Extreme weather is making major trade routes less reliable, and it's only going to get worse

Extreme weather is becoming an increasing challenge for transport. It's now seriously affecting supply chains and hampering the flow of goods on vital waterways – and we're expecting this to gain momentum moving forward. Shippers should be prepared for the risk of this phenomenon returning in 2024 and work on the resilience of their supply chains

The direct effects of low water levels on the broader economy might not be immediately obvious, but can seriously impact profits, growth rates, and industrial production

Drought and low water have had a major impact on vital inland water trade routes lately

Waterways have always been crucial for transport. They're a cheap and environmentally friendly way of transporting heavy or bulk goods such as coal and steel, mineral oil products, chemicals and capital goods. Seasonal and temporary low water levels in rivers and lakes aren't a new phenomenon, and it can be exacerbated by recurring weather events such as El Niño. But now, times are changing for inland freshwater connections. We have seen more rain and longer-lasting droughts across the world – and with the changing climate, this will be a new reality going forward. Last year was the sixth warmest year since global records began in 1880, according to

the National Oceanic and Atmospheric Administration's annual global climate report. This means that the 10 warmest years ever have all been recorded since 2010. 2023 now seems on track for adding to this statistic.

> *The 10 warmest years ever have been recorded since 2010 and this year is on track to add to it*

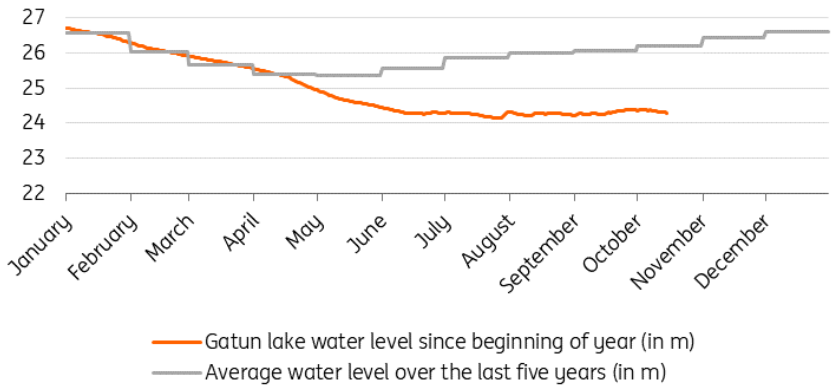
Several regions across the world including parts of the Southwestern and South Central US, Chile, Southern and Western Europe, and North Central China saw below-average annual precipitation last year, leading to dried-out soil and lower streamflow and groundwater. In Europe, for example, this led to the Rhine – one of the busiest waterways in the world – having a water level of less than 135cm at the Kaub gauging station in Germany on 154 days in 2022. The 135cm mark is what large container ships need to navigate the river. This figure has trended upward.

From here on out, the outlook isn't shaping up to be a particularly rosy one, with the discharge volume of the Rhine depending heavily on meltwater which is quickly diminishing. Swiss glaciers, the source of the Rhine, also lost 10% of ice volume in just two years according to the Swiss Academy of Sciences. Structurally decreasing snow levels mean that water volumes turn more volatile, and averages are generally set to trend down moving forward.

Alongside important navigable rivers including the Mississippi in the US, the Yangtze in China and the Amazon in Brazil, one of the most important international waterways – the Panama Canal – has been hit by a severe drought over the course of 2023. The 80 kilometre-long canal connects North and South America and is the most important trade route for the movement of goods between Asia and the east coast of the US, handling about five percent of total world trade volume per year. Since the canal is designed as a lock system, each ship that passes through the canal requires about 200 million litres of fresh water, which is roughly equivalent to the household water use of 4,500 inhabitants in European countries.

