

Progress in physical geography

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Abstract

The nature of physical geography in the context of mathematical and physical aspects of its progress in the framework of Earth Sciences is emphasized. Research in physical geography at Charles University in Prague since 1991 is presented. Remarks to the conception of physical geography in the Czech Republic are introduced. The progress in physical geography and the changes of its structure are a consequence of an expansion of theoretic conceptions and technologic means used in Earth and Space sciences. This has sensibly increased the extent of space and time in which it is possible to observe and investigate natural processes and objects. The application of mathematical and physical approaches and exact methods with specialized techniques and devices for determination, description and measurement of the components of the natural environment stimulates the interpretation transition from the analytical research to the construction of models and to the synthesis of global changes and dynamics of natural systems.

Key words: physical geography, Earth Sciences

1. Nature of physical geography

As a young man, my fondest dream was to become a geographer. However, while working in the customs office I thought deeply about the matter and concluded it was far too difficult a subject. With some reluctance, I then turned to physics as a substitute.

Albert Einstein, unpublished letters

(Remark on a notice-board in the computer hall of the School of Geography and the Environment, University of Oxford.)

The scientific branch of physical geography deals with exploring the development of the Earth's natural environment as a whole; it studies its components and their mutual relations in the general as well as in the regional context. An important task of physical geography is also the research into space and time relations of the natural environment and human society (Ehlers 2000, Thomas, Goudie 2000). By its orientation, physical geography is a natural part of the group of geographic branches, traditionally overlapping mainly with regional geography. When observing the content

of the current international scientific programmes, projects and publications, organization arrangements at universities and in scientific institutions, there is, moreover, a visible trend to apply physical geography in the whole spectrum of Earth Sciences. Earth Sciences priorities are: research into the dynamics, internal structure and physical characteristics of the Earth; studies on the evolution of the lithosphere; the natural environment's palaeogeographic changes since the very late geological past up to the present times (Lowe, Walker 1997, Ross 1999); research into the processes in the near-surface part of the Earth crust influencing the interaction of human activities with the natural environment (Huggett 1995, Sieferle 1997, Lubchenco 1998); and complex studies on the surface spheres of the Earth and of the other bodies of the Solar system. An essential part of the fundamental knowledge of the majority of these themes originated and have also been developed in physical geography (de Blij, Muller 1995, Briggs et al. 1997, Slaymaker, Spencer 1998). Complexly conceived geographic studies of the natural environment and of social systems with a consequent usage of mathematical and physical approaches aim towards a quite new incorporation of geographical branches into an integrated system of natural and social sciences.

Repertition of physical geography into specializations dealing mainly with individual natural spheres are similar to the system organization of simple variants of a hierarchic assemblage. Nevertheless, this conception is currently applied only for methodological clearness (Fig. 1) and for some approximative (e.g. teaching and administrative) models of natural and social processes and phenomena (Strahler, Strahler 1992, Massey 1999). Research into the partial components of the natural environment, their correlation and the effort for integration into a complex physical geographical system (Chorley, Kennedy 1971, Schellenhuber, Wenzel 1998) presupposes (among others) the possibility of combining the space and time diverse data (comp. Fig. 2) of a miscellaneous interpretation value. The present division of physical geography can be thus expressed rather by the model of an n-dimensional crystal structure. Its vertices (dimensions) are then represented by individual specializations, as for instance geomorphology, hydrology, climatology, biogeography, etc. Edges, areas and internal preferred directions of orientation among all the vertices of this model crystal express then the multilateral links of physical geographical disciplines. This integrated model of the branch of science physical geography must be however sufficiently stimulated by a multidirectional flow of data and partial findings of specializations, which collaborate also with other branches of natural science. The dynamism of the so organized "crystalline" structure of physical geography manifests then both evolutionary and degenerative processes and phenomena that are known from the relatively complicated categories of neurone networks. At the same time, from the general natural scientific and methodological view, it is at the same time natural that the research projects of physical geography (and of other Earth and Space Sciences) dealing with very variable, complex and dynamic natural systems (compare Bauer 1999, Gregory 2000) are at present being solved with the preferential using of the principles of general thermodynamics, "fuzzy logic", the theory of percolations or of the so-called deterministic chaos (Culling 1985, Malanson et al. 1990, Lane, Richards

