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Discussions

Interactive comment on "HydroSCAPE: a multi-scale framework for streamflow routing in large-scale hydrological models" *by* S. Piccolroaz et al.

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Introduction

This document corresponds to a peer review process of the article titled *HydroSCAPE: a multi-scale framework for streamflow routing in large-scale hydrological models*. The objective is to revise and make comments about findings of the model and its obtained results. This peer review is summarized in the following 7 comments.

Comment 1

The paper states that most of available models inherit the grid approach from the Large Scale Surface Models (LSMs) which works fine for vertical fluxes but provides grid dependency to the surface routing. In most cases routing is performed by solving either the kinematic wave or the de Saint-Venant equation by using the same discretization adopted for resolving the vertical fluxes, thereby leading to scale-dependent inaccuracies in the representation of horizontal fluxes.

- How horizontal and vertical fluxes are defined?
- Are both flow components (vertical and horizontal) considered in the model?

- Are subsurface flows taken into account?

Comment 2

The model emphasizes on the importance of defining proper *hillslope-channel* within the macro cell that contributes to a certain node. However, it is not explained what is a *hillslope-channel* area and how they are defined. For example, in Figure 1 several hill-slope areas are colored; but it is not understood under which geomorphological considerations they were defined (slope, elevation, etc.).

Comment 3

Based on the kinematic conceptual scheme of the model, water flow produced by the hillslope enters the network system through the hillslope-channel transition site and is subsequently routed through it. The streamflow contribution of the hillslope ℓ, belonging to the macrocell *i*, to node *k* is defined in a way that considers a constant stream velocity V_c and it states that this assumption is crucial for the linearity of the process.

- Since stream velocity depends on stream geometry, does this imply that the model considers a constant geometry of the stream network over time?
- How does the model account for seasonal variations of stream velocities associated to variations on channel Manning's n values?
- How does a non constant velocity makes the system non linear?

Comment 4

The article states that if the DEM resolution is high and the total domain A where the model is applied is large, the preprocessing step can be time consuming; the effort is however compensated in the application of the model, particularly if the modeling activity is performed in a multiple run framework.

- What does consist the preprocessing step?
- Why the preprocessing depend on the size of the DEM?
- Is there any other input to the model that needs to be preprocessed?

Comment 5

The DEM used for the case study in the Upper Tiber Basin corresponds to a high resolution 20m grid size DEM. If it has been established that the model is non dependent on the grid size, why such a high resolution DEM is used? On the other hand, how was associated a CN II number to each DEM cell? A spatially distributed 20m resolution soil classification was available for the site?

Comment 6

An application of HydroSCAPE flood prediction is presented for the Upper Tiber basin. In order to focus in routing, a simple runoff model was coupled. Hence, subsurface contribution to streamflow is not explicitly considered in the model. In some basins, subsurface flows can be determinant and add an important contribution to the flood. What parameters of the model can be affected if a subsurface flow model is coupled?

Comment 7

In the same application example, the superficial runoff at a hillslope is calculated using a classic SCS-CN approach. The procedure assumes that the cumulative rainfall remains constant within a macrocell. This is a very strong assumption depending on the size of the macrocell.

- How valid is this assumption considering the strong spatial variation of rainfall, specially in basins with high orographic influences like the one studied in the application example?
- Based on the previous point, wouldn't be more appropriate to create a macrocell that matches areas with more or less the same accumulated rainfall? It is be-

lieved that this would help to not create excessive differences between observed spatial variation of the rainfall and the assumption of a constant value