Panama Canal water level significantly lower in 2023

Panama Canal (Gatun Lake) water levels 2023 vs. 2022



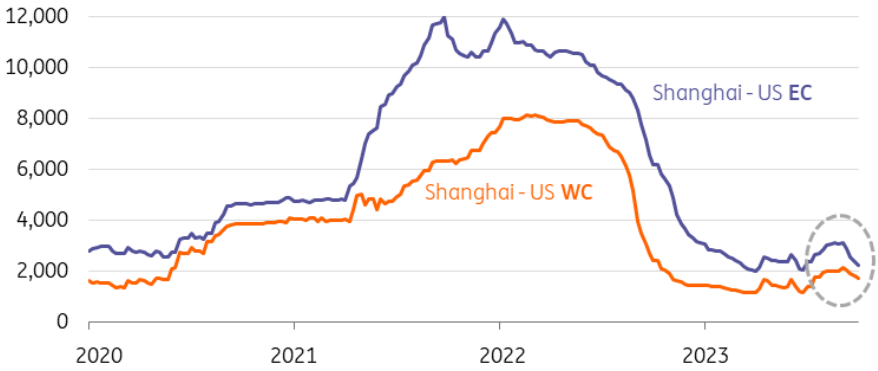
Source: Canal de Panama, ING research

Lack of water weighs on reliability of corridors...

Low water levels lead to capacity reduction on ships, surcharges, rising transportation costs and delays. For example, the Panama Canal is currently only navigable with a reduced ship weight and a limited number of ships. From 1 November, only 31 ships are allowed through the canal per day, compared to usually 36-38 ship crossings daily. The Canal authorities decided to extend the pass-through restrictions until mid-2024. On top of this, there's also a depth limitation for vessels (44 feet or 13.5 metres) which leads to lower loading capacity. Asia-US container spot rates – under heavy pressure from excess capacity and faltering world trade growth – at least showed signs of a revival.

Panama Canal limitations revived Asia-US container spot rates

Development port to port containerised freight tariffs in US$ per FEU (40ft container)*



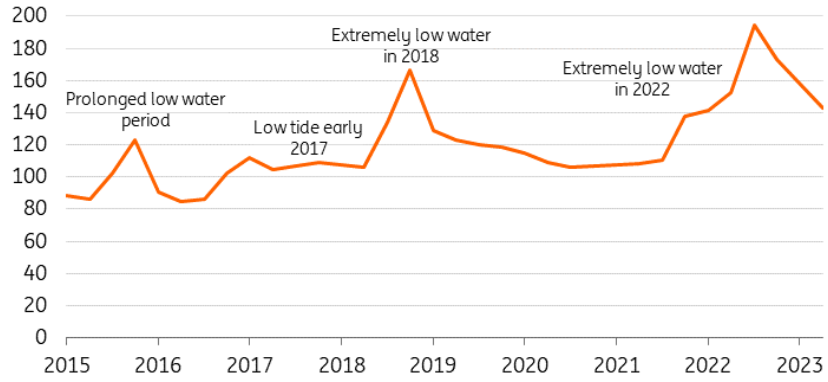
Source: Clarksons, ING research
*Last data point: 10/06/23

... and sends shipping rates on rivers like the Rhine spiking

In Europe, shipping costs on the Rhine spike each time there are periods of extremely low water, as capacity is instantly reduced. Shipping contracts usually contain low water clauses that provide a graduated surcharge when levels drop, e.g., below 150cm at the Kaub measuring point along the Rhine. Prices are usually subject to a graduated surcharge; the lower the water level, the higher the surcharge. Dutch inland waterway transport costs for shippers, which cover roughly half of the Rhine bed traffic, rose by 52% in the fourth quarter of 2018 compared with the previous year and by 76% in the third quarter of 2022. Worryingly, these costs increase with each low water period.

Freight rates inland shipping after low water events

Price developments in Dutch inland navigation (Index, 2015 = 100)



Source: CBS, ING Research, last data point: 2nd quarter 2023

Low water levels inevitably result in delays. In the US, extremely low water levels in the Mississippi River – which is critical for the transportation of agricultural commodities like grains and draining about 40% of the continental US area – log-jammed more than 100 towboats in 2022 and led to loading reductions and significant delays for barges. This year, shippers have once again faced delays and higher rates, threatening the harvest season. Water levels of the Amazon fell to century lows in mid-October 2023, damaging the ecosystem and also disrupting cargo flows up the inland port of Manaus.

