Linking weather types to tense dewatering situations of the Kiel Canal (NOK)

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Within the “Network of experts” of the German Federal Ministry of Transport and Digital Infrastructure (BMVI), the effect of climate change on infrastructure is investigated. One aspect of this project is the future dewatering situation of the Kiel Canal (“Nord-Ostsee-Kanal” (NOK)). The Kiel Canal is one of the world's busiest man-made waterways navigable by seagoing ships. It connects the North Sea to the Baltic Sea and can save the ships hundreds of kilometers of distance. With a total annual sum of transferred cargo of up to 100 million tons it is an economically very important transportation way. Additionally to the transportation of cargo, the canal is also used to discharge water from smaller rivers as well as drainage of a catchments area of about 1500 km².

The canal can only operate in a certain water level range. If its water level exceeds the maximum level, the water must be drained into the sea. In 90% of the time, the water is drained into the North Sea during time windows with low tide. If the water level outside of the canal is too high, drainage is not possible and the canal traffic has to be reduced or, in extreme cases, shut down. Due to the expected sea level rise, the potential time windows for dewatering are decreasing in the future. With a decrease in operational hours, there will be substantial economic losses as well as an increase in traffic around Denmark.

To get a better understanding of what causes tense dewatering situations other than sea level rise a linkage between high water levels on the outside of the canal and weather types is made. Weather types describe large-scale circulation patterns and can therefore give an estimate on tracks of low-pressure systems as well as the prevailing winds, which can explain surges and water levels at the coast. This analysis is conducted for one weather type classification method based solely on sea level pressure fields. Weather types derived from regionally coupled climate models as well as reanalyses are investigated.