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# Application of a non linear model to a reach of the Cecina River

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We apply a recently developed non linear 3D model to a short reach of the Cecina River (Tuscany, Italy), a gravel bed river with actively migrating banks. The model is based on an asymptotic theory for flow and bed topography in meandering channels, able to describe finite amplitude perturbations of bottom topography.

Our aim is twofold: we first wish to investigate whether the model is capable of predicting the right tendency for meander formation in terms of wavenumber selected, wave celerity and lateral erosion rate. With this aim, we have extrapolated the plan form shape of the channel axis from a 1978 aerial picture, which was the first available showing the formation of the meander starting from a nearly straight reach (aerial picture of 1954). Equilibrium flow field and bottom topography, predicted for prescribed values of water discharge and sediment size, were computed and compared with results from the classical linear model. We then calculated the meander growth rate by varying the wavenumber and found that a peak is reached for a wavelength smaller than the one predicted by the linear model and consistent with what observed in the field. Both amplification and migration rates corresponding to the wavenumber selected were then compared with the values extracted from the aerial pictures and give reasonable results, quite different from the linear ones.

Finally, we have compared the equilibrium bed topography predicted by the model with the one measured during a recent topographical survey of the Cecina reach under investigation (July 2007). Results show that the values of the maximum scour and deposit and their phases relative to the bend apex are consistent with field measurements and far from those predicted by the linear model.