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Dragging Anchor

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§ 1 Introduction

In the event of anchoring, it is common to carry out single anchor mooring, using one of the anchors outfitted on either side of the ship. However, due to strong winds from typhoons or violent storms, as a dragging anchor preventative measure, one must be ready to drop the snubber anchor on the opposite side (to the sea bottom), or carry out two-anchor mooring or ride at two anchors.

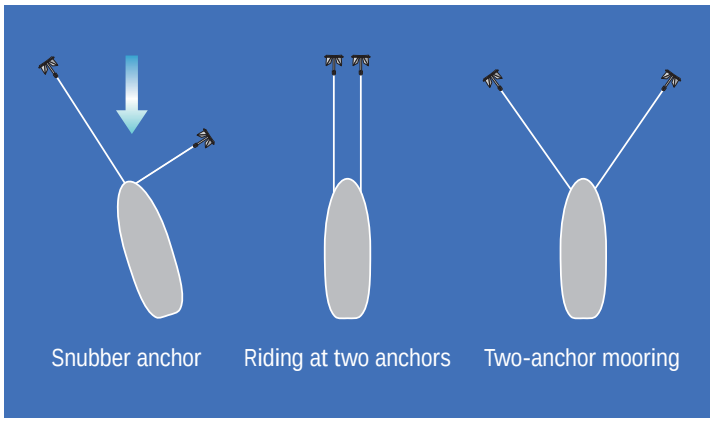


Fig. 1 Anchoring method

In order to learn from the Aomori - Hakodate "Touya Maru" ferry accident that occurred on 26th September, 1954, the anchor dragging mechanism, which will be introduced in §3 was studied and it was ascertained that once the JIS type anchor started dragging, the holding power of the anchor system was lost.

In addition, the Master decided on an anchoring method and length of anchor chain needed to veer, taking the following into account: space for anchorage, depth of the water, nature of the sea bottom, other ships' anchoring situations, expected maximum wind speed and tidal currents etc. However, this has not led to a significant decline in dragging anchor cases.

In 2012, we provided a lecture mainly focusing on the technical aspects of preventing an anchor from dragging and also issued the Loss Prevention Bulletin No. 25.

This time, we are going to introduce typhoon and dragging anchor cases, referring to "Typhoons and marine accidents" in the Maritime Casualty Analysis Report (Vol. 6), that was issued by the Marine Accident Inquiry Agency (MAIA) at that time in 2006.

Photograph 2
AC14 type anchor

Photograph 3
JIS type anchor

§ 2 Typhoons

Accidents due to a dragging anchor are not only caused by Typhoons, but also occur during gales. However, according to statistics they predominantly occur when a typhoon has just passed. First, it is necessary to understand how typhoons move.

2－1 Definition of a typhoon (from the Japan Meteorological Agency website [available only in Japanese])

Typhoons are defined as follows.

Definition:

"Atmospheric depression that comes forth in the tropical ocean is called 'tropical depression'. Among them, those which are found in the north-western part of the Pacific Ocean (sea area to the north of the equator and west from 180 degrees east longitude) or in the South China Sea, moreover, with a maximum wind speed within the region of atmospheric depression (10 minutes average) of more than approximately 17m/s (34 knots and wind force 8) are called 'typhoons'".

A typhoon also has characteristics whereby it is moved by the wind in the sky and heads north due to the rotation of the earth. Therefore, the typhoon gradually moves northward while being blown to the west at a low latitude, where regular easterly winds blow. Then, once it reaches middle and high latitudes, where strong westerly winds (heights of 8 - 13km and speeds of approximately 100km/h) are in the air, the typhoon proceeds north east at a high speed.

Also, regarding the force and the size of the typhoon which we frequently hear of in weather forecasts and so on, the Japan Meteorological Agency expresses the "size" and "strength" of a typhoon based on the wind speed (at an average within ten minutes). This can be seen in Tables 5 and 6. In addition, the range where there is a wind speed of more than 25m/s blowing or when it has the possibility of being that speed, it is referred to as the storm area. For example, it is expressed as a "very large and violent typhoon" when it is a typhoon with a maximum wind speed of more than 54m/s with more than an 800km radius of strong wind at 15m/s.

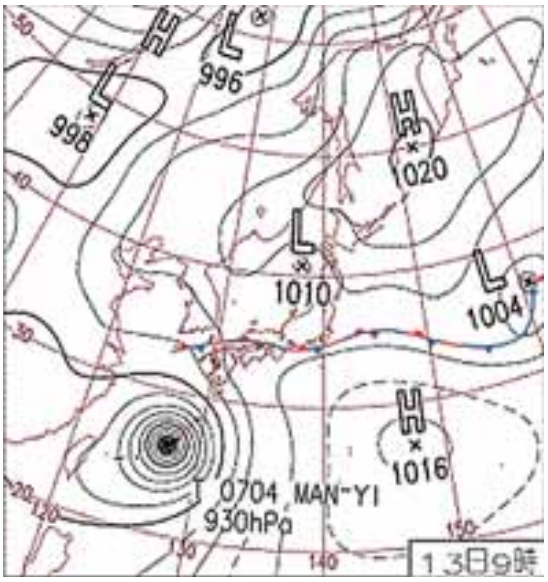


Fig.4 Surface weather chart at 9:00 on July 13th, 2007
(The centre of typhoon No.4, which is large and severely strong, found in the sea around Okinawa's main island)

