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CONNECTIONS AND INTERACTIONS AS PARTS OF RELIEF-FORMATION

SUMMARY. Communications and interactions that are equal with the relief's forms and elements summed up from friable formations, processes and external conditions of relief formation are examined. The communications (eight classifications) and interactions (7 levels) that are subdivided into sublevels, and on the 2d level — on ranges are systematized.

KEY WORDS. Connections, interactions, levels, sublevels, ranges.

Introduction. The problem of systems analysis of the relief is discussed in many literature resources, in particular — the most recent one [1-2]. It discusses various provisions relating to the determination of geomorphosystems (GMS) and their properties. In the field of geomorphology consideration, the two most important relief formation participants: communication and interaction are rarely in the field of investigation. The present work is devoted to their interconnected consideration in order to develop their fullest possible systematic characteristics.

Variety of interactions, based on the existing relations is relief-high. The need of case studies was proved long ago, in particular by I.S. Schukin [3], Yu.A. Bilibin [4], N.I. Makkaveev [5], [6], S.S. Voskresensky, N.A. Florensov [9], L.N. Ivanovsky [10]. The main justification for these works (different in directions and content) is: if the description of interactions is excluded, there will be almost nothing left of thecontent.

The results of the later studies [11-12] demonstrated the critical need and importance for organizing and ranking the relationships and interactions. This work will continue systematic research as a partial fulfillment of the previously assigned tasks: substantive consideration of relationships and interactions [13].

Statement of the problem. Communications and interactions are often mentioned in the geomorphological literature resources. However, their definitions are not worked out so far. On the basis of their general scientific definitions [14 598, 8] we suggest and apply the following.

Communication *is interdependence of existing phenomena and their properties, separated in space and / or time, and functionally.* Communications are not only elements of geomorphosystems structure, connecting their parts together. According to communications of certain versions (types), there is an interaction of geomorphosystems and their parts. Communications are essential to their mechanisms of action — processes, in this case — the relief formation.

Interaction in the relief formation *is naturally interdependent, mutually influencing the development of both related parties of relief formation* (forms and landscape elements that form their loose formations, processes and external environment of relief formation and / or components, i.e. — the GMR and the external conditions of their functioning). In the course and as a result of these interactions,the properties, conditions of the GMR and its elements are altered, including the destruction of some and functioning of others. Not only are the characteristics, properties of relief-forming processes altered, but the processes themselves. The alterations of properties of the relief formation participants are happening continuously. Relief-changing members and communications between them cause continuous changes in the mode and nature of the interactions themselves.

Interactions perform a variety of functions in the relief-formation and participate in the formation and action of almost all of them, in particular — features of relief-forming processes ("preparatory" (preparing to move debris), transport, exchange, (matter, energy, information), dynamic, connective consolidating, information (diagnostic) identified in the review of formation of river valleys [15-16].

Under a consolidating function, the components of fluvial processes are established: 1) initiates and activates other processes of formation of river valleys, 2) regulating the interaction of all relief-forming processes, and 3) summing (integrating) them up [17].

The most important function is to integrate the interactions of all the participants of relief formation. It provides consistent patterns of variability and their planetary geomorfosystem in general — without changing its preservation.

The progress and results of research. Interactions occur in the presence of mutual (bilateral and / or multilateral) relations. Therefore systematizing of interactions follow from consideration of relationships and their properties. According to their properties, the communications are simple (one-property basis) classification.

1. In quantity of active participants in the communication: 1.1. one-sided (one); 1.2. two-sided (two); 1.3. Many-sided or multivariate (more than two).

2. In relation to the system: 2.1. internal (within the system); 2.2. external: 2.2.1. between the elements of different systems belonging to different parties of relief formation (RF); 2.2.2. between systems relating to one of SD; 2.2.3. between systems and elements of other systems, or between elements of different systems, as related to different, and to the same RF.

3. By level steps: 3.1. equal level (between the same order systems); 3.2.different levels, or step, or hierarchical (between different order systems).

4. In direction of the action as to the source: 4.1. Direct (the source of the communication on the subject of its action); 4.2. Back from the object of the direct link to the source of her actions).

