APUS-ONE 貨櫃落海事件分析 APUS-ONE 貨櫃落海事件的具體情況
https://youtu.be/biMhE4NYWGs

詳細分析 APUS-ONE 貨櫃落海事件的具體情況,包括船隻的 pitching 和 rolling 特性、航線變化過程中遇到的各種氣象條件變化,以及最終導致貨櫃大量落海的原因。

船隻的 pitching 和 rolling 特性
這些特性與船隻的長度和波浪長度有關。當船隻遇到與自身長度相近的波浪時,會產生同步橫搖,給駕駛帶來很大挑戰。文章提供了具體的計算方法,教會船員如何快速計算船隻的橫搖週期。

航線變化過程中的氣象條件
APUS-ONE 從日本出發後遇到的各種氣象變化,包括初期平靜的天氣、隨後出現的強風浪、溫帶氣旋的生成及其帶來的渦流氣旋等。這些氣象變化導致船隻航向和航速頻繁調整,最終遭遇了嚴重的參數橫搖。

貨櫃大量落海的原因
貨櫃大量落海的直接原因是船隻失去動力。在劇烈的參數橫搖中,船尾被抬起導致失去推進力,最終導致貨櫃大量落海。文章強調,在惡劣天氣下,船員應該優先保護好主機,而不是過於關注貨物本身。

結論
通過對 APUS-ONE 貨櫃落海事件的全面分析,文章總結了船員在惡劣天氣下應當注意的關鍵點,為今後類似事故的預防提供了寶貴經驗。

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這是航海氣象講座的第 16 講。今天，要重新再檢視一下 APUS-ONE 貨櫃落海事件的真實情況？首先，先研究一下這個波浪，大家應該看得出來，圖中波長與船隻長度是一樣的。下面 OOCL 這個波浪，就是很明顯的，波峰到船中的時候，又遇到一個船頭浪。所以，這個就是波長等於船長一半的時候，造成的這個參數橫搖。

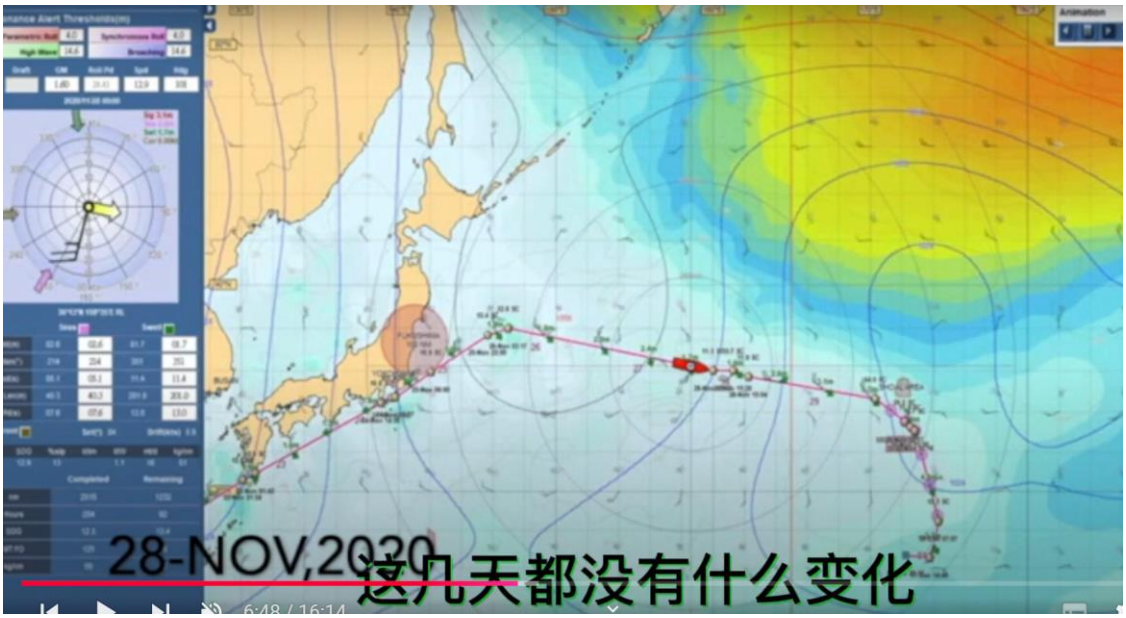
或這應該是像橫搖跟縱搖同時產生時，造成同步橫搖。好，站在駕駛台當班，不是看船搖了幾度就好，要計算左右橫搖的週期。現在右邊的最低是 2:00(YT 影片的時間)，然後再往左邊最低是 2:21(YT 影片的時間)，大概是 21 秒左右，橫搖週期應該是 21 x 2 =42 秒。 42 秒的橫搖週期 GM 是多少？這個做大副，一定要知道，本船的橫搖特性。做一個船副應該要有讀秒的能力，也就是心算本船橫搖週期是多少秒？