Typhoon categorised by strength

Category	Maximum wind speed
N/A	Less than 33m/s (64 knots)
Strong	More than 33m/s (64 knots) but less than 44m/s (85 knots)
Severely strong	More than 44m/s (85 knots) but less than 54m/s (105 knots)
Violent	More than 54m/s (105 knots)

Table 5

Typhoon categorised by size

Category	Radius of more than 15m/s wind speed
N/A	Less than 500 km
Large	More than 500 km, but less than 800 km
Super large	More than 800 km

Table 6

Fig.7 shows a comparison of a typhoon's size with that of the Japanese islands. In the event of such a super typhoon appearing, a strong wind area with a wind speed of 15m/s will cover most of Honshu. Because a dragging anchor is often caused in the event of the wind speed exceeding 15m/s (approximately 30 knots), it is necessary to pay attention to the size of the typhoon.

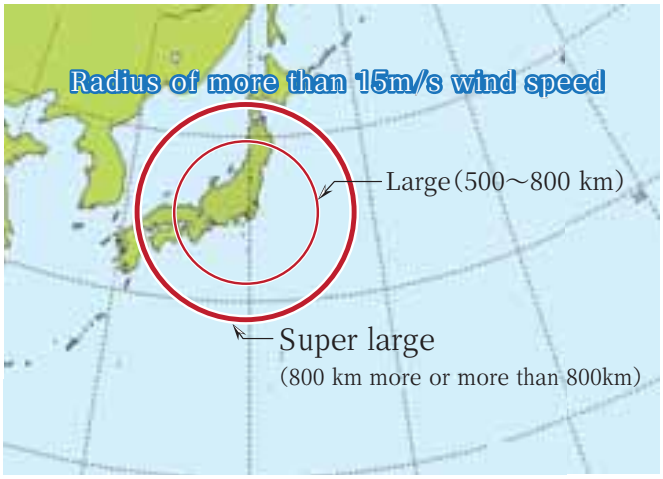


Fig. 7

In addition, the wind of a typhoon has the following characteristics.

Although there is a region called the "eye of the typhoon" where the wind is relatively mild close to the centre, the region surrounding the eyewall has the strongest wind. A typhoon is a swirling mass of air, which blows anticlockwise to the centre of the typhoon close to the ground. Moreover, it is common to observe the typhoon's right side blowing stronger when compared to the left side. This is because the typhoon's wind itself and the flow direction which moves the typhoon are identical in terms of the right side of the typhoon. To the contrary, it will be less strong on the left side of the typhoon, because it is reversed.

Furthermore, at the front right side of the typhoon, it is referred to as a "dangerous semicircle" due to the fact that vessels drift into the centre. On the other hand, it is known as a "navigable semicircle" on the left side of the typhoon because it is blown away from the centre.

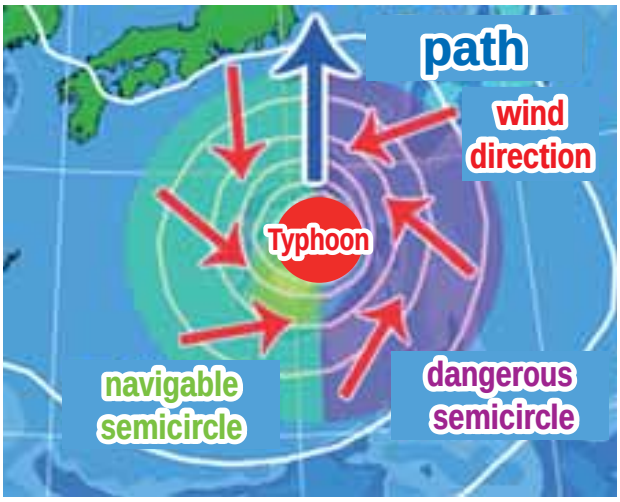


Fig. 8

2－2 Number of typhoon landings (from the Japan Meteorological Agency website)

According to the Japan Meteorological Agency, “in the event that the centre of a typhoon approaches the coastline of Hokkaido, Honshu, Shikoku and Kyushu, it is defined as being ‘a typhoon that visited Japan”. However, if it goes back to the sea again only crossing small islands and peninsulas, it is said to be a “pass”. Tables 9 and 10 show the typhoons that have landed between 2001 and 2017. There are 10 typhoons that landed in 2004, which makes it a remarkable year. The average number of typhoons that landed within this specific 16 year period, except 2004, is 2.7 per year. Also, the typhoons that landed between July and October came to 92% of the total. Within those, the typhoons that landed among the months of August and September came to 60% of the total. On the contrary, there were no typhoons that landed between the months of November and April in sixteen years.

