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Baltic Sea port waters extreme events of last 30 years caused by climate-weather hazards

Keywords

Baltic Sea port waters, sea accident, climate-weather states, extreme weather hazard states

Abstract

The paper deals with the sea accidents that have occurred at the Baltic Sea port waters for last three decades. For each accident, the climate-weather change process state is fixed to examine the weather hazard influence on this accident. Moreover, the Baltic Sea port waters accidents caused by the extreme weather hazard states are described.

1. Introduction

Despite the lack of exhausting, detailed and completed documents on ship accidents at the Baltic Sea for last three decades, we collected more than 100 sea accidents that have happened at the Baltic Sea area for last three decades [1]. A lot of them (81%) occurred at the Baltic Sea open waters [2]. The remaining accidents (19%) happened at the Baltic Sea ports (Figure 1).

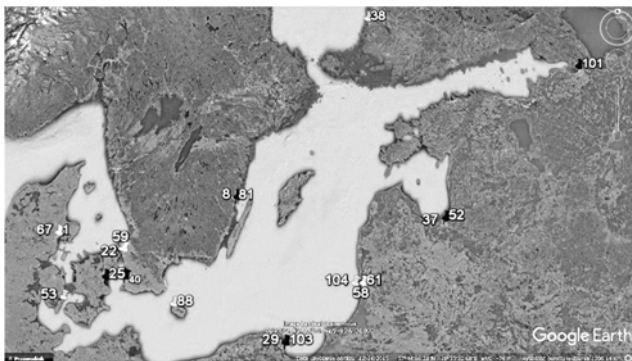


Figure 1. Ship accidents the Baltic Sea, port waters (the number on the map is corresponding to the accident number in Table 1 in [1]).

2. Weather condition during ship accidents at the Baltic Sea ports

To examine the influence of weather condition on the sea accidents, we established the kind of state of the climate-weather change process at the Baltic Sea port waters [4] during particular sea accidents.

2.1. States of climate-weather change process for ship operating at the Baltic Sea ports

To define the climate-weather states at the Baltic Sea ports, there are distinguished $a = 2$ parameters that mainly describe the climate-weather states in this area: w_1 – the wind speed measured in meters per second and w_2 – the wind direction measured in angle degrees. Next, taking into account expert opinions on the climate-weather change processes for the ship operating area at the Baltic Sea ports, $w = 6$ climate-weather states are distinguish [4]:

- the climate-weather state c_1 – the wind speed belongs to the interval $\langle 0, 17 \rangle$ m/s and the wind direction belongs to the interval $\langle 0, 22.5 \rangle$ or $\langle 67.5, 112.5 \rangle$ or $\langle 337.5, 360 \rangle^\circ$;
- the climate-weather state c_2 – the wind speed belongs to the interval $\langle 17, 33 \rangle$ m/s and the wind

- direction belongs to the interval $\langle 0, 22.5 \rangle$ or $\langle 67.5, 112.5 \rangle$ or $\langle 337.5, 360 \rangle$ °;
- the climate-weather state c_3 – the wind speed belongs to the interval $\langle 0, 17 \rangle$ m/s and the wind direction belongs to the interval $\langle 22.5, 67.5 \rangle$ or $\langle 112.5, 247.5 \rangle$ °;
- the climate-weather state c_4 – the wind speed belongs to the interval $\langle 17, 33 \rangle$ m/s and the wind direction belongs to the interval $\langle 22.5, 67.5 \rangle$ or $\langle 112.5, 247.5 \rangle$ °;
- the climate-weather state c_5 – the wind speed belongs to the interval $\langle 0, 17 \rangle$ m/s and the wind direction belongs to the interval $\langle 247.5, 337.5 \rangle$ °;
- the climate-weather state c_6 – the wind speed belongs to the interval $\langle 17, 33 \rangle$ m/s and the wind direction belongs to the interval $\langle 247.5, 337.5 \rangle$ °.

2.2. States of climate-weather change process during accidents at the Baltic Sea ports

In the compilation of accidents occurred at the Baltic Sea port areas there are 5 ones that happened when the climate-weather change process was at the state c_1 . In opposite, there are no accident that happened when climate-weather change process was at the state c_6 , means the extremely bad weather condition, but there are 1 and 7 accidents when the climate-weather change process was at the state c_4 or c_5 respectively, mean the moderate weather hazard states (Figure 2).