讀秒最簡單的方法就是，兩千零一，兩千零二，兩千零三…，兩千一零，兩千零二，兩千一二……，兩千二零，兩千二一，每一秒以 4 個讀音的長短來代替，每一秒的時間間隔，要用碼表來確認與自我訓練，這樣子來計算秒數。

好，這是 APUS-ONE 的過大洋的航線。首先我們看，紅船開航的時候沒有什麼風浪，大家心情都還很愉快，準備是要走高緯，現在看看 APUS ONE，它的航跡圖，這是 11 月 25 號，從這日本開航準備走高緯度向上，這時候看得到是船頭方向來的風浪，四級的風浪。所以情況是還好，走著走著過 6 個鐘頭以後(紅船剛過東京灣)，忽然在庫頁島的蒙古高壓出現，風向轉西北風，這一波一波的冷氣南下所造成的冷鋒，這冷鋒就壓迫到暖空氣不能北上，所以就沿著東北方向吹，在船隻的東北方產生暖氣團產生暖鋒(紅船航向 100 度)，這樣冷空氣南下與暖空氣北上產生渦流氣旋，這是溫帶氣旋的生成第一階段。

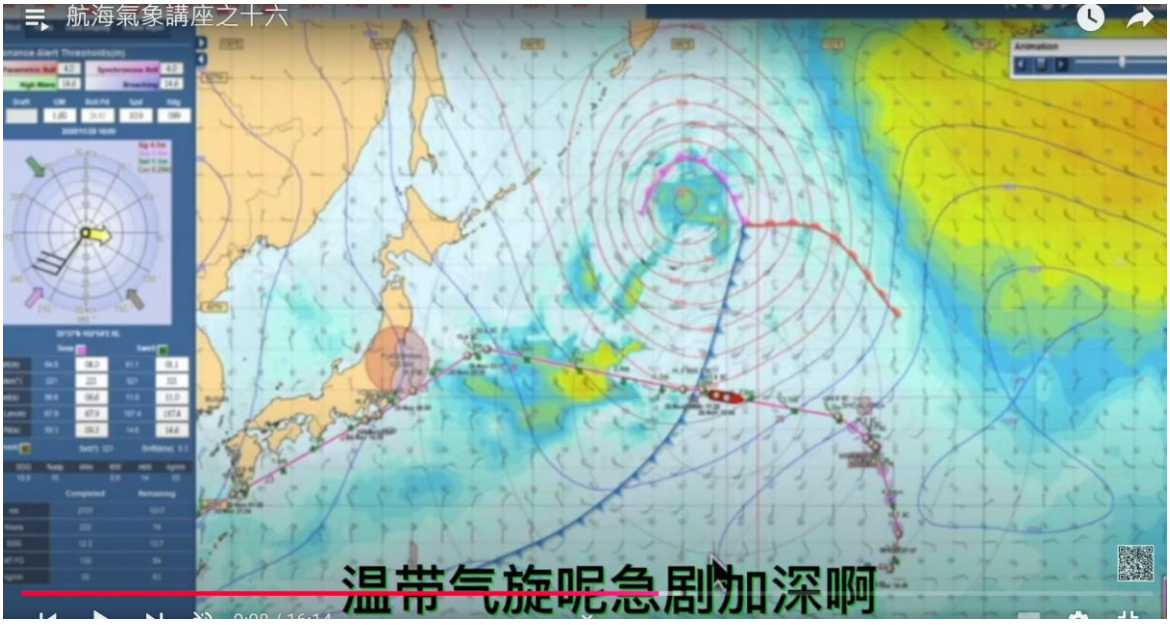
現在看到它的風向是船尾來的風 15 節(風向又逆時鐘轉至西北風)，這風就是沿著這等壓線下來的方向，剛好在左船尾的方向，眼看船隻如果再繼續開過去的話，也還是吹的就是西北風，現在船繼續走，風向風力不變還是 15 節的風，從西北方來的風，船隻已經感覺不對勁，準備要什麼往南走，這大概是 11 月 26 號，開航一天過後。