Number of typhoon landings in Japan (2001-2017)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly total
2017							1	1	1	1			4
2016								4	2				6
2015							2	1	1				4
2014							1	1		2			4
2013									2				2
2012						1			1				2
2011							1		2				3
2010								1	1				2
2009										1			1
2008													0
2007							1	1	1				3
2006								1	1				2
2005							1	1	1				3
2004						2	1	3	2	2			10
2003					1			1					2
2002							2			1			3
2001								1	1				2
Sum total	0	0	0	0	1	3	10	16	16	7	0	0	53
%	0%	0%	0%	0%	2%	6%	19%	30%	30%	13%	0%	0%	100%

Annual average number of typhoon landings over 16 years excluding 2004:

2.7

92%

Table 9

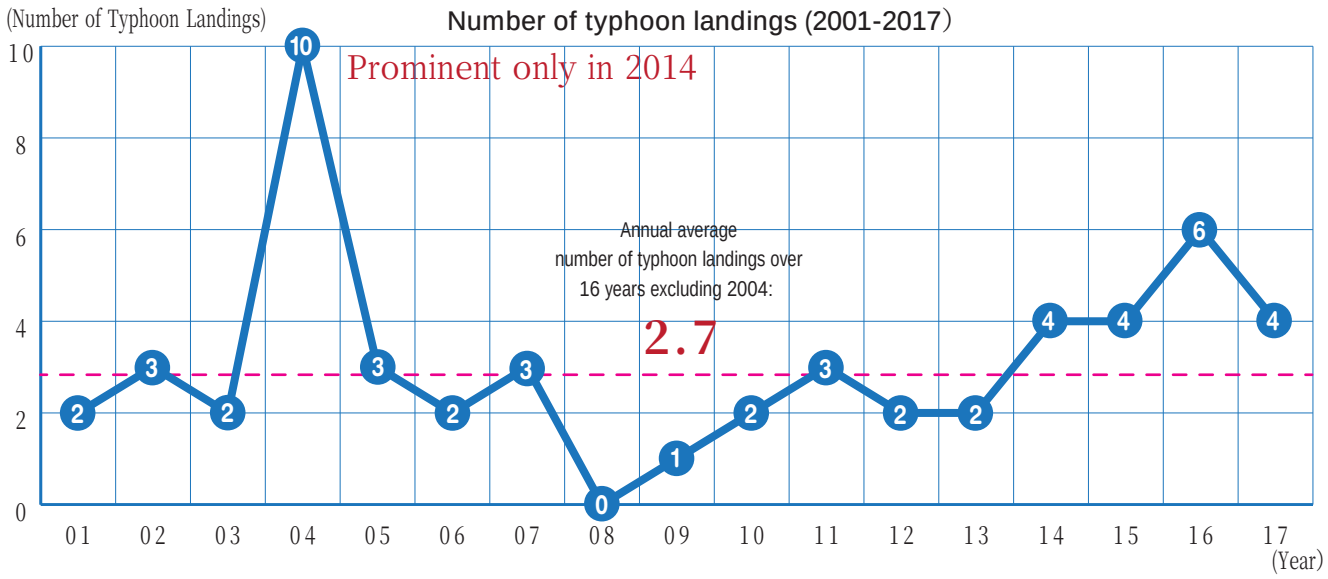


Table 10

2－3　The paths and the wind speeds of the typhoons that landed in 2004

The paths and wind speeds of ten typhoons that landed in 2004 are shown in Fig. 11 and Table 12. It was observed that the maximum instantaneous wind speed was more than 60m/s for typhoons No. 10, 18 and 22. Also, it was observed that the maximum instantaneous wind speed was more than 50m/s for eight typhoons except No. 11 and 15. The solid line indicates the typhoon path and the dotted line is the path in the event of a tropical dipression.

