



THDC India Ltd.

**International Conference on
HYDROPOWER AND DAMS DEVELOPMENT FOR WATER AND
ENERGY SECURITY – UNDER CHANGING CLIMATE**



Indian National Committee
on Large Dams

Impact of climate change and time-dependent hazards on dam safety

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Types of hazards to be considered in large dam projects

- Hazards from natural environment
- man-made hazards
- site-specific and
- project-specific hazards





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Main dam hazards from natural environment

- Floods (floating debris, sediment transport, breach of natural dams)
- Extreme weather (wind storm, heavy rainfall, floods, ice)
- Earthquakes (ground shaking, fault movements, mass movements, liquefaction etc.)
- Mass movements (landslides, rockfalls, avalanches, debris flows, impulse waves in reservoirs)
- Climate change hazards for dams include mainly floods and mass movements

Note: Several hazards may be interrelated or may trigger the same event like mass movements or floods





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Flood release through gated spillway





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Overtopping during construction





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Flood hazard (floating debris)





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Embankment dam overtopping (Germany 2021)





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Embankment dam overtopping (Myanmar 2015)





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Mass movements into reservoir





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Rockslide into reservoir





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Earthquake hazard – faulting and ground shaking **not related to climate change**





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Reasons for flood safety reviews of dams

- New information on flood hazard is available
- Major flood has occurred
- New flood design and/or safety criteria are introduced
- New flood analysis methods
- Flood vulnerability of dam has increased (ageing)
- Flood risk classification of dam has changed
- Increase in flood risk due to downstream developments
- Silting up of reservoir
- New requirements from emergency planning, etc.
- **Climate change**





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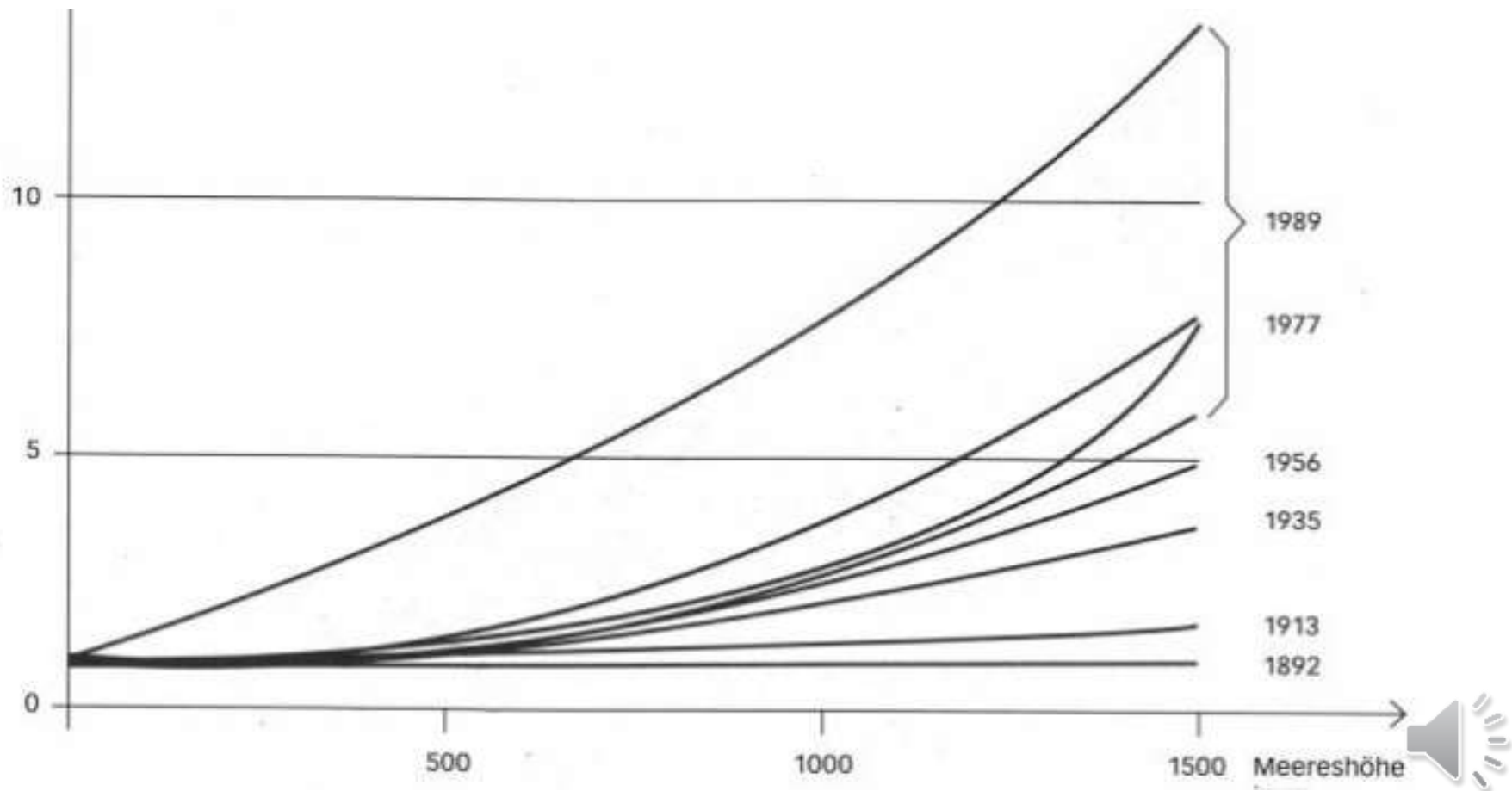
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Changes in snow loads in Switzerland from 1892 to 1989

Changes due to increased safety standards and not climate change





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How to deal with climate change effects on dam safety?

Simple answer: To carry out periodic safety review of dams (e.g. every 5 years) where any changes in dam safety criteria and new data on hazards are analysed.

If the safety criteria are not satisfied then the safety of the dam must be upgraded.

In urgent cases the reservoir could be lowered temporarily.





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Conclusions

- For the safety evaluation of dams, natural and man-made hazards, and site- and project-specific hazards must be considered.
- Climate change causes a multiple of natural hazards
- Mass movements and debris flows may cause overtopping of dams.
- Debris flows and mass movements will silt up reservoirs, but this is not a safety problem for the dam body.
- Periodic safety reviews are required for all types of hazards incl. climate change hazard, which is one among many others.
- For a resilient dam, it is recommended to check its safety for loads and actions that are beyond the corresponding safety levels.
- No new techniques are required to ensure the safety of dams affected by climate change.

