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A finite volume code for simulating debris-flow routing: preliminary results

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The bi-phase governing flow equations of a solid-liquid mixture are numerically integrated within the shallow water approximation using the finite volume method. The one-dimensional FORCE scheme is extended to the two-dimensional case and reviewed for use with a structured computational grid comprising quadratic cells. The intermediate points, at which the solution is computed at time $t+\frac{1}{2}$, correspond to the corners of a cell, and this solution is derived from the values of the four surrounding cells adjacent to the corner. Consequently, the solution for a (*i*, *j*) cell $\left(\bar{Q}_{i,j}^{t+1}\right)$ within the domain depends on the four intermediate solutions computed at the corners: $\bar{Q}_{i+1/2,j+1/2}^{t+1/2}$, $\bar{Q}_{i-1/2,j+1/2}^{t+1/2}$, $\bar{Q}_{i-1/2,j-1/2}^{t+1/2}$, $\bar{Q}_{i+1/2,j-1/2}^{t+1/2}$. Subsequently, for a (*i*, *j*) cell, the *t*+1 solution is reliant on the value of the $\bar{Q}^{t}$ at that cell and the values of its eight neighbouring cells. The model is used for replicating the flow depth, velocity, and solid concentration values observed in a systematic series of flume experiments documented in the literature. The comparison shows good agreement for solid concentration and satisfactory alignment for flow depth and velocity values. Finally, the model is used for reproducing the flow pattern of the debris flow that occurred on Rio Lazer on November 4th, 1966. The comparison results are satisfactory.