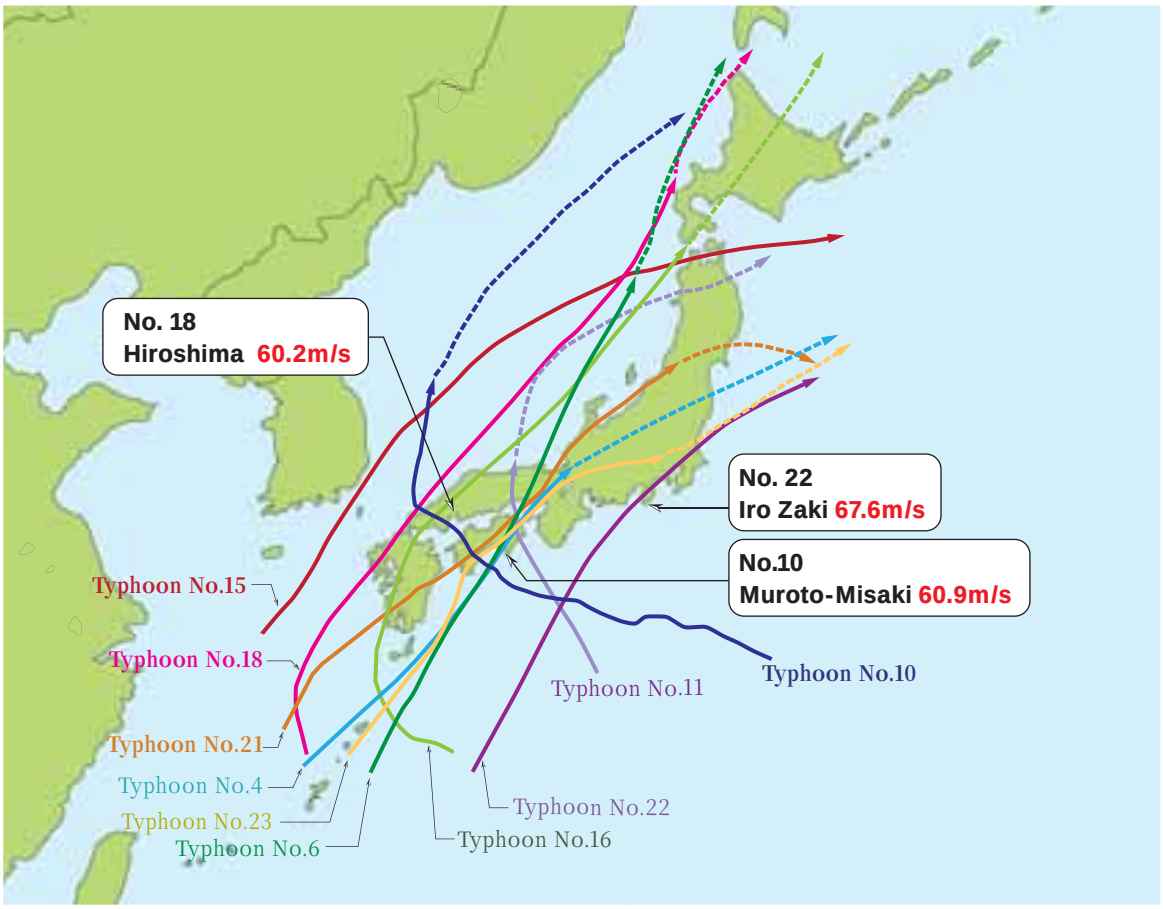


Fig. 11

Typhoon	Period	Maximum wind speed	Maximum instantaneous wind speed (m/s)	Meteorological Office
No. 4	June 11th	29.2	51.5	Miyako Island
No. 6	June 21st to 22nd	43.7	57.1	Muroto-Misaki
No. 10	July 31st to Aug. 2nd	47.7	60.9	Muroto-Misaki
No. 11	Aug. 4th to 5th	20.3	29.8	Shiono-Misaki
No. 15	Aug. 20th	27.1	48.7	Izuhara
No. 16	Aug. 30th to 31th	46.8	58.3	Muroto-Misaki
No. 18	Sept. 7th to 8th	33.3	60.2	Hiroshima
No. 21	Sept. 29th to 30th	31.5	52.7	Kagoshima
No. 22	Oct. 9th to 10th	39.4	67.8	Iro Zaki
No. 23	Oct. 20th to 21st	44.9	59.0	Muroto-Misaki

Table 12

Coastal vessels that experienced anchoring problems, following the passing of ten typhoons, are shown in Fig. 13 and Table 14. Approximately half of the number of ships anchored at Seto Inland Sea. In addition, 30% of the ships anchored at main sea areas such as: Tokyo Bay, Ise Bay, Mikawa Bay, Osaka Bay etc.