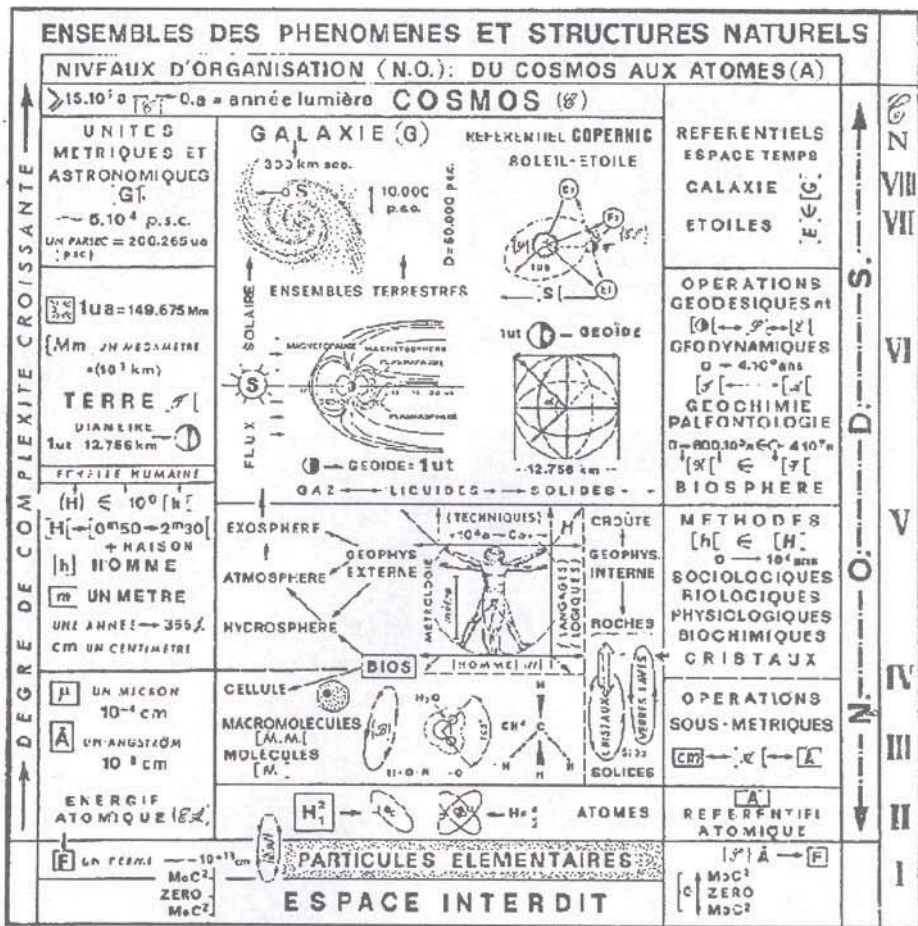


Fig. 1 Example of a methodological model of the hierarchical structure of natural phenomena and processes (after Glangeaud 1970).

1997, Thomas 2001). This physical geographical approach also gives birth to new branches of science, both in specialized studies and in the integrated research of the natural environment of the Earth.

Physical geographical research contributes at present in an essential way to the knowledge of the dynamics of global and regional changes of natural systems (Lesser 1997, Park 1997, Ehlers 2000). An example of the immediate usage of these theoretical papers may be the progress in diagnosis of natural risks and hazards and in prognostication and prediction of catastrophic events and phenomena. Physical geography is essential both for the preparation and implementation of risk situation solutions (Goudie, Kalvoda 1997) and for the construction and testing of models of regional and global environmental changes. The difficulties related with gathering and processing of a great quantity of high quality analytic data in Earth Sciences are

