 03:27:45	ENVISAT ASAR	150 m
	01/03/2005 04:20:00	Terra MODIS	250 m
7	26/06/2005 02:07:57	ENVISAT ASAR	150 m
	26/06/2005 02:55:00	Terra MODIS	250 m
8	12/07/2005 02:04:01	ENVISAT ASAR	150 m
	12/07/2005 02:55:00	Terra MODIS	250 m
9	22/04/2007 02:07:45	ENVISAT ASAR	150 m
	22/04/2007 02:50:00	Terra MODIS	250 m
10	18/06/2008 02:13:24	ENVISAT ASAR	150 m
	18/06/2008 02:55:00	Terra MODIS	250 m
11	20/07/2008 02:06:47	ENVISAT ASAR	150 m
	20/07/2008 02:55:00	Terra MODIS	250 m
12	03/05/2010 02:15:59	ENVISAT ASAR	150 m
	03/05/2010 03:20:00	Terra MODIS	250 m
13	31/07/2010 02:17:58	ENVISAT ASAR	150 m
	31/07/2010 03:15:00	Terra MODIS	250 m
14	22/07/2011 02:17:19	ENVISAT ASAR	150 m
	22/07/2011 02:50:00	Terra MODIS	250 m

Table S2. Summary of experimental conditions

Case	h_1(m)	h_2(m)	h_2/h_1	η_0/h_1
1	0.04	0.12	3	0.26-1.27
2	0.04	0.16	4	0.34-1.27
3	0.04	0.20	5	0.38-1.62

4	0.04	0.24	6	0.24-1.67
5	0.04	0.28	7	0.31-2.21
6	0.04	0.32	8	0.37-2.42
7	0.04	0.36	9	0.35-2.39