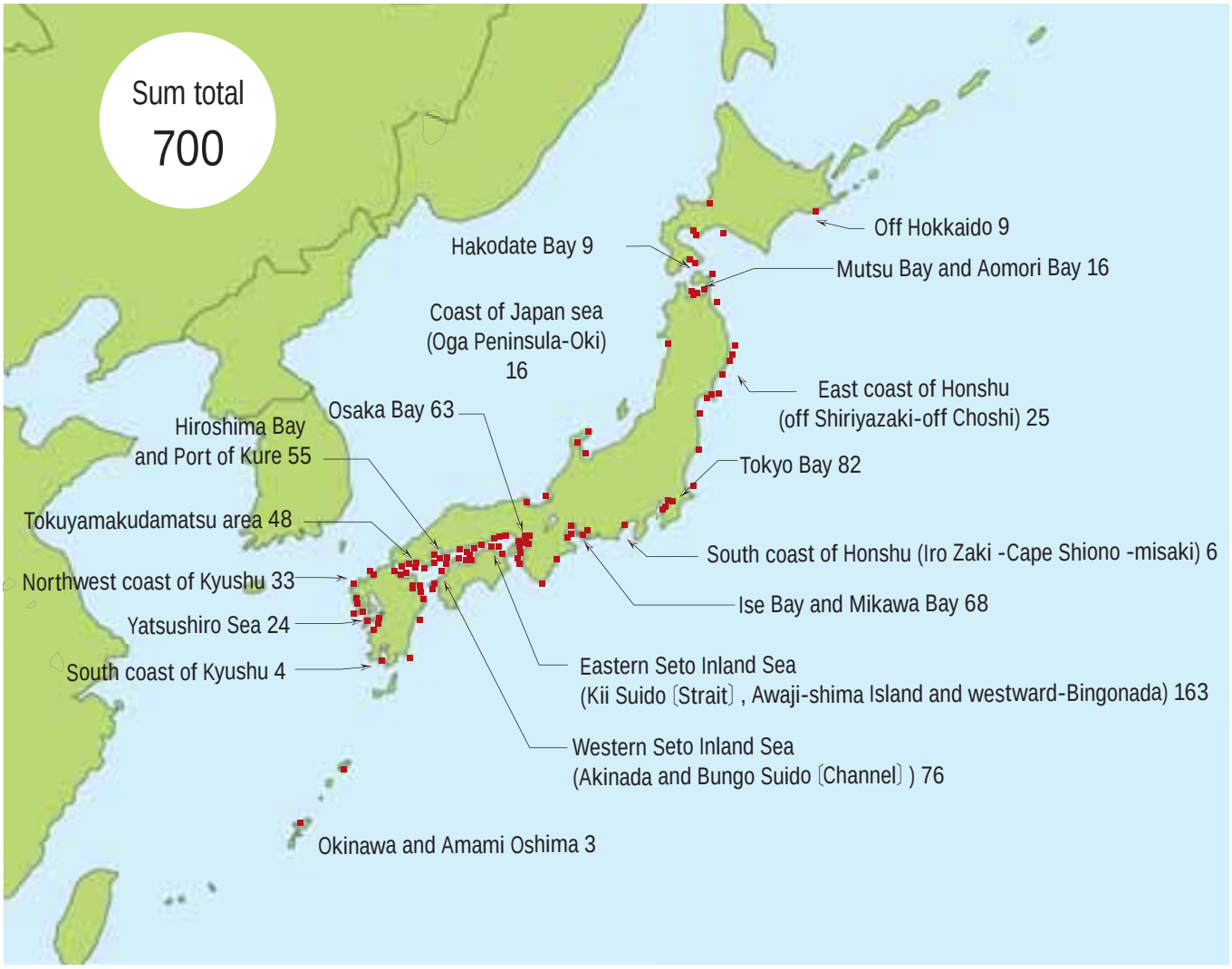


Fig. 13

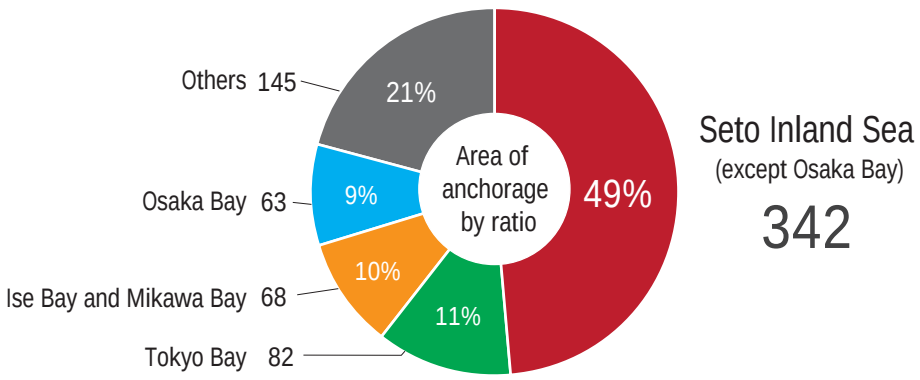


Table 14

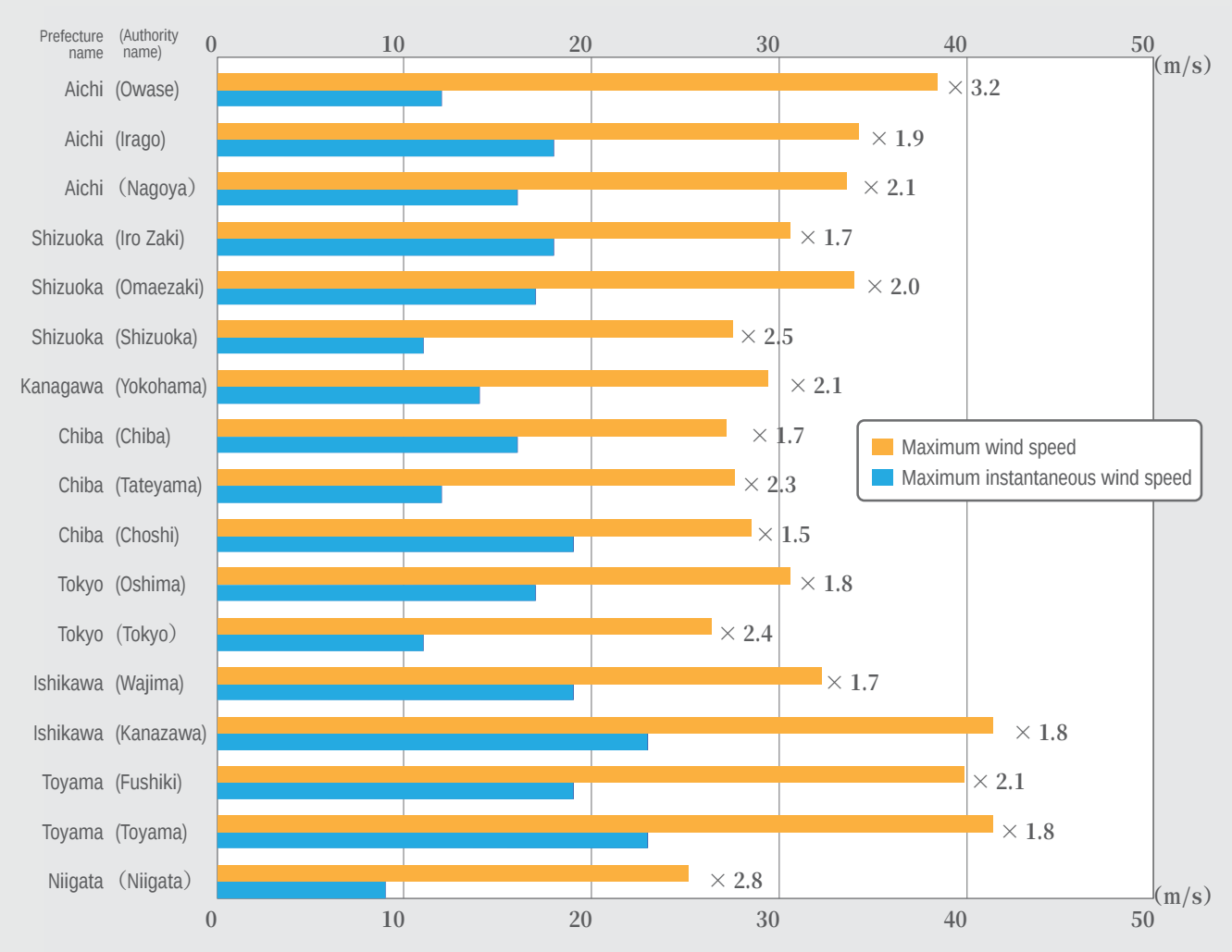


Table 15

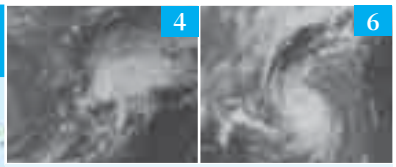
Following a comparison of the maximum wind speed (the maximum value of the 10 minute average wind speed) and the maximum instantaneous wind speed (the maximum value of the instantaneous wind speed) which were detected at each meteorological office, at the time when typhoon No.23 landed on October 20th and 21st, is shown in Table 15. Maximum instantaneous wind speed becomes 1.5 - 3.2 times greater the average wind speed.

At sea, where there are few structures that stand against the wind, it is particularly necessary to estimate the maximum instantaneous wind speed to be at least 1.5 - 2 times that of the average wind speed.

2－4　Typhoon marine accidents in 2004

Typhoons have caused large-scale disasters, not only for ships, but also on shore. Figs. 16, 17, 18, 19, 20, 21, 22 and 23 indicate damage statuses.

No.4 and 6

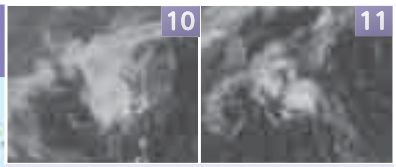


- June 10th to 22nd
- No. of deceased and missing: 5
- No. of totally or partially destroyed houses: 6

It brought damage to the Chubu, Kinki and Shikoku regions. Along with major disruptions caused to each form of transportation, part of the national highway in Tokushima prefecture was closed.

http://agora.ex.nii.ac.jp/digital-typhoon/wnp/by-name/200404/0/512x512/GOE904061106.200404.jpg
http://agora.ex.nii.ac.jp/digital-typhoon/wnp/by-name/200406/0/512x512/GOE904062003.200406.jpg

No.10 and 11



- July 29th to Aug. 6th
- No. of deceased and missing: 3
- No. of totally or partially destroyed houses: 32

It brought heavy rain mainly in the Shikoku regions, and continuously, it caused landslides and mudslides in Tokushima and Kochi prefectures.

http://agora.ex.nii.ac.jp/digital-typhoon/wnp/by-name/200410/0/512x512/GOE904080103.200410.jpg
http://agora.ex.nii.ac.jp/digital-typhoon/wnp/by-name/200411/0/512x512/GOE904080403.200411.jpg