走著走著，27 號風也沒有比較大，眼看風速反而還比較小，現在是北方來風，風向順轉，26 號是西北轉到正北，風向順轉照講應該是什麼? 氣旋遠離的跡象。在北半球觀測颱風動向，也是一樣，要保持風向順時針轉來避讓，可是運氣不好時，風向逆時針轉，就是風暴接近。



這時候風向還是繼續在順轉對不對? 風雖然是大了一點，可是確是遠離的前面的低氣壓，在 28 號的時候，這時西南風開始加大，當然西南風是暖空氣，應該是沒關係的，這時候應該氣溫升高，氣壓梯度這幾天都沒有什麼變化，然後風向繼續順轉，這時候看到船上已經開始減速了，實際上是減到多少? 應該是 12 節，前面最多也只是 15 節的船速。

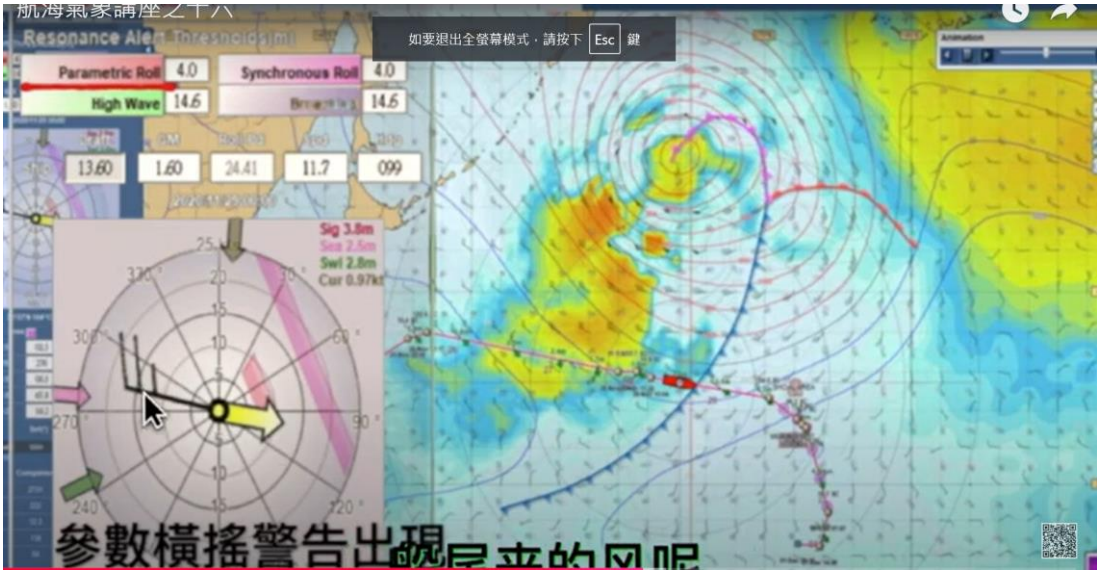
這時候吹的是什麼風啊? 是西南風，六級的西南風，風暴已經遠離，為什麼吹到西南風的時候，船上感覺到不對勁，這是因為，一路西南風都是由南邊來的，所以到這裡的時候，可能已經超過三天，應該是有湧浪的產生，船繼續走，忽然就生成一個很大的冷鋒面(船長加車到 15 節)，這冷鋒面生成的原因，當然也是因為一個大面積的藍色冷氣團南下，紅色是是暖空氣的暖鋒，上面紫色的，就是什麼? 囚錮鋒，還是什麼滯留鋒。這是溫帶氣旋的第二 R 階段(囚錮鋒)。