5. By result of actions: 5.1.positive (increase the results of the bonds); 5.2.negative (weaken (reduce) the results of the bonds).

6. According to the degree of mediation: 6.1. Immediate (without regard to intermediate participants (intermediaries) 6.2-mediated (with related intermediate members (agents) — links of this type are based on known locations "in nature, everything is connected."

Table 1

Types of communications; levels, subtotals and ranks of interactions of geomorfosystems and their ratio.

Notes. 1. Levels of interactions, except II, are subdivided into subtotals, and within the II levels — into ranks.

2. Levels of interactions will be coordinated with classifications of communications: I-with the 1st, II — with the 2nd and the 3rd, III-VII — with 4-8th (respectively).

Properties of communications — their classification signs	Types of communications and their short characteristics (on properties)	Levels (Roman figures), subtotals and ranks of interactions	Examples of interactions of various levels and ranks
1. Number of active participants of communication	1.1. unilateral (one)	-	-
	1.2. bilateral (two)	I.1. the bilateral	between a bed waterway and the bed of the river: formation of the course and stream; participation in formation of river banks, valley and valley bottoms as a whole
	1.3. multilateral or multiple-factor (more than two)	I.2. the multilateral	between elements of a relief of a slope: formation of slopes
2. The relation to considered system 3. Action level	2.1. internal (in system) 3.1. identical level (between one-serial systems) 3.2. different levels, either step, or hierarchical (between multi-ordered systems)	II.1. internal (in a form, process, an external condition)	between elements of the bottom of a valley: formation of the bottom of a valley; participation in valley formation as a whole
	2.2. the external:	-	-

Table 1 cont.

2. The relation to considered system 3. Action level	2.2.1. between elements of the different systems relating to various participants of a relief formation (further — RF) 3.1. identical level (between one-serial systems) 3.2. different levels, either step, or hierarchical (between multi-ordered systems)	II.2. external 1st rank (between elements of forms, processes, external conditions)	between structure of products of aeration, slope formations, river-borne sediments and speeds of a watercourse: formation of river-borne sediments, participation in formation of the course, coast, valley and valley bottoms as a whole
	2.2.2. between the systems relating to one of UR; 3.1. identical level (between one-serial systems) 3.2. different levels, either step, or hierarchical (between multi-ordered systems)	II.3. external the 2nd rank (between only forms, only processes, only external conditions)	between the mountain systems, separate ridges and hollows (depressions), macro-slopes of ridges and river valleys dismembering them: participation in development of these forms and elements and relief as a whole
	2.2.3. between systems and elements of other systems, or between elements of the various systems relating both to various, and to the same RF 3.1. identical level (between one-serial systems) 3.2. different levels, either step, or hierarchical (between multi-ordered systems)	II.4. external the 3rd rank (between forms, processes and external conditions (and/or their elements) which basically provide large changes in a relief structure)	between a structure of the bottom of a valley, the directions and speeds of vertical and horizontal migrations of the course, structure and anti-erosion stability of the breeds composing the course, coast and the floodplain, and also — properties and changes of external conditions: formation of the bottom of a valley, participation in valley formation as a whole

Table 1 cont.

4. The action direction concerning an action source	4.1. straight lines (from a source of action of communication on object of its action)	III.1. direct (influences)	between not compensated tectonic raisings, increase in height of a terrestrial surface and contrast of a relief: solving participation in formation: a) deeply cut river valleys; b) mountainous terrain; c) contrast relief as a whole
	4.2. the return from object of action of direct link on a source of its action)	III.2. return (reactions)	between tectonic distortions of a terrestrial surface and changes of sizes and the directions of biases of a longitudinal profile of a waterway: changes of intensity and an orientation of fluvial processes, formations an alluvia, courses, floodplains, lakes in valleys, valleys as a whole
5. Result of action	5.1 positive (strengthen (increase) results of action of communications)	IV.1 single valued (mainly) positive	between a bed stream and bed alluvia (speed of which particles has less than speeds of a current of water in a stream): river incision
	5.2 negative (weaken (reduce) results of action of communications)	IV.2 unequivocally (mainly) negative	between slope processes and a steepness of slopes in time: vypolazhivaniye of slopes
	5.1 positive (strengthen (increase) results of action of communications) 5.2 negative (weaken (reduce) results of action of communications)	IV.3 ambiguous (in essential parts both positive, and negative)	between bed processes and the valley bottom: wash-out of one sites of the bottom of a valley and increase — others (in particular — in one alignment); building of height of the bottom of a valley (relatively edge waters in the river) both at negative, and at positive vertical migrations of the course