No.15

- Aug. 17th to 20th
- No. of deceased and missing: 10
- No. of totally or partially destroyed houses: 105

It brought extremely heavy rain, not only to the Kyushu and Shikoku regions, but a storm that swept each area on the Sea of Japan side from Kyushu to Hokkado.

http://agora.ex.nii.ac.jp/digital-typhoon/wnp/by-name/200415/0/512x512/GOE904081903.200415.jpg

No.16

- Aug. 27th to 31st
- No. of deceased and missing: 17
- No. of totally or partially destroyed houses: 256

It brought heavy rain and flooding, due to high tide, to the Pacific coast of western Japan. A wide area of the Seto Inland Sea coast, such as Kagawa Prefecture, Okayama Prefecture and Hiroshima Prefecture were affected.

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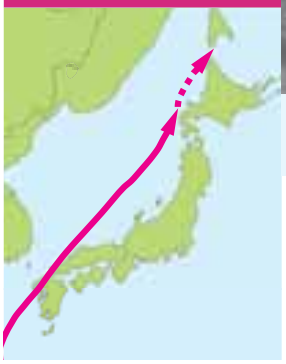
No.18

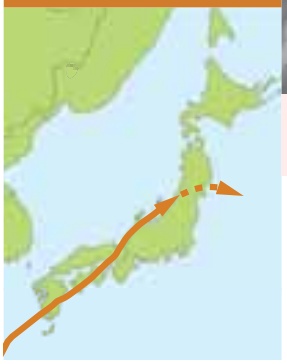


- Sept. 4th to 8th
- No. of deceased and missing: 46
- No. of totally or partially destroyed houses: 1,650

In the regions of Okinawa, Kyushu, Chugoku and Hokkaido, there were areas that recorded the highest instantaneous wind speeds. Buildings were damaged and trees were fallen in each area while a large number of people were injured.

http://agora.ex.nii.ac.jp/digital-typhoon/wnp/by-name/200418/0/512x512/GOE904090704.200418.jpg

No.21



- Sept. 25th to 30th
- No. of deceased and missing: 27
- No. of totally or partially destroyed houses: 893

She crossed the Kyushu and Shikoku regions, kept proceeding to the Kinki and Hokuriku regions and finished up in the Tohoku region.

http://agora.ex.nii.ac.jp/digital-typhoon/wnp/by-name/200421/0/512x512/GOE904092803.200421.jpg

No.22

- Oct. 7th to 9th
- No. of deceased and missing: 9
- No. of totally or partially destroyed houses: 435

The typhoon was not so big, however, the vicinity of the centre was accompanied by raging rain and wind. It caused sediment damage such as landslides, flooding and damage caused by gusts, from the Tokai region to the southern part of Kanto.