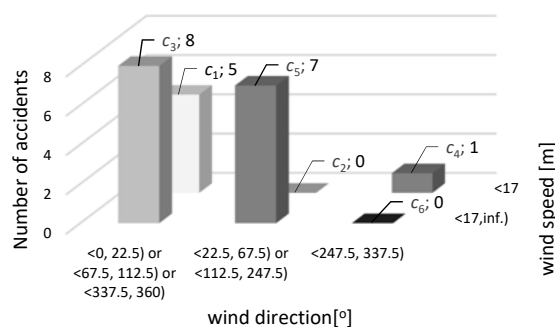


Figure 2. Number of the Baltic Sea port area accidents according to the states of the climate-weather change process.

3. Description of the Baltic Sea port area accidents of the extreme weather hazard states

The accidents that happened when the climate-weather change process was at the state c_4 and c_5 are marked with black pin on the map in Figure 1. We described these accidents in detail below.

3.1. Hannes accident

The general cargo vessel *Hannes* grounded on 28th February 2004, while leaving port (Figure 1, #8 on the map) with searchlights illuminating the foredeck where the final securing of the deck cargo was ongoing. The Master was the only person on the bridge at that time. The Master failed to inform MRCC of the accident which was reported to them at 06.32 by a boatman who noticed the vessel's predicament. The vessel was pulled off the ground on March 1st in the morning by means of two tugboats, and was then righted and towed to a quay in Oskarshamn. No injuries to personnel or environmental damage were reported. The underwater hull of the vessel was heavily damaged. Some of the damage was caused when the vessel was pulled off the ground [6].

The *Hannes* accident was classified as a serious casualty according to the Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety Committee and Marine Environment protection Committee [7].

The Baltic Sea was influenced by the col in the zone between the area of low pressure with the central pressure value of 995 hPa over the North Sea and the depression with the central pressure value of 992 hPa which was moving from Ukraine over the eastern Russia. Secondary weather fronts across the North Sea indicated an unbalanced polar maritime air mass (Figure 3).

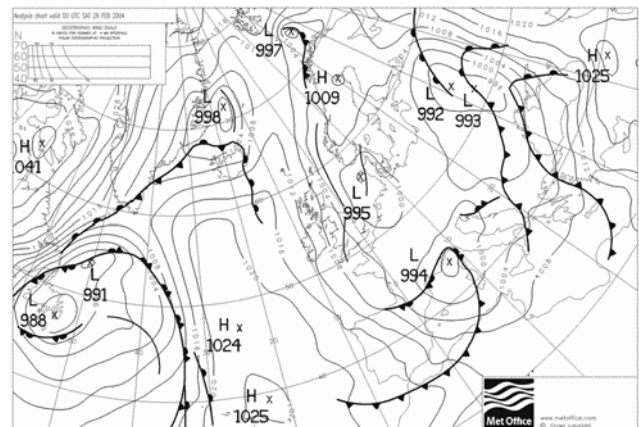


Figure 3. Synoptic map for Europe on February 28, 2004.

3.2. Olivia accident

On 17th March 2005, during heating of water for use in a tank *Olivia* (Figure 1, #25 on the map) cleaning process a boiler explosion happened. The boiler front gate was blown out and blazes from the boiler started a fire in the boiler room. The fire was extinguished by fire-fighting service from ashore within an hour. No injuries. Damages to cables and other in the

engine room. The vessel was towed to shipyard for repair [6].

The *Olivia* accident was classified as a serious casualty according to the Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety Committee and Marine Environment protection Committee [7].

Over the Baltic Sea a trough of low pressure between Scotland and southern Norway was moving east. The previous day, the weather was influenced by a traveling warm front. The warmer part of the polar maritime air mass modified the weather at night. Whereas during the day the weather was subject to a cold front bringing a cooler polar maritime air mass (Figure 4). Despite the moderate weather hazard during the accident, the weather condition had the irrelevant influence on it.

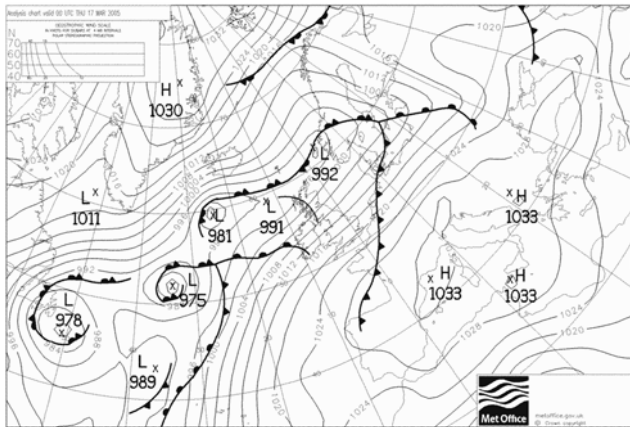


Figure 4. Synoptic map for Europe on March 17, 2005.

