

Memo. No. 26.

The enclosed compilation, presenting in a succinct form the laws of storms prevailing in the Asiatic seas and revealing the means of escaping them, was made last year by order of the Admiral commanding the United States fleet in China and Japan, and was distributed among the various Commanders of vessels. It is hereby submitted with the recommendation that it be translated and printed in both English and Japanese for the use of masters of transports and other vessels connected with the expedition.

Yokoi, April 4<sup>th</sup>, 1874.

Respectfully Submitted

His Excellency

General Saigo.

Secretary of War, Chief Commissioner, etc.

Chunshiro



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Extract from the Memoir  
of Mr. Keller, published in 1847.

We will recapitulate for  
each hemisphere the nautical  
directions for attempting to avoid  
the violence of hurricanes and  
to facilitate their application by  
navigators threatened to be envel-  
oped by these storms:—

In the Northern Hemisphere  
Hurricanes of West Indies, Cy-  
clones of India, Typhoons of  
China Sea.

If the wind hauls by the  
Compass to the right, or in ac-  
cordance with the movement  
of the hands of a watch you  
are in the dangerous semi cir-  
cle of the tempest, and whatever



may be the latitude you should heave to on the starboard tack, or, if the force of the wind is not too great, stand on close hauled on the starboard tack. If, on the contrary, the wind hauls, by the Compass, to the left or in an opposite direction to the hands of a watch, you are in the manageable semicircle of the tempest, and if the sea is not too heavy, you should run with the wind on the starboard quarter or, if the sea is too heavy, heave to on the port tack.

In the Southern Hemisphere, Hurricanes in the Channel of Mozambique, Island of Bourbon, &c.:

If the wind hauls by the Compass to the left or in a direction opposite to the movement of the hands of a watch, you are in the dangerous semicircle of the tempest, and whatever be the latitude, you should heave to on the port tack or, if the storm is not too heavy, stand on close hauled on the port tack. On the contrary, if the wind hauls by the Compass to the right or in accordance with the movements of the hands of a watch, you are in the manageable semicircle of the tempest, and if the sea is not too heavy, run with the wind on the port quarter. If the sea becomes too heavy,



brace to on the starboard  
tack.

We will add, that after  
having experienced a hurricane  
in less than  $26^{\circ}$  S. or  $30^{\circ}$  N. lat,  
you should not for some days  
steer towards the pole, to  
avoid again encountering the  
branch of its path the farthest  
removed from the Equator - for  
although the velocity of its  
movement exceeds nearly that  
of the ship, yet the latter may  
describe the chord which joins  
two points of the course of the  
hurricane in the same time  
employed by the meteor to  
run over the arc of the chord.  
This precaution would be su-  
perfluous in the hurricanes  
of the Bay of Bengal and in



the typhoons of the China Sea, for these seas only extend to  $30^{\circ}$  N. lat., and only contain a limited and sensible rectilinear portion of the general path of hurricanes, which spend themselves on the land when directed towards the N. W.

These practical directions are independent of the lat. They apply to all the sorts of typhoons, and assure escape in the right direction when this is possible.

Extract from an Unpublished Memoir of M. Kellen relating to manœuvres in Hurricanes, Typhoons, Cyclones and Tempests.

The gyratory movements



of hurricanes determine the tack. The movement of translation decides the course a ship should take.

In the Northern Hemisphere the gyratory movement is opposite to the movement of the hands of a watch, and in the Southern Hemisphere it is in the same direction. The gyratory movement being invariable in each hemisphere, the tack upon which a ship should be placed is equally invariable in each hemisphere. It is starboard in the Northern Hemisphere and port in the Southern. The movement of translation of the hurricane determines for both hemispheres:-

1<sup>st</sup>. In the dangerous semicircle

the course close-hauled as long as the barometer falls, and with the wind free when it rises.

2<sup>nd</sup>. In the manageable semicircle the course with the wind on the quarter as long as the barometer falls, and with the wind free when it rises.

The dangerous semicircle being to the right of the path of the centre in the Northern Hemisphere and to the left in the Southern Hemisphere, the course for escape, that is to say, the route which should be pursued to increase the distance from the centre of the hurricane, will be known, if it is known on which side of the path of the



centre of the hurricane the ship is placed. Now the side is indicated by the variation of the wind by the Compass produced by the change of place of the centre of the storm. If in looking in the eye of the actual wind, the wind as it hauls blows from the right, the ship is to the right of the path of the centre of the hurricane. If, on the contrary, the wind changes to the left, the ship occupies a position to the left of the centre. After this the route to be pursued to increase the distance from the centre depends exclusively on the variation of the wind. The variation should be observed how to



in order that it be the result of the Change of the base of the Cyclone, and not the change of position of the ship; beside it should correspond to a fall of the barometer, a distinctive mark of the actual penetration of the ship into the body of the hurricane.

The indications of the approach of a hurricane being a heavy swell, a steady fall of the barometer and an increasing violence of the wind, as soon as they are observed a ship should reduce sail and be hove to on the starboard tack in the Northern Hemisphere and the port tack in the Southern Hemisphere, without taking into consideration the direction of the waves, in



order to escape the centre of the storm, and be in a position to execute at once such ulterior manoeuvres as the variation of the wind, observed while hove to, may determine.

A resume of these manoeuvres is given in the following:-  
Manoeuvre in hurricanes in the Northern Hemisphere, Starboard tack.

Being hove to on starboard tack, barometer falling:—

1. - If the wind hauls by compass to the right or in the direction of the movement of the hands of a watch, the ship is to the right of the path of the centre, in the dangerous semicircle, and would

run close hauled on the starboard tack and keep this course until the barometer rises and then run free.

