



WP 8

Ice problems in rivers

Winter conditions in northern rivers can usually be divided into an ice formation period in late autumn/early winter, a stable ice period during the winter months and breakup in spring. Releases of warmer water from reservoirs due to hydro power production will influence the downstream ice regime, usually by reducing static ice formation (stable ice cover) and by increasing dynamic ice formation (frazil and anchor ice). The length of the influenced reach will be dependent on geomorphology, discharge and climate conditions within the river system.

A more fluctuating production schedule could have adverse impacts on ice conditions, particularly if periods with low production permits an ice cover to form which is subsequently broken when releases are increased (mechanical ice-breakup). Also, predicted climate change towards a warmer winter climate is expected to create more frequent changes between ice forming periods and mild periods with increased river flow resulting in ice break up and ice-runs, also in unregulated rivers. This could lead to more frequent ice runs which will have negative impacts both on the environment and on technical installation in the river, for example hydro intakes, bridges and revetments.

To cope with these challenges, the following sub-projects are proposed:

- Analyze ice formation at several regulated study sites with rapid variation in hydro power production over the winter season. Develop models and tools for the assessment of ice formation, ice volume and ice breakup
- Study the impacts of ice runs and increased ice production at intakes and downstream of the hydropower outlet, identify critical areas and damage potential
- Propose mitigation measures to handle adverse ice conditions at intakes and in downstream reaches

There are strong links to WP2 and WP7.