Results of simulation experiments on critical wind speed for anchoring

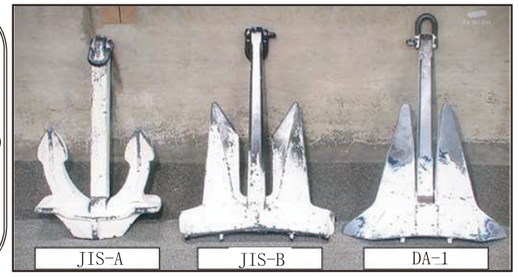
How to anchor	type of vessel	Type of anchor	External force conditions		
			Wind only	Wind＋Weves	Wind + high water + tidal current
Single anchor mooring	Cargo vessel 299 GT	Type JIS-A	20.0 m/sec(30) 456.5	20.0 m/sec(30) 74.5	20.0 m/sec(30) 718.0
		Type JIS-B	20.0 m/sec(30) 2551.5	20.0 m/sec(30) 299.5	20.0 m/sec(30) 4312.0
	Cement carrier 3,176 GT	Type JIS-A	13.3 m/sec(20) 4566.5	13.3 m/sec(20) 1738.0	13.3 m/sec(20) 1194.0
		Type JIS-B	16.7 m/sec(25) 308.5	16.7 m/sec(25) 305.5	16.7 m/sec(25) 304.5
	Car ferry 12,439 GT	Type JIS-B	16.7 m/sec(25) 2855.0	16.7 m/sec(25) ○	16.7 m/sec(25) 2858.0
		Type DA-1	20.0 m/sec(30) 797.5	20.0 m/sec(30) ○	20.0 m/sec(30) 725.5
Twin anchor mooring	Cargo vessel	Type JIS-A	20.0 m/sec(30) 432.5	16.7 m/sec(25) ○	16.7 m/sec(25) 4572.5
		Type JIS-B	20.0 m/sec(30) ○	20.0 m/sec(30) 131.5	20.0 m/sec(30) 3444.0
	Cement carrier	Type JIS-A	16.7 m/sec(25) 147.5	13.3 m/sec(20) ○	13.3 m/sec(20) 1565.0
		Type JIS-B	16.7 m/sec(25) 4577.5	16.7 m/sec(25) 1393.5	13.3 m/sec(20) 1570.0
	Car ferry	Type JIS-B	16.7 m/sec(25) 1576.0	20.0 m/sec(30) 1564.0	16.7 m/sec(25) 3456.0
		Type DA-1	20.0 m/sec(30) 718.5	20.0 m/sec(30) 1570.0	20.0 m/sec(30) 1832.5
Two anchor mooring	Cargo vessel	Type JIS-A	20.0 m/sec(30) ○	-	-
	Cement carrier	Type JIS-B	16.7 m/sec(25) ○	-	-
	Car ferry	Type DA-1	20.0 m/sec(30) ○	-	-

Note: Regarding the values in each cell in the table, the upper row is the average wind speed (maximum instantaneous wind speed), and the lower row is the number of seconds from the start of the experiment to anchor drag. "○" indicates that the anchor was not dragged for 90 minutes. Orange hatchings in the table show under which external force conditions the highest figures were obtained for each combination of anchoring method, ship type, and type of anchor.

Results of demonstration experiments on anchor holding performance

The experiments were conducted by using three types of anchors weighing 50 kg (cf. the right photograph) at three points in Osaka Bay (detailed positions ❶, ❷, and ❸ shown in the overleaf) for three days from September 8, 2020.

※ The following figures are the results of the experiments mentioned above, and does not represent the overall situation in Osaka Bay.