2. - If the wind hauls by compass to the left or contrary to the movement of the hands of a watch, the ship is to the left of the path of the centre, in the manageable semicircle of the cyclone, and should run with the wind on the starboard quarter and maintain this compass course during the ulterior changes of the wind while the barometer rises; from this time shape a course free.

3. - If the wind, as noted when hove to, does not change its direction during the progressive fall of the barometer, the ship



path of the centre, in the dangerous semicircle. She should run close hauled on the port tack, and preserve this course until the barometer rises, and then shape a course with the wind free.

2.- If the wind hauls by Compass to the right or in accordance with the movement of the hands of a watch, the ship is to the right of the path of the centre, in the manageable semicircle of the storm, and should run with the wind on the port quarter, and maintain this Compass course during the ulterior changes of the wind, until the barometer rises, when shape a course free.



3. If the wind when hoove to does not change its direction during the progressive falling of the barometer, the ship is in the path of the centre, and should run before the wind and keep the same compass course on the port tack until the barometer rises, when a course with the wind free should be constantly maintained until the end of the storm. (These directions differ from those recommended by Reid in the two editions of his first work "The Law of Storms.") This latter work recommends heaving to on the port tack in the manageable semicircle of hurricanes in the Northern Hemisphere, and on the starboard

tack in the Southern Hemisphere in order to avoid the danger of being taken aback in the shift of wind. But this manœuvre has the grave disadvantage of pushing the ship towards the centre and precipitating her into a danger more certain and more formidable. Reid, struck by this disadvantage, advises at present to renounce this mode, and in all cases to take the starboard tack in the Northern Hemisphere and the port tack in the Southern.

We are entirely of this opinion, which simplifies the manœuvres in reducing them to a question of direction, and placing the tack out of the case, the more so as the course with the wind on the



quarter and the wind aft being substituted in the recent directions for hove to on the opposite tack in the manageable semicircle of hurricanes, ships need not fear being taken aback, for the shifts of wind are never so great at the commencement of a hurricane as to pass from aft forward. On the other hand the variation of the wind arising from the ship penetrating the face of the hurricane is greater in a given time as the penetration is greater or as the velocity of the translation of the hurricane is greater. Now, this velocity, keeping back the wind from the manageable semicircle, the wind there is more feeble according to the rapidity with



which the hurricane advances in its path: hence the greatest variation in the direction of the wind which could be feared would be from a wind comparatively light and by no means formidable; and if, on the contrary, the wind is strong, it varies but little, because the velocity of transition is feeble, and then there is no danger of being taken aback, although, in this case, the violence of the wind in the manageable semicircle differs but little from that in the dangerous semicircle.

We will add that the manoeuvre, wind aft, involves a great reduction of sail to manage the ship, almost under bare poles if the wind is violent, in order to reduce the speed of the ship



and the impetus which she communicates to the waves, which would be likely to come over aft if the speed were too great. It is always better to run the risk of shipping a few seas than to remain stationary. On all courses, except that with the wind aft, it is necessary to make sail, otherwise the ship would be at the mercy of the waves.

### Direction of the Predominant Wave on the different Courses.

In the Northern Hemisphere  
Starboard tack:-

On the Course } the predominant } On the star-  
prescribed. free } wave is } board quarter.

In the dangerous semicircle:

1. Wind aft	} the wave is	On Port Quarter.
2. Wind on Quarter		Aft.
3. Wind free		On Starboard Quarter.
4. Close hauled.		On Starboard Beam.

In the Southern Hemisphere,  
Port tack, the ship being hove  
to, port tack:-

On the Course } the wave is } On the Port  
prescribed free } Quarter.

In the dangerous semicircle:-  
On the Constant } the wave is } On the Port  
Course, close hauled } Beam.

In the manageable semicircle:-

1. Wind aft	} the wave is	On Starboard Quarter.
2. Wind free		On Port Quarter.
3. Wind in Quarter		Aft.
4. Close hauled		On Port Beam.



According to the foregoing, the most unfavorable direction of the wave is that of close hauled in the dangerous semicircle; but on this route, the ship, being supported by the wind, the rolling is not likely to affect the spars, the pitching will be moderate, and the helmsman must watch the waves and strive to avoid the shock of the heavy seas. This course should not be abandoned, for it is the only one by which to avoid future peril, as the skill of the helmsman may meet present danger. The danger here mentioned should never make the mariner neglect the rules laid down. He should follow them at all hazards, whatever may be the state of the sea;



for certainly his situation will become more dangerous the longer he delays to execute the manoeuvres which alone can secure his safety by removing from the centre of the hurricane.

### Resumé.

General representation of the manoeuvre in Hurricanes, Typhoons and Tempests.

As soon as the progressive fall of the barometer, and increasing violence of the wind indicate the approach of a hurricane, all the necessary precautions should be taken: leave to so as to remain as nearly as possible stationary, or at least making very little progress, in order



to observe the wind during the first depression of the barometer, and, to decide from it the Course to escape as follows:-

In the Northern Hemisphere, Starboard tack: the starboard tack should be taken equally in heaving to at first. As for the Course of escape, if, when hove to, the barometer falling, the wind has not changed its direction, run with the wind aft and keep this original Compass Course.

If the wind hauls to the left, run with the wind on the quarter, and keep this original Compass Course	If the wind hauls to the right run close hauled and keep this Course
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until the barometer rises.

From this moment, and as long as the wind is violent, follow the Course free on the Starboard tack.

In the Southern Hemisphere, Port tack. The port tack should be taken equally in heaving to at first. As for the Course of escape, if, when hove to, barometer falling, the wind has not changed its direction, run with the wind aft, and keep this original compass course.

If the wind hauls to the left run close hauled and keep this original compass course	If the wind hauls to the right run with the wind on the quarter and keep this original compass course
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until the Barometer rises.