3.3. *Stena Baltica* accident

The ferry *Stena Baltica* (Figure 1, #29 on the map) exceeded allowed speed on the fairway and hit into the pier on 30th July 2005 [8]-[9].

The *Stena Baltica* accident was classified as a serious casualty according to the Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety Committee and Marine Environment protection Committee [7].

The Baltic Sea and northern Poland were influenced by a surface low pressure area originated over Denmark with a fronts system traveling east and northeast. Warm part of the low pressure area stagnating at night over Poland contained a warm, moist and unbalanced air mass (Figure 5).

3.4. *Azov Mariner* accident

The motor tanker *Azov Mariner* departed the port of Malmö (Figure 1, #40 on the map), Sweden on 22nd March 2006, bound for Riga, Latvia.

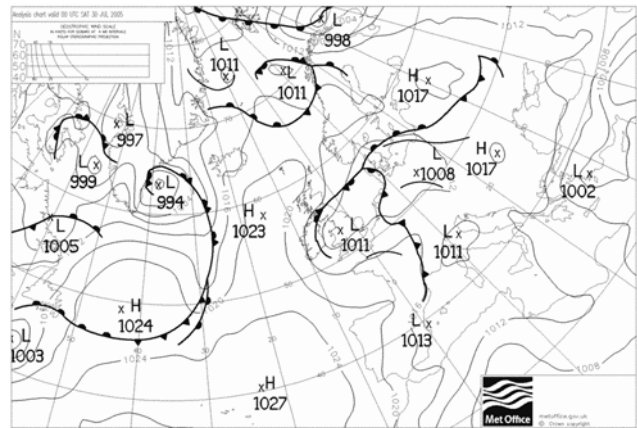


Figure 5. Synoptic map for Europe on July 30, 2005.

The vessel was in ballast after she had discharged her cargo of oil at Malmö's oil harbour. As soon as the vessel cleared the fairway to Malmö's oil terminal, the pilot was accompanied to the pilot station by the Officer of the Watch (OOW). The pilot disembarked at around 12.15. The vessel proceeded in a southwest direction, steering a course of 2250(T). At about 12.30, the OOW, who had returned to the bridge, took a global positioning system (GPS) position and calculated that the *Azov Mariner* was four cables from the Flintrännan NE lighthouse. However, he immediately realised that the vessel was outside the channel and was in fact navigating further to the East. The OOW changed over to hand steering and put the rudder hard to starboard but the vessel only altered course by a few degrees and subsequently ran aground. As a result of the grounding, the bottom shell plating in way of the bow thruster room was perforated. The vessel was refloated and she proceeded back to the port of Malmö. There were no pollution or injuries reported as a result of this grounding [6].

The *Azov Mariner* accident was classified as a serious casualty according to the Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety Committee and Marine Environment protection Committee [7].

The Southeastern Baltic Sea was influenced by the col characterized by a weak pressure gradient, which was related to the cold air mass approaching from Scandinavia (Figure 6).

3.5. *Barri* accident

The *Barri* was moored at JM-15 jetty in Riga harbour (Figure 1, #52 on the map) on 26th June 2007. Ship was being prepared for a trip to RKB 7 jetty (same harbour) to collect bilge water from *Khatanga*. Chief engineer repeatedly tried to start the main engine for two hrs. These attempts were unsuccessful.

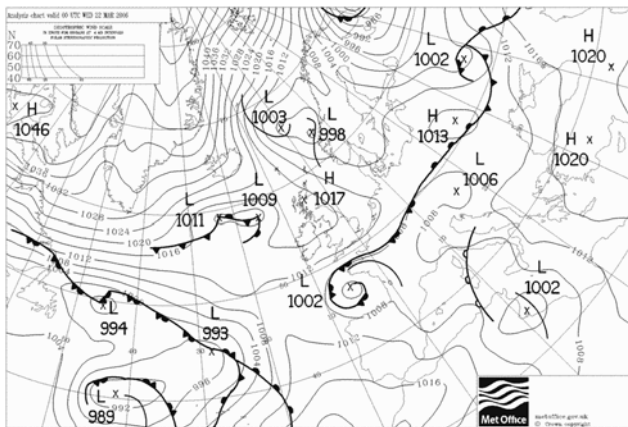


Figure 6. Synoptic map for Europe on March 22, 2006.