Table 1 cont

6. Indirectness degree	6.1. direct (without existence in communication of intermediate participants (intermediaries)	V.1. the direct	between a consistence of soil on slopes and speeds of shift of fragments under the influence of slopes processes of mass shifts of soil: formation of slopes processes under the influence of a consistence of soil and, under the influence of slopes processes, acquisition by fragments of certain speeds of shift downhill
	6.2 mediated (at existence in communication of intermediate participants (intermediaries)	V.2. the mediated	between a structure of a relief and the general condition of external conditions of its formation—— relief formation as a whole (intermediaries in this interaction — relief forming processes)
7. An action mode in space	7.1. the surfaces developed on the area and/or in an active layer (in expressed on the area and/or of capacities of an active layer a spatial framework)	VI.1. expressed on the area and / or in an active layer	between a relief structure, processes and the general condition of external conditions of its formation: relief formation on a terrestrial surface as a whole and on its separate sites
	7.2. the local: on lines (for example, in a river alignment), «in a point» (for example, in prospect hole) (not expressed in any appreciable spatial framework)	VI.2. the local: expressed on lines (for example, in a river alignment), «in a point» (for example, in a hole)	between slope processes: rock stream and deflection.

The end of Table 1

8. An action mode in time	8.1. continuous (constantly operating) (constant)	VII.1. continuous (constantly operating)	between a structure of river valleys, processes and external conditions of their formation: formation of river valleys
	8.2. faltering (from time to time and/or under certain conditions)	VII.2. the faltering	between water streams and catastrophic high waters: participation in formation of the course, the bottom and a river valley as a whole — at solving stages; active incision; flooding of the floodplain and, in certain cases, first over bottomland terrace
	8.3. operating in the past	VII.3. past interactions	between rock stream process, a slope and slope formation — in case of having the horizon of blocks of local petro-composition, lying in the lower part of slope thickness
	8.4. faltering and continuous (for example, seasonal) (action with variable intensity (the periods of inaction of communications (much less) periods of their action there is less)	VII.4. faltering and continuous (for example, seasonal)	between changes of degree of moisture content of soil, their consistence and solifluction process: solifluction action during acquisition by soil of high degree of moisture content and plastic (or liquid — fluid) consistence

7. by mode of action in space: 7.1. developed in the surface area and / or in the active layer (as expressed in the area and / or the capacity of the active layer spatial framework) 7.2. local: on the line (for example, in the alignment of the river), "at the point "(e.g., in the pit) (not expressed any significant spatial framework)

8. by mode of action in time: 8.1. constant (permanent acting) (permanent); 8.2 interrupted (from time to time and / or under certain conditions) 8.3. acted in the past; 8.4. interrupted-continuous (e.g. seasonal) (the action of variable intensity (periods of inactivity bonds less (much less) periods of their actions).

Thus, due to the relief-are characterized by eight simple classifications and synthesized a large number of them are difficult, necessary and useful for the characteristics of bonds in each GMS.

The main property of the order of relationships classifications and interactions is not in their importance (they are all significant in their own way), but in their mutual and accurate coherence.

Study of interactions can solve a complicated problem, that is characterized in the language of mathematics as an expression of the infinite in the finite form. Interactions are represented more simply than all their infinite number and variety of levels, sublevels and grades.

The main conclusions. Communications and interactions, presented in a systematic way, allow us to study relief more specifically, closer to the knowledge of its being — a more specific and detailed than it was (and is) so far. The offered system of communications and interactions, based on real, substantial and specific features, will provide adequate relief-review and forecast of the GMR in all their complexity and interconnected development. The interaction forecasts relief objectively will be more accurate. Researchers and, most importantly, practicians, come close to solving the problems of management of relief formation and the formation of a sustainable environmental management.

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