風在這裡，風向本來是順轉的，現在變成逆轉，船本來是向東走 R 減速到 10 節(航向 090 在

YT 的 7 分 29 秒，船速 10 節，可能想在風浪後面過)，現在也改成向東南方走(船速加到 15 節)，所以船長有在調整航向跟航速，想要脫離鋒面，也是蠻有經驗的，這邊有綠色的箭頭(看影片)，指的是湧浪來的方向(西北方)，如果這是湧浪的方向的話，就是風浪/風吹浪(紅色箭頭)，西北風的方向跟東南來的湧浪成 90 度，這就開始會造成什麼? 三角浪。

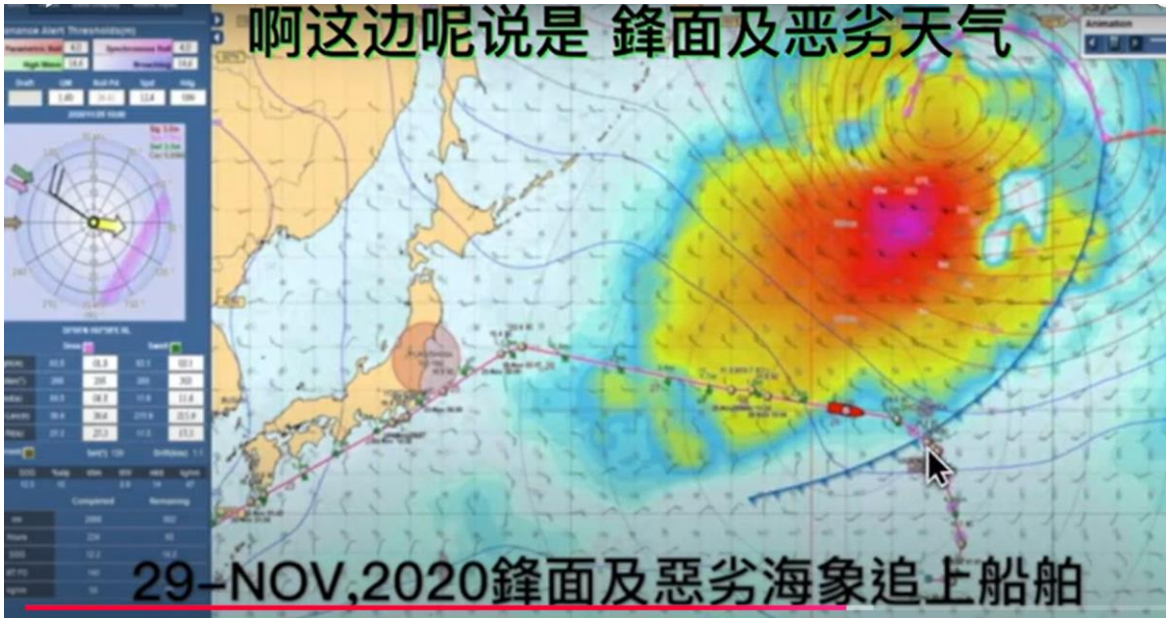
看，到現在這裡東經 160 度(航向約 095/航速減到 11 節)，溫帶氣旋急劇加深，這是溫帶氣旋生成的第三階段，風還是西南，其實溫帶氣旋最低氣壓，現在還在船隻的北方，很少船隻會直接衝到裡面去。



