Reducing screen-induced refraction of sound by wind

The efficiency of common noise barriers under downwind sound propagation conditions is significantly reduced. The wind flow induces large gradients in the wind speed near the top of the screen. As a result, sound is refracted in downward direction, into the diffraction zone.

The use of a vegetation screen (row of trees) behind a noise barrier was found to be successful in this respect. The study consisted in a wind tunnel experiment at scale (Act. Ac. Ac. 88, 231-238, 2002), in an extensive field monitoring (Act. Ac. Ac. 88, 869-878, 2002) and in numerical calculations to optimize parameters involved (by combining CFD analysis and FDTD calculations, Act. Ac. Ac. 89, 764-778, 2003).

The positive effect of a row of trees behind a traffic noise barrier increases significantly with wind speed in case of downwind sound propagation. Results were drawn based on a field monitoring. A direct comparison of the sound pressure level between part of a noise barrier with and without a row of trees was made, at close distance.

Sound propagation in mountainous areas

A Green’s Function PE method with a rotated reference frame (GF+PE) was used and optimized for sound propagation over several kilometers in a valley-slope configuration (Unterinntal region, Austria). The numerical simulations were validated based on combined noise and meteorological measurements. Focus was on the effect of the relief and of typical temperature gradients in mountainous areas.

Total sound pressure levels, resulting from road traffic, expressed relative to the reference receiver MP6, in case of a complex, measured temperature profile. A comparison with GF+PE simulations is made. Additional numerical calculations were made to estimate the effect of the undulation of the terrain and the effect of the inhomogeneous atmosphere.