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via donau – Österreichische Wasserstraßen-Gesellschaft mbH

Adaptation and mitigation of inland waterways to weather extremes

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Transportation Research Board 91st Annual Meeting

January 22–26, 2012 • Washington, D.C.

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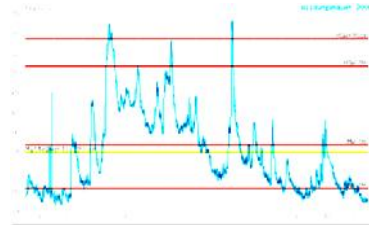
- Weather related effects on infrastructure
- General adaptation measures
- Particular examples related to adaptation
- Conclusions

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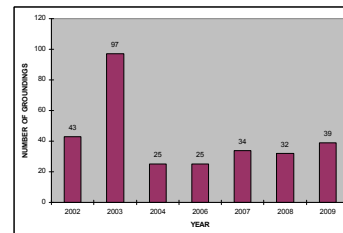
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Weather related effects on infrastructure (1)

- **Drought:**
 - Water levels low =>
 - insufficient navigation conditions
 - Increase in accidents (grounding)
 - low flow velocities => little sedimentation
 - Recent examples for drought: 2003, 2011



Distribution of daily water levels at the gauge Wildungsmauer on the Austrian Danube in 2006.

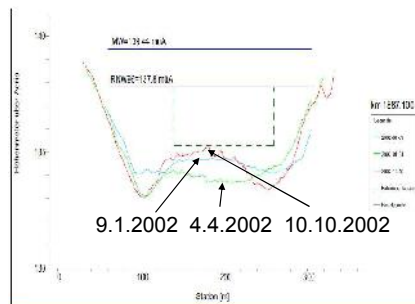


Development of grounding events on the Upper and Central Rhine within 2002 and 2009. Based on WSD Südwest.

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Weather related effects on infrastructure (2)

- **High water and floods:**
 - Suspension of navigation
 - Changes in river morphology
 - Sedimentation
 - Aschach on the Danube:
 - 13.8.2002: 1 800 000 m³
 - Total in 2002: 5 000 000 m³
 - Aggradation
 - Damage of towpaths
 - Damage of banks and flood protection installations



Changes in the river cross-section geometry of the Danube at river kilometre 1887.1 in 2002, being partly caused by the flood in August.

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Weather related effects on infrastructure (3)

- Ice:
 - Suspension of navigation
 - Prevented operation of locks
 - Damage of navigation signs

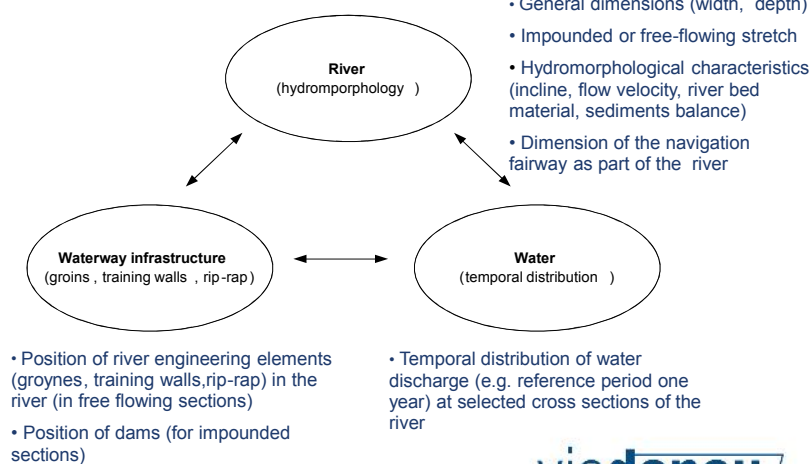


Ice occurrence in locks on the Danube preventing their operation. Source: via donau.



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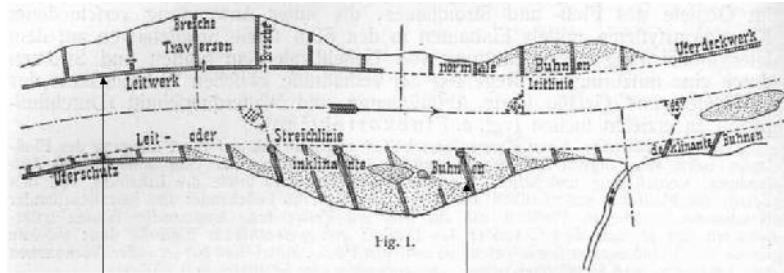
Waterways – system elements



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Waterway infrastructure (1)



Training wall

Groyne

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Waterway infrastructure (2)