http://agora.ex.nii.ac.jp/digital-typhoon/wnp/by-name/200422/0/512x512/GOE904100803.200422.jpg

No.23

- Oct. 18th to 21st
- No. of deceased and missing: 98
- No. of totally or partially destroyed houses: 8,836

Because she crossed Honshu with a large force, she brought overflow to rivers, flooding and sediment damage to a wide area. There were a large number of the deceased and missing on a wide scale, mainly in Hyogo, Kyoto and Kagawa prefectures.

http://agora.ex.nii.ac.jp/digital-typhoon/wnp/by-name/200423/0/512x512/GOE904101803.200423.jpg

Fig. 16 ~ 23

Source: "Digital Typhoon Project" courtesy of the National Institute of Informatics

Table 24 indicates each typhoon marine accident situation that occurred in 2004 (as published in the Marine Accident Inquiry Agency [MAIA]).. The total number of marine accidents was 233, however, the number of marine accidents (72 accidents) and the number of vessels (88 vessels) affected by Typhoon No. 18 are remarkably prominent.

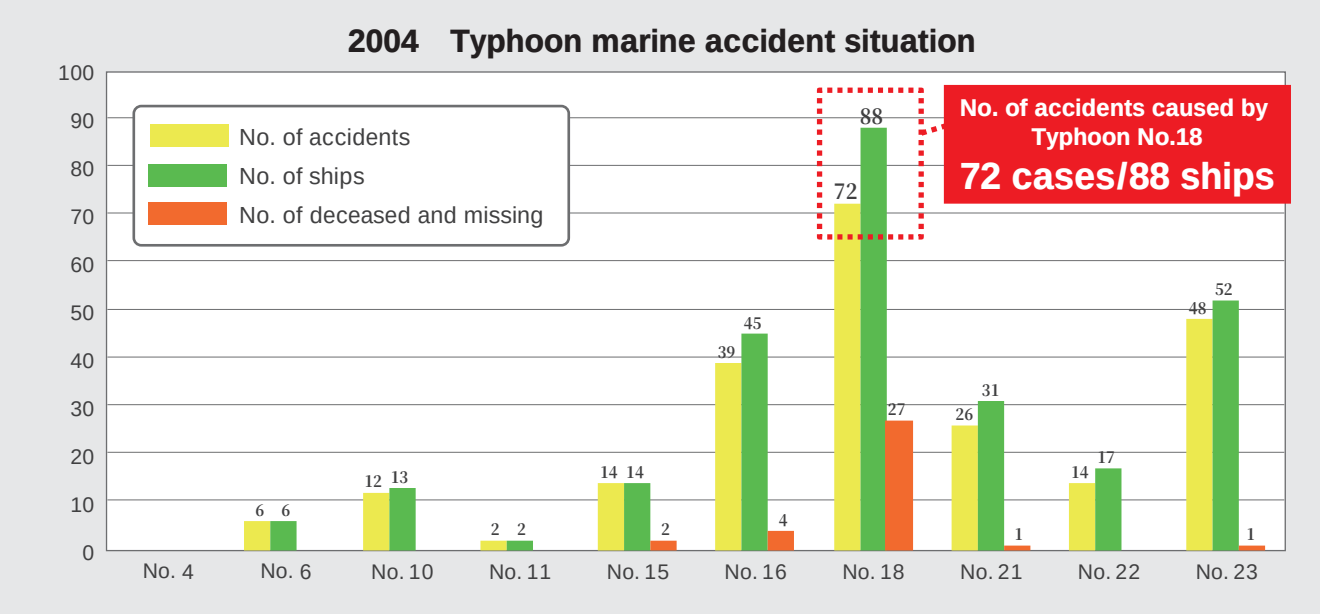


Table 24

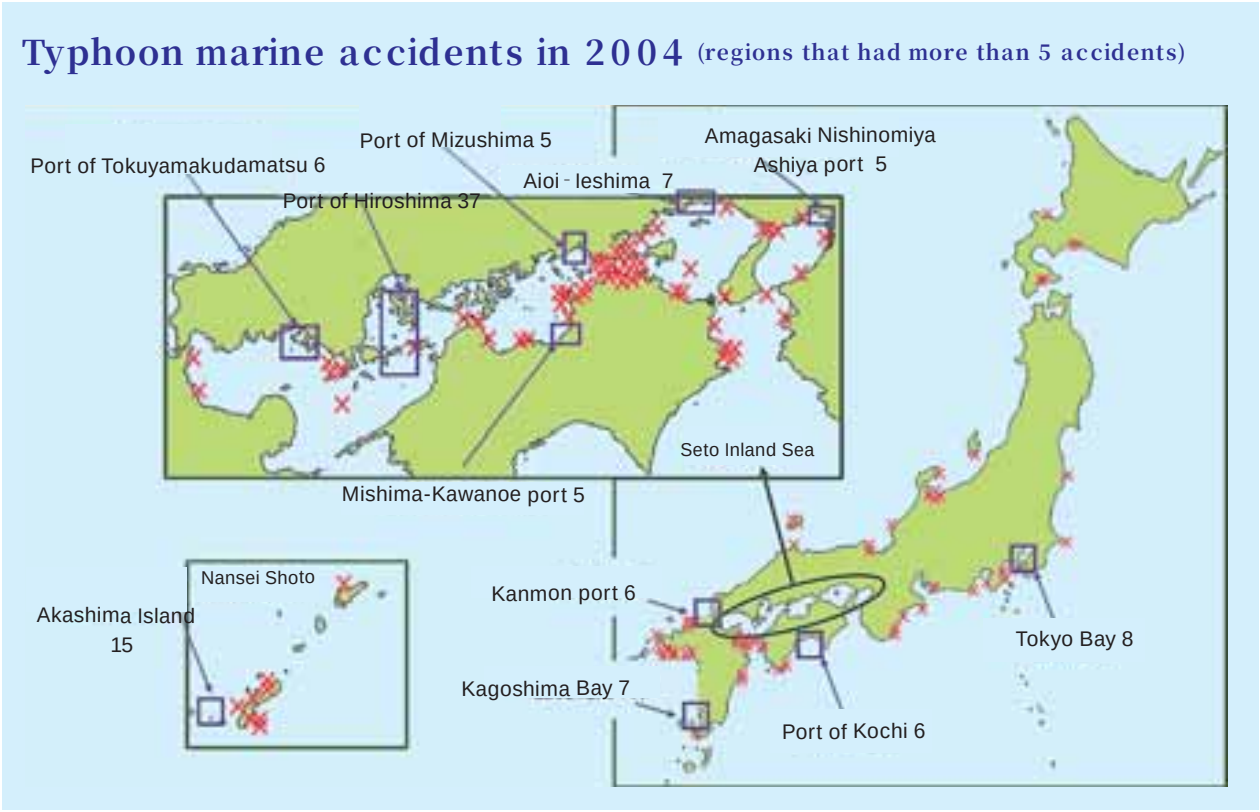


Fig. 25

= Summary of Typhoon No. 18 (From the Japan Meteorological Agency website) =

On the 28th of August 2004, approximately 09:00 Japan Standard Time (here in after referred to as JST), Typhoon No.18 which was formed in the sea around the Marshall Islands moved northwestward over the southern Sea of Japan and passed through the northern part of the main Okinawan island with great size and force on the 5th of September. Afterwards, she proceeded north, to the East China Sea and changed path to the