Small but visible implications for the broader economy

From a macroeconomic point of view, the direct effects are still small overall – but not negligible. The operators of the Panama Canal alone expect a drop in profits of $200 million due to the restrictions on shipping traffic, which would correspond to about 4.5% of last year's revenue. This decline in sales also directly affects the country of Panama, as the Panama Canal contributes 4.5% to GDP, which means a reduction in growth of 0.3%.

The long-lasting low Rhine water levels seen in 2018 led to a drop in German industrial production of 1.5%, causing a decline of about 0.4% of economic output in Germany alone, according to the IfW institute. Overall, inland waterway freight transport in Germany fell by 11.1% in 2018 compared with the previous year according to the Federal Statistical Office. Meanwhile, volumes in international goods transport dropped an average of 18% during the prolonged low tide over August-November 2018. Several sectors like agriculture and construction (building materials) are affected, along with certain manufacturing activities as a result of required supplies and product outflows, such as steel and chemical plants. The extensive plant of BASF in Gelsenkirchen had to curb production for this reason, and in 2018, other companies like steelmaker Thyssen Krupp also lost production. This has knock-on effects down the supply chain.

From a macroeconomic point of view, the direct effects are still small – but not negligible

The low water levels in the Mississippi River in the US last year led to a loss of up to a third of overall loading capacity, which caused an estimated $20 billion in economic activity loss due to the resulting slowdown in production. China's inland lifeline, the Yangtze River, links densely populated and industrial inland areas with Shanghai, the East Chinese Sea and the world's busiest inland waterway and faced a similar situation in 2022. Sections of the river reached their lowest level since at least 1865, which significantly dented goods transportation and affected hydropower reservoirs, resulting in power shortages. Manufacturing companies had to pause production, leading to less output.

Structural alternatives for transportation are often unrealistic

To mitigate the impact of low water events, shippers are investigating alternatives – but in most cases, the scale of goods flows, available capacity and connections and the associated costs can make things difficult. For intermediate goods and raw materials, including bulk goods such as coal and steel, mineral oil products, chemicals and heavy goods, there is currently no permanently sustainable alternative to ships due to their weight and size. Switching to road or rail is therefore often only a temporary and emergency solution.

> *There are very few alternatives to shipping during low water events*

For containerised transport through the Rhine corridor, trucking and rail could offer an alternative as several terminals are equipped as multi-modal hubs. This is, however, usually more costly and less efficient, and therefore not the preferred option. Throughout the pandemic, we have also seen shippers turning to air cargo as an alternative for deep-sea shipping. But this could only be feasible for higher valued, time-sensitive products and isn't a structural solution.

In several cases, straits and canals connecting oceans could be circumvented in theory but the bypasses are often not a viable alternative due to currents, winds or extremely extended travel time. For example, due to the construction of the Panama Canal, the travel time at sea between New York and San Francisco could be reduced by about half. Whether it's an alternative route or not, the duration of transport increases because of waiting times or detours, which also cause costs that could ultimately be reflected in price increases. With extreme weather events on the rise due to climate change, we expect supply lines to be disrupted more often due to weather-related events in the years to come.

Shippers should not be caught off guard and better be prepared

So, what could be the way forward for navigation? Ship designs for new barges could be adapted to lower water levels, but retrofits won't be feasible. Converting the fleet of ships to flat-bottomed ships can help, as conventional inland vessels can often still sail when the water level is low – but only smaller quantities than usual may be loaded.

Another advantage could be that fleet replacements reduce emissions and contribute to CO_2 footprint reduction, although this would require significant capital investment and mean potential capital losses. Investments in waterway infrastructure could also help. But solutions such

as weirs or canalisation may also spark criticism. The preservation, but above all the strengthening of resistance to increasing weather events is crucial so that goods can continue to be transported safely, efficiently, and cost-effectively across the world's oceans and rivers in the future.

Capital investments may have an impact in the long run. From a shipper's perspective, low water levels hamper the reliability and predictability of supply already. Strengthening resilience with back-ups, buffers or at least contingency plans deserves to be higher on the agenda with extreme weather on the rise.

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