VERSITA

Acta Geophysica
vol. 56, no. 3, pp. 753-777
DOI: 10.2478/s11600-008-0017-y

Flow and transport in channels with submerged vegetation

Heidi NEPF[1] and Marco GHISALBERTI[2]

[1]Department of Civil and Environmental Engineering,
Massachusetts Institute of Technology, Cambridge, MA, USA
e-mail: hmnepf@mit.edu (corresponding author)

[2]School of Environmental Systems Engineering,
University of Western Australia, Crawley, Australia
e-mail: ghisalbe@sese.uwa.edu.au

A b s t r a c t

This paper reviews recent work on flow and transport in channels with submerged vegetation, including discussions of turbulence structure, mean velocity profiles, and dispersion. For submerged canopies of sufficient density, the dominant characteristic of the flow is the generation of a shear-layer at the top of the canopy. The shear-layer generates coherent vortices by Kelvin-Helmholtz (KH) instability. These vortices control the vertical exchange of mass and momentum, influencing both the mean velocity profile, as well as the turbulent diffusivity. For flexible canopies, the passage of the KH vortices generates a progressive wave along the canopy interface, termed *monami*. The KH vortices formed at the top of the canopy penetrate a distance δ_e into the canopy. This penetration scale segregates the canopy into an upper layer of rapid transport and a lower layer of slow transport. Flushing of the upper canopy is enhanced by the energetic shear-scale vortices. In the lower layer turbulence is limited to length-scales set by the stem geometry, and the resulting transport is significantly slower than that of the upper layer.

Key words: vegetation, transport, channel hydraulics, dispersion.