風繼續保持西南風，船隻應該是沒有什麼問題，看，船長又把航向調的向東一點，這時候就開始有參數橫搖粉紅色的警告(黃色速度向量端點落入粉紅色區域)，為什麼?因為船尾來的風啊，船尾來的風，這裡是二十五節，也就是五級風，船速應該現在是落在十三節的速度。

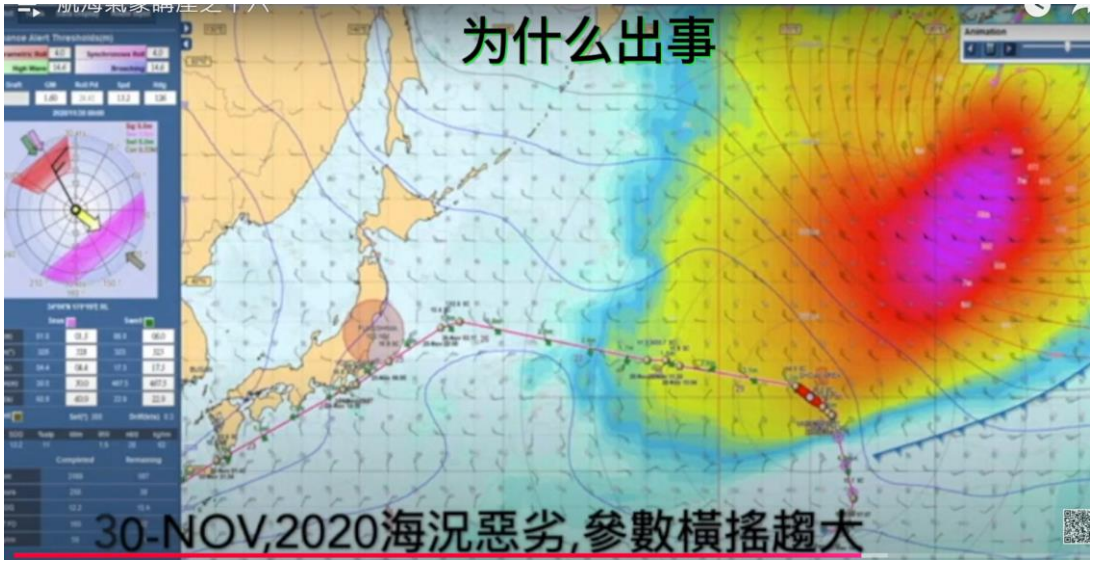
看它的圖。這是參數橫搖(4)是? 浪高四米。高浪是 14.6 米。這 Sig 3.8 米，這就是顯著波高 3.8 公尺，海浪 2.5 米，湧浪 2.8 米，洋流 0.97 節。一般湧浪比這比這風吹浪要大一點，這是參數橫搖的警告，因為船的速度慢，所以船的 pitching 的週期也就跟著變慢，這邊是鋒面及惡劣天氣。因為這低氣壓移動的很快，所以可見的是什麼? 白令海這裡有新的冷高壓或是噴射氣流的加入，所以這要再去研究五百毫巴啦，到底是阿拉斯加的冷高壓，還是噴射氣流南下。

說這溫帶氣旋就是一個陀螺，噴射氣流南下又北上，就等於在打陀螺一樣，所以溫帶氣旋的氣壓降低的非常快。船隻本來吹的西南風，現在改成了西北風，西北風是由於阿拉斯加的冷氣團持續的南下(第三階段)跟噴射氣流的南下(第四階段)，所以就造成了北牆效應，暖空氣被推升到高空，就有可能產生這很大的風浪。



11 月 29 日影片上，寫的鋒面及惡劣天氣追上船舶，這是錯誤的，應該是新的阿拉斯加冷高壓南下，是船隻又進入新的危險區域。這時風速大概是二十節左右，然後船繼續開始東偏東，然後轉東南在走，這時候不幸，又變成尾浪，因為船隻轉向。剛剛船在向東走的時候還沒事，一轉向東南走，就跟西北風的方向一樣。本來是從船尾的左邊一點來，現在從正船尾來，就很容易產生同步橫搖跟參數橫搖(船的速度向量端點進入紫色參數橫搖區域)，趨勢就變大。實際上風是怎麼樣? 風並沒有變很大，風還是什麼四到五級的風，