northeast. At approximately 9:30 on the 7th of September, she landed in the vicinity of Nagasaki-city and passed through the northern part of Kyushu. In the afternoon of the 7th she reached the Sanin offing. Then, while accelerating northeastward up the Japan Sea, on the morning of the 8th she headed north on the western offing of Hokkaido with a storm area accompanying after. Then, after changing into an extratropical cyclone at 09:00 on the 8th, she reached the Soya Strait, while still growing.

Gale force winds with a recorded maximum instantaneous wind speed of 50m/s were observed in regions of Okinawa, Kyushu, Chugoku and Hokkaido, for example, 60.2 m/s in Hiroshima and 50.2 m/s in Sapporo. In addition, there was an area of the Kyushu region where heavy rain which exceeded 900mm was observed. Moreover, damage caused by high water levels on the coast of the Seto Inland Sea and on the coast of the Japan Sea from western Japan to northern Japan was also observed.

This typhoon caused damage to buildings and trees to fall in each area it passed. A large number of people were injured because of falling debris. Also, grounding accident of ships occurred one after another in western Japan.

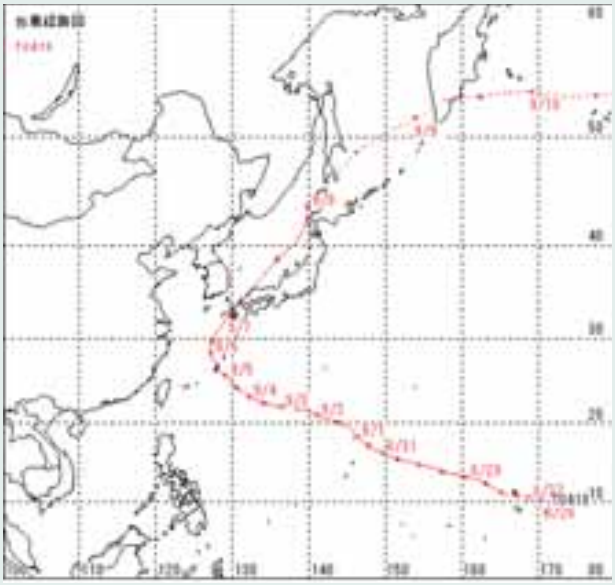
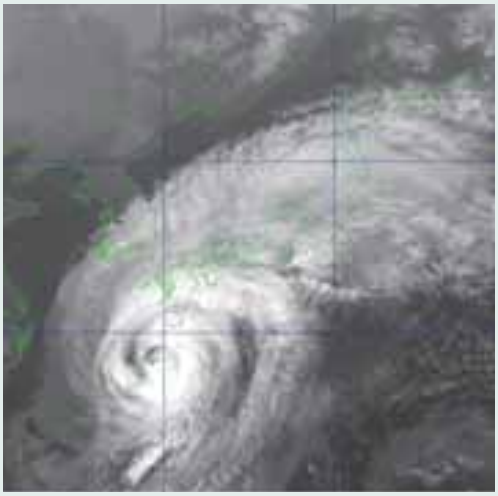


Fig. 26
The route of Typhoon No.18 in 2004



Photograph 27

Fig. 28 shows the routes of Typhoons No. 18 and 23. Moreover, the severe dragging anchor accident of the cargo ship "MV TRI ARDHIANT" (6,315 tons) and grounding accident of the training ship "Kaiwo Maru" (2,556 tons) may be familiar.