第II部門 **GIS-BASED SIMULATION OF SOFT GEOOBJECTS**

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1. Introduction

Traditional GIS data models such as TIN and grid are appropriate for representing rigid geoobjects, which will not deform under forces under normal conditions. But there are also many kinds of soft geoobjects in the real world, which will deform under forces. These objects include flood, landslides, lava flow and so on. How to appropriately simulate soft geoobjects in GIS is still a challenge. This study will try to meet this challenge.

2. GIS Flow Element(FE) and GIS Soft Voxel(SV)

Controlled by geoscientific models and built based on a pixel from remotely sensed imagery, a GIS FE is used to simulate the dynamic change of velocity and direction of soft geoobjects in 3D space and taken as a basic simulation unit. A GIS FE has position, velocity and direction, but neglects volume. The appearance of a GIS FE can be rendered as an arbitrary point, line segment, face or volume. But considering that it is built based on a pixel, the perpendicular projection of a GIS FE in the pixel plane should be completely within the pixel. Via adding colors or other geometric characteristics, a GIS FE can represent more geoscientific attributes. A GIS SV is a voxel with position, velocity, direction and volume and covered by an isosurface, which is defined by implicit functions. It is also controlled by geoscientific models and built based on a pixel from remotely sensed imagery and taken as a basic simulation unit to simulate the deformation of soft geoobjects. By adding colors or modelling its internal structure, a GIS SV can represent more geoscientific characteristics.

3. Case Study

We simulate the integrated process of rainfall, overland flow and soil erosion, where rainfall and overland flow can be realistically simulated by GIS FEs and soil erosion can be naturally simulated by GIS SVs as shown in Figs. 1–3. Collected data from a small watershed in China Loess Plateau region, we simulate one rainfall event in that region (Figs. 4-7).

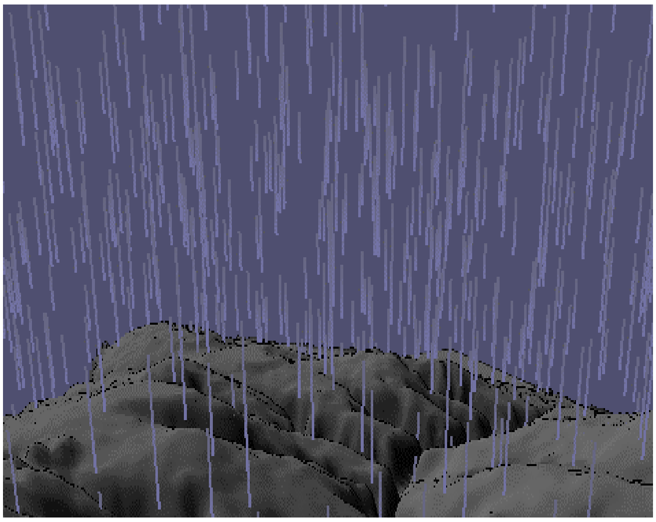

Fig. 1 Rainfall

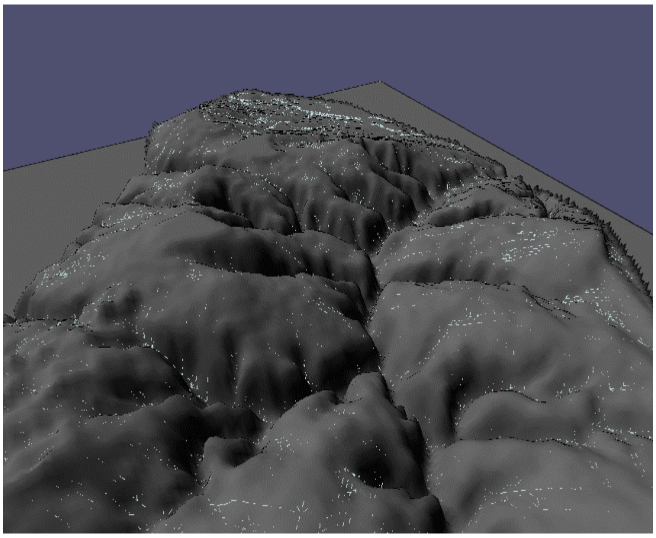

Fig.2 Overland flow.

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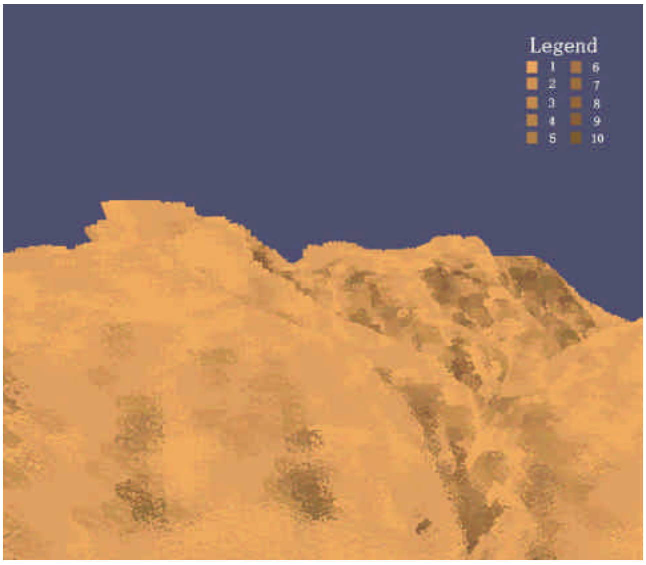

Fig.3 Soil erosion.

