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Mean residence time of lagoons interspersed in wetlands

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Abstract

Lagoons interspersed within natural or constructed wetlands are expected to increase the residence time of the flow in the ecosystem, leading to an increase in the pollutant removal and ensuring a good ecological status of the ecosystem. In this study, lagoons interspersed in vegetated wetlands have been mimicked in a laboratory flume in order to establish the impact three major driving parameters (the vegetation density surrounding a lagoon, the depth aspect ratio (length versus depth) of the lagoon and the circulating flow) have on the residence time of the flow in the lagoon. The experiments were carried out with natural vegetation, *Juncus maritimus*. The results indicate that the presence of vegetation decreases the residence time though the short-circuiting of the flow, due to the presence of preferential flow paths generated in the vegetated shallow zones. The vegetation also enhances the mixing of the flow at the leading edge of the lagoon. Vertical downward velocities at the leading edge of the lagoon and positive velocities at the trailing edge of the lagoon were observed. The vertical velocity gradient at the center of the lagoon was greater as the lagoon length decreased, due to both the greater proximity of this point to the vegetated shallow zones in small lagoons. An increase in the mean flow velocity or a decrease in the lagoon depth resulted in a decrease in the lagoon residence time, reducing the potential of lagoons in treating pollutants. The length of the lagoon, however, was found not to affect the residence time. High lagoon residence times in either natural or constructed wetlands are desirable because they enhance pollutant removal from the water. Although, if the residence times are too long, this may lead to anoxic water conditions that could in fact threaten the wetland's ecosystem.

Keywords

lagoons, wetlands, residence time, unidirectional flow