跑船看的不是風速多少? 那是陸地上在報颱風氣象用的。船上看的是波浪的來向以及波浪的高度，所以雖然風不大，可是西北風吹了兩天(冷風的密度/質量都大)，已經把浪與湧吹起來了，



你看這裡，30 號是報告貨櫃落海的地方? 這船數，大概減到十節以下，在貨櫃船可能就是 slow ahead 不幸的是什麼，因為始終都是船尾來風，容易造成什麼? 同步橫搖。

雖然講是這樣子講，看到這裡的風力，甚至只有五節的風力，風根本就沒有，且風力又再一次順轉表示，風暴已經遠離。船尾來的浪，最大的影響是對機艙的影響，容易把船尾抬起來飛車，一飛車以後，船就容易什麼呀?

失去動力，會在海裡面隨浪漂流，這時候就是容易打橫在波谷，造成貨櫃的大量落海，應該回頭再去看看照片。一般，船上經常遇到貨櫃落海，貨櫃落海一 bay 兩個 bay 就已經非常警惕，知道出事了，這時候，就會趕快調整航向航速，該輪可是從船頭落到船尾，表示就是什麼，船長無能為力，沒有辦法調整航向航速，唯一的解釋就是失去動力，所以，船員要知道在大風浪之中，照顧好主機，比照顧好 lashing 是更重要的事情，另一個可能就是遇到超級巨浪，這個在後面有講解。

Dear colleagues, hello, this is the ONE6th lecture of our maritime meteorology seminar. Today, we are going to take another look at the true circumstances of the APUS-ONE container falling into the sea. First, let's study the pitching and rolling of the container again, you should be able to see that the wave length of this wave is the same as the ship's length. The next wave is clearly when the peak reaches the ship, encountering a bow wave again. So, this wavelength equals half the ship's length causing this parameter to sway. So this should be causing something like this simultaneous sway both in the transverse and pitch directions. Standing at the helm during the watch, it is not about observing the tilt degrees but calculating the period of transverse rolling.
Now, to the bottom right is 4ONE seconds, then correcting to the left, going down on the left for 3 seconds, then back to the right 02 seconds. The transverse rolling cycle is approximately 2ONE seconds. What is the transverse rolling cycle of 2ONE seconds in GM? For this response, you must know the ship's transverse rolling characteristics. As a sailor, you should develop the ability to count seconds, that is to mentally calculate how many seconds in a cycle. The simplest method is to calculate the seconds using ONE00ONEONE 002ONE003 like this, which is a push and what navigation route for passing the Equator. First, when we set sail there were no waves, everyone's mood was still very pleasant, preparing to go to Gaotou, and now, let's take a look at push ONE, its chart on November 25, setting sail from Japan heading towards Gaotou.
So the situation was still After sailing for 6 hours, suddenly a Mongolian high pressure appeared, wave after wave of cold air causing cold winds, these cold winds oppress the warm air, unable to go north so it goes along the northeast direction of the ship, generating a warm air mass and warm winds on the northeast side of the ship, the cold air and warm air generate eddy currents, the first element of the generation of a temperate cyclone, now we see that the wind