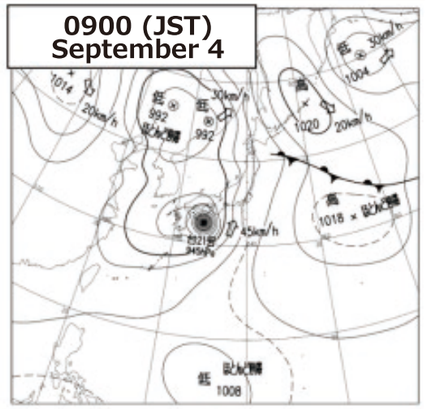


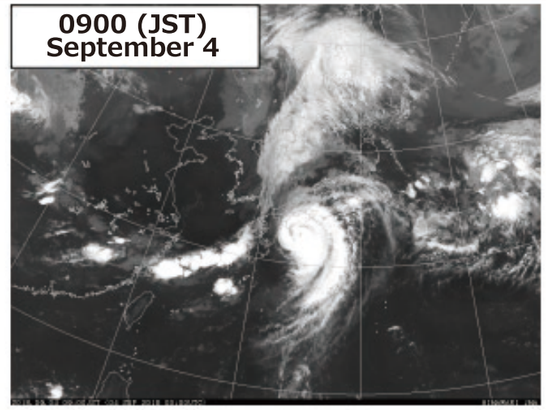
Type of anchor	Average holding power coefficient at each point		Commonly known holding power coefficient
Type JIS-A	Point ①	4．9	3
	Point ②	4．9	
	Point ③	5．3	
Type JIS-B	Point ①	12．0	10
	Point ②	11．2	
	Point ③	14．4	
Type DA-1	Point ①	18．2	5～8
	Point ②	18．3	
	Point ③	16．7	

Note: As a commonly known holding power coefficient the values in the case of the mud bottom sediment, as described in General Ship Maneuvering Practice (Keinosuke Honda 2008), are shown for JIS-A type and JIS-B type, and the value in the case of sludge bottom sediment, as announced by the manufacturer, is shown for DA-1 type.

Comparison of anchor holding power coefficient

Prevention of anchor dragging accidents when a typhoon hits Osaka Bay





Pressure distribution chart and meteorological satellite image of typhoon No. 21 at 0900 on September 4, 2018 (Source: Japan Meteorological Agency)

Since 2019 the system concerning evacuation due to typhoons and other extreme weather conditions has changed.
From January 2019 onwards navigation in the sea area within 3 nautical miles from Kansai International Airport has been restricted.
From March 2020 onwards self-restraint of anchoring within 3 nautical miles from Kobe Airport and Sakai-Senboku Port Piers has been recommended.
From July 2021 onwards the system concerning evacuation to outside Osaka Bay / Kii Channel, the midwestern area of the Seto Inland Sea, etc., has been maritime policy.

Sources of typhoon-related information, etc.

Maritime Information and Communication System（Japan Coast Guard）
You can get maritime safety information and marine weather information across the country. https://www6.kaiho.mlit.go.jp/

Japan Coast Guard Anchor Dragging Accident Prevention Information Portal
You can get helpful information to prevent anchor dragging accidents.
https://www.kaiho.mlit.go.jp/mission/kaijyoukoutsu/soubyo.html

OSAKA WAN Vessel Traffic Service Center
You can get information of vessels at anchor in Osaka Bay, Harima-Nada, Kii Channel, etc. https://www6.kaiho.mlit.go.jp/osakawan/

Japan Meteorological Agency disaster prevention information
You can get information of typhoons and weather warnings.
https://www.jma.go.jp/jma/menu/menuflash.html

Maritime Bureau, Ministry of Land, Infrastructure, Transport and Tourism Anchor Risk Judgment System (nickname: Ikari-ing)
By entering the basic information you can estimate the risk level of your ship for dragging anchor. https://cloud.nmri.go.jp/apps/ikaring/