At about 16.22 (UTC+3) there was an explosion in ships engine room which also caused fire. As a result of explosion both crew members lost their lives and ship was totally demolished. Restrictions of the Class on the composition of sludge and bilge waters being carried by vessel were violated. On previous voyages the ship was carrying slop waters with following flash points: +52; +40; +38; -16; -43°C (allowed flash point of cargo $t > +60^{\circ}\text{C}$). Instead of diesel oil fuel mixtures from mentioned slop waters were used for main engine [6].

The *Barri* accident was classified as a very serious casualty according to the Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety Committee and Marine Environment protection Committee [7].

An active depression originated over the North Sea and Denmark associated with a fronts system was deepening and moving northeastwards (Figure 7).

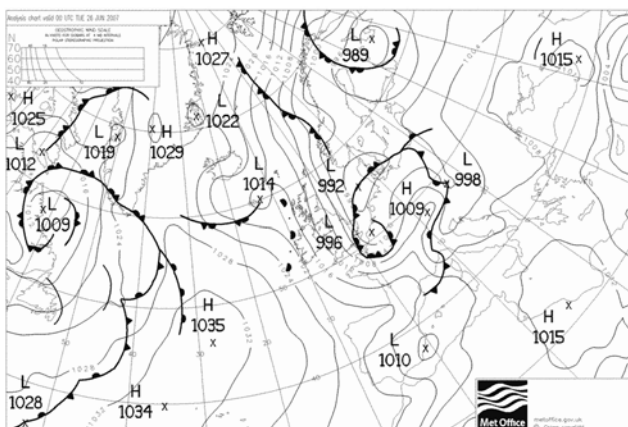


Figure 7. Synoptic map for Europe on 26 June 2007.

Despite the moderate weather hazard during the accident, the weather condition had the irrelevant influence on it.

3.6. *Tor Corona*, *Anichkov Bridge* and *Valle Di Nervion* accident

The *Tor Corona* was in the channel of port Klaipeda (Figure 1, #58 on the map) on 6th March 2008, and reduced her speed to approximately 7 knots to allow the pilot to disembark inside the port area. The ro-ro vessel then headed out to sea, but began to drift northwards towards some berthed oil tankers under the impact of 15 m/s W wind and strong currents. The Master was unable to control the vessel and failed to switch on the bow thruster, which was switched off after the vessel left the berth. Continuing to drift at a speed of about 6 knots, the vessel's starboard side made contact with the oil tanker *Anichkov Bridge*, after which her bulbous bow struck against the stern and ropes of another oil tanker the *Valle Di Nervion*. After the contact with tankers the ro-ro ship turned around and the pilot embarked the vessel again. She proceeded back to the port and berthed at the same berth. The ro-ro ferry *Tor Corona* sustained damage to her bulbous bow and side shell plating. The *Valle Di Nervion* was damaged to the stern and the *Anichkov Bridge* received damage to her port side. The *Tor Corona* and *Valle Di Nervion* were unable to continue their voyages. Nobody was injured during the accident, and the environment was not polluted [6].

The *Tor Corona*, *Anichkov Bridge* and *Valle Di Nervion* accident was classified as a serious casualty according to the Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety Committee and Marine Environment protection Committee [7].

The weather in Central Europe was influenced by a polar maritime air mass which was rapidly approaching from the Atlantic. The Baltic Sea was influenced by the through of low pressure in a weather fronts zone associated with a low pressure area. The depression center was dissipating and moving towards Scandinavia from the Norway Sea (Figure 8).

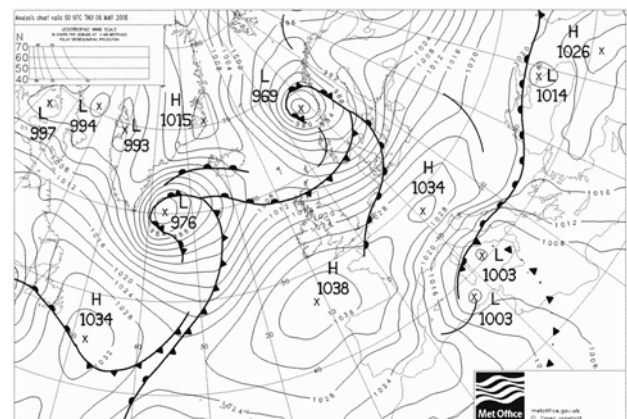


Figure 8. Synoptic map for Europe on March 6, 2008.