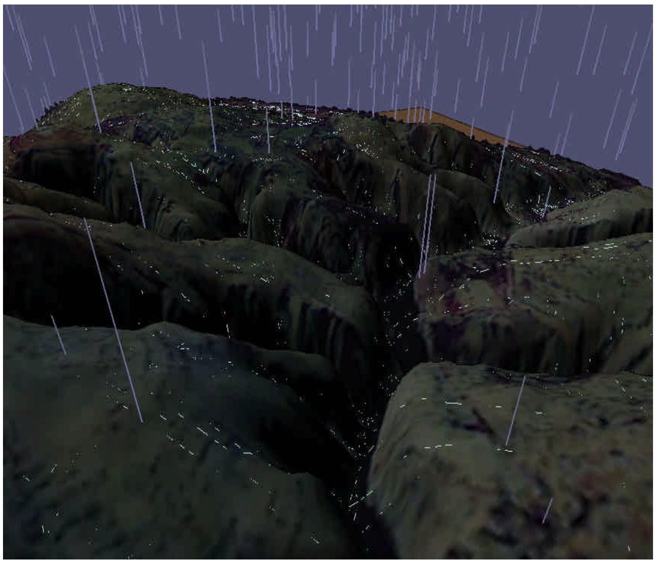

Fig. 6 Adding texture.

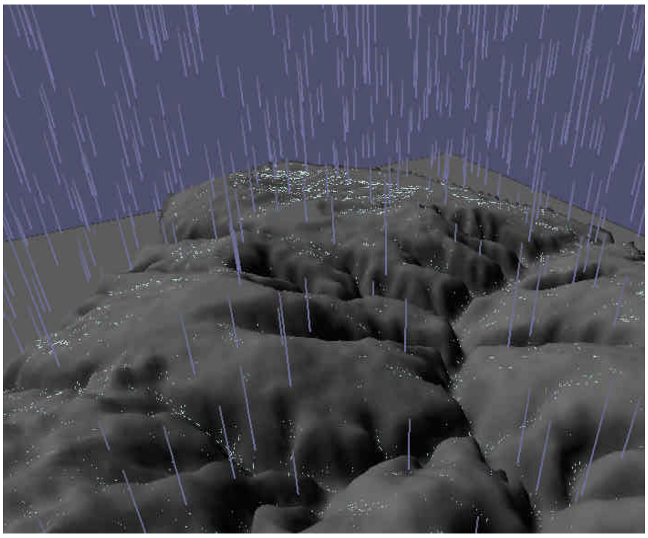

Fig.4 Integrated process - 1.

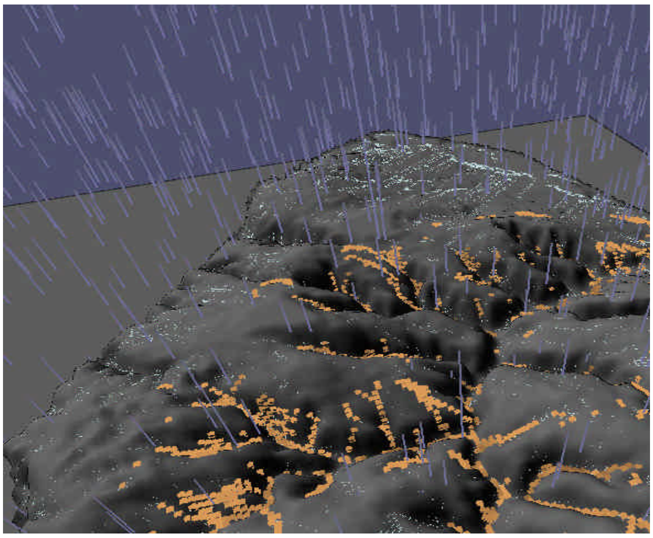

Fig. 7 Integrated process - 2.

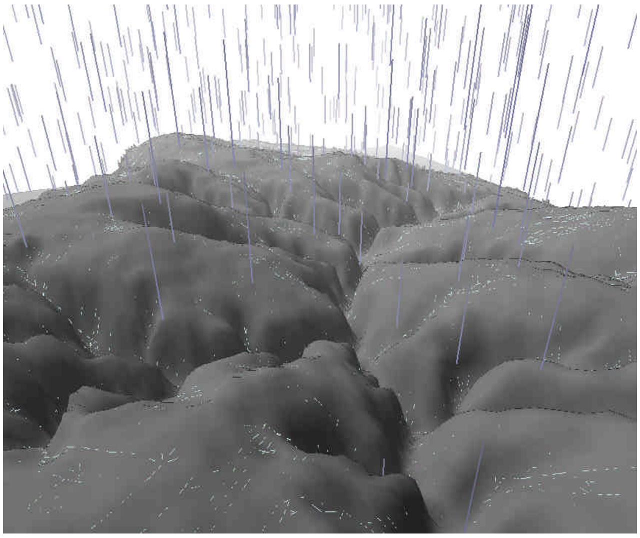

Fig.5 Adding fog.

4. Conclusion and Prospects

We describe the approach of GIS FE and GIS SV to meet a challenge in GIS. Through a case study on simulating rainfall, overland flow and soil erosion, the approach can realistically simulate soft geoobjects in 3D space. As future study, GIS FE and GIS SV will be used to simulate flood, landslides and so on.

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