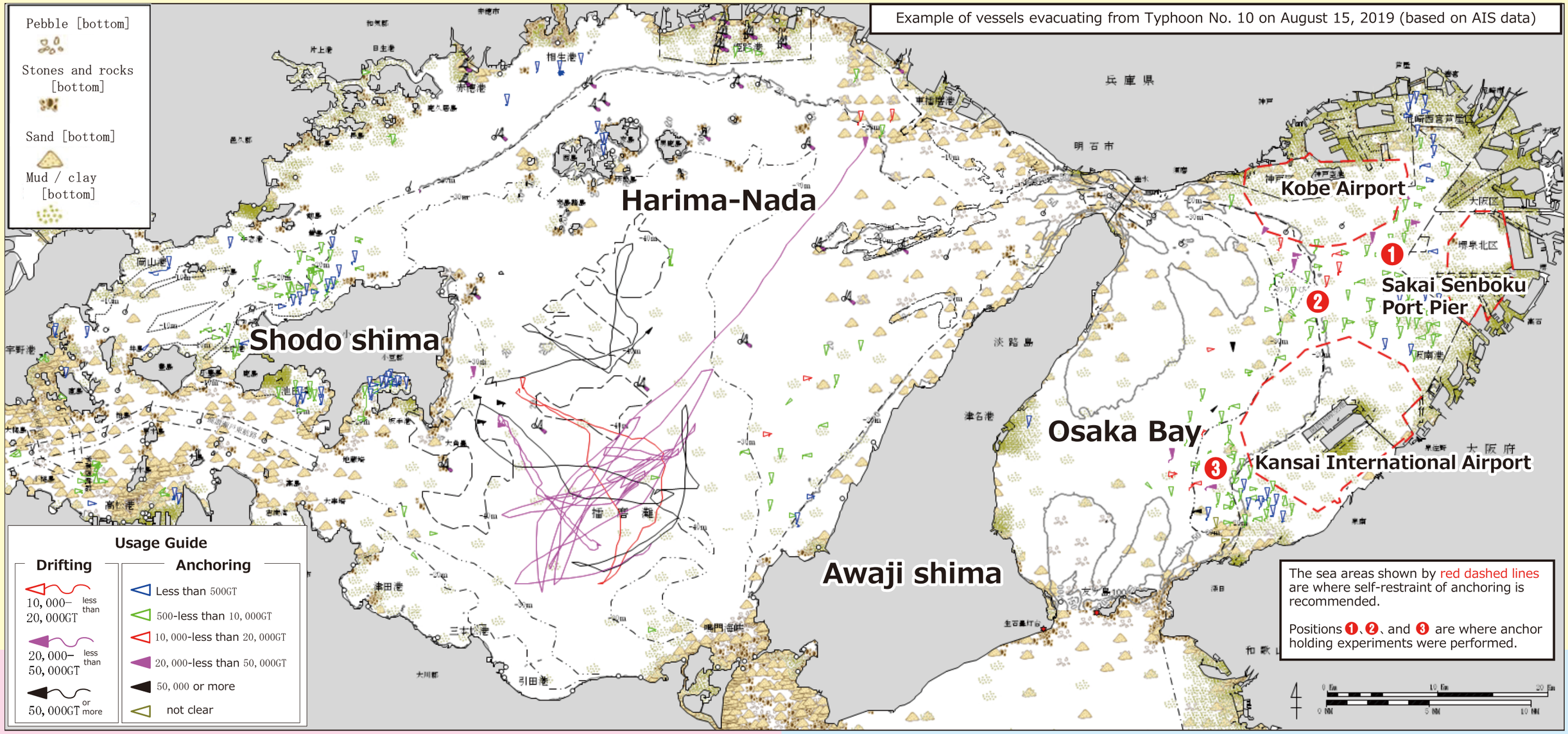
MAD Situational Indication Linkages
You can get information on fishing grounds, etc.
https://www.msil.go.jp/msil/htm/main.html?Lang=0

This leaflet was created based on research and studies on the prevention of anchor dragging accidents during typhoons and other extreme weather conditions in Osaka Bay.

The KOBE MARINE CASUALTY PREVENTION INSTITUTE
URL http://kobe-kaibouken.or.jp TEL 078-332-2035 FAX 078-332-2037

日本海事センター JMC 補助事業

Evacuation status of vessels in Osaka Bay and Harima-Nada during typhoons and other extreme weather conditions



Precautions for evacuating to Harima-Nada

- When a typhoon passes the western Japanese archipelago the number of vessels evacuating from the Seto Inland Sea area increases. As a result, the Harima-Nada sea area tends to become congested with vessels at anchor.
- Vessels will possibly be advised to evacuate from the Central Seto Inland Sea area.
- Vessels are recommended to avoid major routes and fishing grounds and to carefully select their anchorages.
- Compared to Osaka Bay, fishing grounds are set in a wider area of the Central Seto Inland Sea, more often in the coastal areas and the areas around Shodoshima and the Ieshima Islands.
- The bottom sediment is mostly mud or sand, but in some areas it is gravel and rocks.
- The sea area north of Shodoshima and Ikeda Bay and Utsumi Bay south of Shodoshima are congested.
- Vessels with a gross tonnage of 10,000 tons or more may be drifting in the sea areas south and north of the Harima-Nada traffic route.

Precautions for evacuating to Osaka Bay

- Vessels are mostly at anchor in the sea area east of the 30m depth contour lines.
- The bottom sediment in the sea area east of the 30m depth contour lines is mostly sand or mud, and the anchor holds relatively well, but the characteristics of the sediment is reported to have been changed in the sea area west of the lines.
- In stormy weather vessels are recommended to refrain from anchoring within 3 nautical miles from Kansai International Airport, Kobe Airport and Sakai-Senboku Port Piers.
- The anchoring position tends to move more offshore than within 3 nautical miles from Kansai International Airport, Kobe Airport and Sakai-Senboku Port Piers in normal weather conditions because of the weather advisory anchoring protocols.
- In the sea area east of Awajishima vessels with a gross tonnage of 10,000 tons or more may be drifting.
- Vessels will possibly be advised to evacuate from Osaka Bay and Kii Channel area.
- Pay attention to vessels evacuating from the Central Seto Inland Sea.