direction is coming from the stern at ONE5 knots, this wind is coming down along the isobars direction just right from the stern, and looking at the ship if it continues to sail
past it, it will still be blowing from the northwest, just said wrongly, this is the northwest wind, and now the ship continues to sail and the wind direction remains the same, still a ONE5-knot wind from the northwest, the ship already feels something is not right, preparing to head south, this was probably on November 26th, a day after setting sail, after walking for a while, the wind hasn't picked up much, and instead the wind speed is relatively small, now the wind coming from the north has changed direction, from northwest to due north, saying there should be a sign of a cyclone moving away, in the northern hemisphere, it's the same as a typhoon, it follows
clockwise movement if you're lucky counterclockwise is a sign of a storm approaching, at this point the wind direction continues to turn clockwise, even though the wind has picked up a bit, it's still moving away, in the previous days there was no change in the air pressure gradient, and the wind direction continues to turn clockwise, now we see that the ship has already started to slow down, actually how much it has slowed down is not clear here, and what is blowing at this time, ah, it's a southwest wind with a force of 6 southwest winds, that The storm has already passed, so why does the ship feel something wrong when the southwest wind blows? This is because, all the way, the southwest wind comes from the south.
So by the time it reaches here, it may have been more than three days, which may have generated swells. The ship continues to sail and suddenly a large cover is formed. The reason for this cover is of course this blue cold air mass, and this is warm air. What is wind up here? It's a wind that remains. The wind direction here was originally clockwise, now it's counterclockwise. The ship was originally heading east, now it's changed to southeast. So the captain is experienced in adjusting the heading and speed. Here, there are black arrows indicating the direction of the swell. If this is the direction of the swell, then the wind blowing southwest and the swell intersect 90 degrees, which will start to create triangular waves.
Now we see this extratropical cyclone deepening rapidly, the wind force is causing rough seas. Since the lowest pressure of the extratropical cyclone is rarely directly into the ship's North, continuing with the southwest wind, the ship should have no problem. We see the captain adjusting the heading a bit to the east, and then there are warnings of parametric rolling. Why? Because the wind coming from the stern is 25 knots, which is a force 5 wind, but the ship

speed is currently at ONE3 knots. We see this parameter rolling, is it the number of seconds? The speed is ONE4. 4, these numbers need to be further studied, SG3. 8, this is the effective wave height, 3. 8 meters generally? Slightly larger than the wind blowing waves, the warning of parametric rolling is because its speed is slow, so its pitching period also slows down.
Here it says windward and bad weather, because this low-pressure is moving very fast, so what is visible here is the injection of oil spray airflow, so this needs to be further investigated, 500 millibars, which is the injection of airflow. We say this extratropical cyclone is a gyroscopic injection of airflow, southward and northward, similar to spinning a gyro, so the wind pressure drops very quickly. The ship, originally blowing southwest winds, has now shifted to northwest winds, which is the Mongolian cold air moving south and the jet stream moving south, causing a north wall effect, which may produce very large waves. The wind speed is roughly around ONE2 knots, and the ship continues to gradually turn to east-northeast. Unfortunately, it becomes a tailwave again, because the ship turned.
Just now, when the ship was heading east, everything was fine. When heading east-southeast, the wind direction was the same, originally coming slightly from the left rear of the ship, now coming directly from the front rear of the ship, which easily leads to parametric rolling and synchronous rolling, causing the trend to increase. In fact, the wind hasn't changed much, still a force ONE5 wind. What we are looking at on the ship is not the wind speed, which is what is used on land for typhoons, but on the ship, we look at the direction and height of the waves. So although the wind is not strong, the northwest wind blowing for two days has already caused waves. Here is where the report of containers falling into the sea is located, and the ship's speed has dropped to below ONE0 knots, which may mean the cargo ship is slowing down.
What's unfortunate ahead, because it's always the wind coming from the stern that causes what, swaying all the way although this is how it's said, we see the wind here, even with only a wind force of five knots, there is no wind at all. And the wind force has once again turned in a favorable direction, indicating that the storm has already moved away from the waves from the stern, the biggest impact is on the engine room, which is easily affected by lifting the stern up and flying the car. After that, the ship is susceptible to what, losing power, drifting with no waves at sea, at this time, it is easy to lie sideways in the valley, causing a large number of containers to fall into the sea.
We should turn back and take another look at the photos. Generally, containers falling into the sea are often encountered on ships. When one container falls,

the crew will be very vigilant and know that something has happened. At this time, they will quickly adjust the heading and speed, which can go from the bow to the stern, meaning, they are powerless and unable to do anything. The only explanation is the loss of power, so our crew must know that in high winds and waves, taking care of the main engines is more important than taking care of the sailing.