3.7. Arizona accident

On 21st February 2012, while loading a cargo of steel rolls on board the vessel during cargo operation at the Port of St. Petersburg, Russia (*Figure 1*, #101 on the map), the vessel *Arizona*, under the assistance of 3 tugs, was moving astern into a turning area. After the vessel had turned, the vessel lost movement in the middle of that turning area. The vessel had run aground in an ice pillow that had formed during cargo operations. High power heaters were rented to re-float the vessel. There were no injuries or incidents of pollution reported [6].

The *Arizona* accident was classified as a serious casualty according to the Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety Committee and Marine Environment protection Committee [7].

The polar maritime air mass in the deep and extended trough of low pressure area was spreaded over the Baltic Sea and northern Poland. A weather was influenced by rapidly moving fronts systems (*Figure 9*).

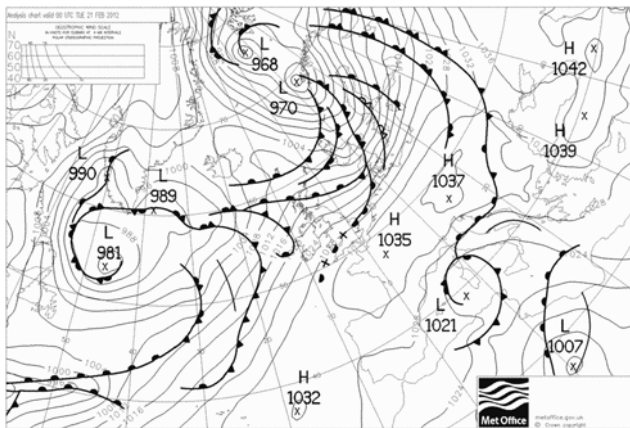


Figure 9. Synoptic map for Europe on February 21, 2012.

3.8. Stena Spirit accident

On 17th May 2012, the *Stena Spirit* was departing from Gdynia Ferry Terminal en route to Karlskrona, Sweden when she became involved in an accident at the Baltic Container Terminal (*Figure 1*, #103 on the map). The bow (ship) of the cruise ferry struck one of the Gantry cranes causing it to catastrophically collapse onto the quay below as she was manoeuvring. Three employees of the container terminal were injured, all requiring hospital treatment. Two of the three staff members are said to be in a serious condition. None of the passengers or crew on board the *Stena Spirit* were injured [10].

The *Stena Spirit* accident was classified as a serious casualty according to the Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety

Committee and Marine Environment protection Committee [7].

The trough of low pressure area was deepening and moving north along with the fronts system from southern Scandinavia and the North Baltic Sea. An area of high pressure was moving eastwards. A polar maritime air mass was approaching from the North Sea (*Figure 10*).

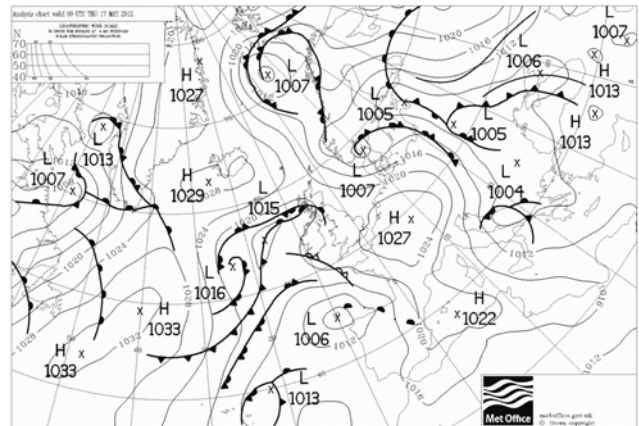


Figure 10. Synoptic map for Europe on May 17, 2012.

4. Conclusion

The description of ship accidents of the extreme weather hazard states occurred at the Baltic Sea port waters was done in this paper. The data are the part of the set of sea accidents at the world sea waters and will be used to the risk analysis of chemical spill at sea. Its practical applications will be performed in [3] to the chemical spill consequences generated by the accident of one of the ships of the shipping critical infrastructure network operating at the Baltic Sea waters as the preparatory approach to the Case Study 2, Sea Surge and Extreme Winds at the Baltic Sea Area, Scenario 2: Chemical Spill Due to Extreme Sea Surges [5].

Acknowledgments



The paper presents the results developed in the scope of the EU-CIRCLE project titled "A pan-European framework for strengthening Critical Infrastructure resilience to climate change" that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653824. <http://www.eu-circle.eu/>.

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