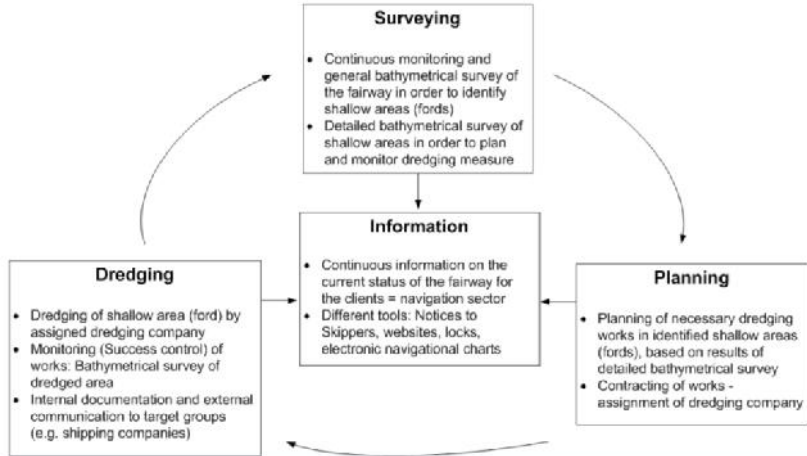
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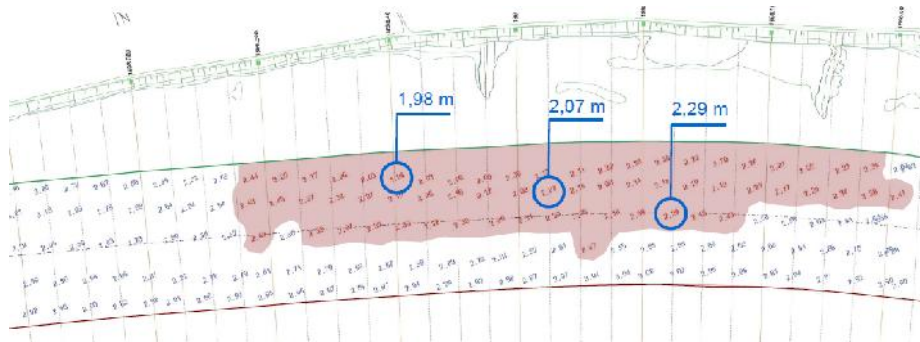
Fairway maintenance (1)

Fairway maintenance cycle



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Fairway maintenance (2)

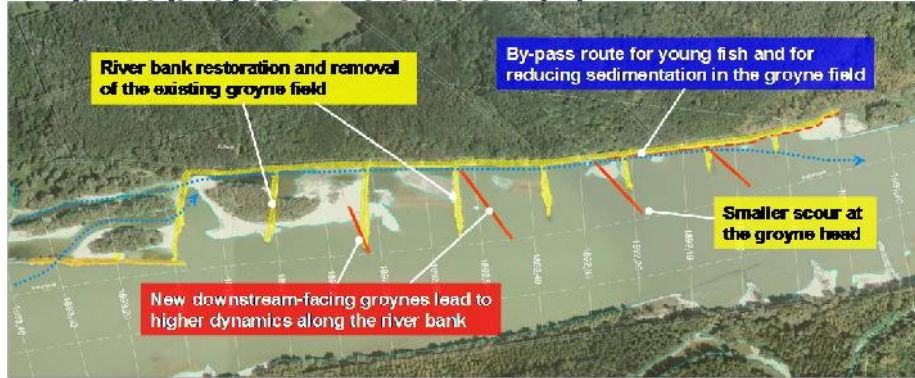


Improved fairway information. Source: via donau.



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Example infrastructure adaptation pilot project Witzelsdorf (1)



**innovative groyne shapes –
advantages for ecology and navigation
by interdisciplinary planning**

- Removal of old groynes and river bank restoration
- Construction of new groynes

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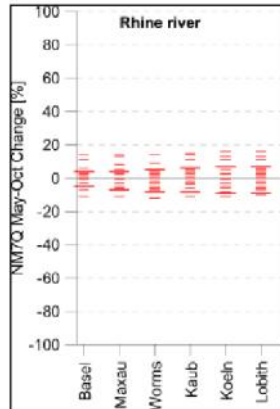
Example infrastructure adaptation pilot project Witzelsdorf (2)



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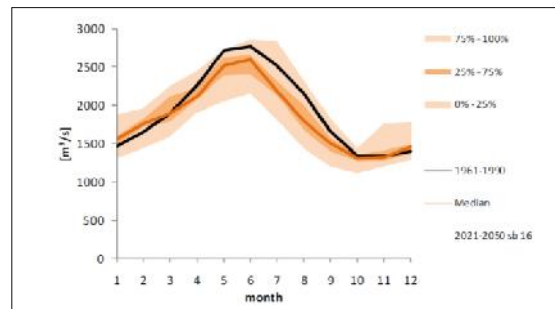
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Climate change effect 2021-2050



Source: Kliwas

Danube at Vienna



Source: Pöyry Energy GmbH, 2011, Auswirkungen verschiedener Szenarien der Klimaänderung auf den österreichischen Abschnitt der Donau

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Conclusions

- Projected climate change effects minor, but extreme events today
- Measures with significant effect on nature problematic
- Integrative approach recommended (e.g. Joint Statement)
- First measures to be taken now (improved maintenance)
- High potential for improvement related to waterway management and usage of ICT
- On medium and long term:
 - infrastructure measures (e.g. groynes)
 - Implementation of TEN-T priority projects in EU

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