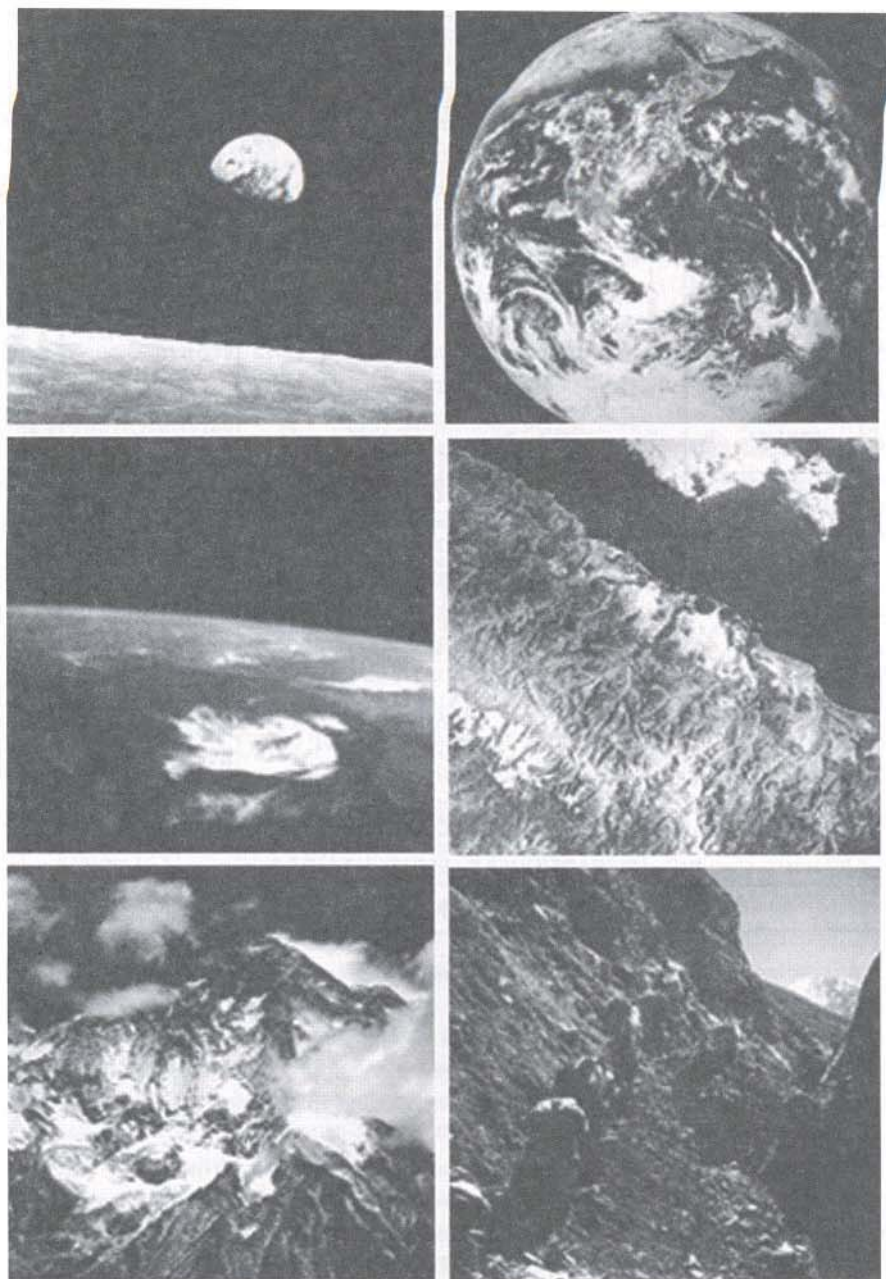


Fig. 2 Demonstration of space extents and the scale variability of observations related to physical geographical and/or geodynamic processes and events: images of the Earth above the horizon of the Moon's surface (Zond - 7), its sphere with Africa and the Indian Ocean (Apollo 8), the origin of a storm above the Atlantic Ocean, central parts of Andes and the Pacific Ocean, rock massifs of Himalayan peaks and boulder ruins of their disintegration.

widely known, as well as a high sensibility of the dynamism of non-linear systems or their models to the determination of the initial conditions (Mandelbrot 1967, Philips 1992, Robert, Roy 1993). Nevertheless, the present physical, chemical and information technologies allow a significantly higher quality of sampling, archiving and processing of data from field monitoring and measurements or of laboratory experiments. Classing and interpretation of these data also include their exchange between working teams and institutions. Creation of large data files enables scientists to prepare algorithms for mathematical and physical modelling of the monitored natural processes. A certain degree of knowledge of the natural processes dynamism can be then used for purpose-aimed expert systems, e.g. for preparation and testing of prognostication and prediction of events, processes and phenomena.

Research into the Earth's body and its near neighbourhood is carried out by a number of Earth Science disciplines related to physical geography which get mutually interconnected and cooperate. For physical geography is very important the over-lapping with geophysics, geology, biology, geodesy and cartography. This situation not only leads to a quick propagation of special findings, but also to the birth of new branches proceeding from the original physical geographic specializations (Goudie 2000). At the same time, urgent problems connected with the need for a complex evaluation and research into the natural environment dynamism are being solved, which stimulates the integration of individual disciplines of physical geography.

2. Research in physical geography at Charles University in Prague since 1991

As an example of the progressively implemented variant of the development of a physical geography workplace, this paper sums up general aspects and conceptions of the current scientific activities at the Department of Physical Geography and Geoecology, Faculty of Science, Charles University in Prague, since 1991. Until 1991, physical geography and its individual disciplines were cultivated at the Faculty of Science at the Department of Cartography and Physical Geography. The newly formed Department of Physical Geography and Geoecology aiming simultaneously at education and research activities has been working for 10 years. At present, it participates in teaching of the common rudiments of geographic branches, of several specializations of the two-subject studying programme and in the one-subject studying programme – geography teaching. The Department also provides master and PhD studies in the physical geography programme. Information about the above-mentioned study programmes have already been published as part of the report by Bičík, Kalvoda (1997) and the current structure of pedagogical activities of this Department as well as of the whole Geographic Section of the Faculty of Science, Charles University, is accessible on Internet (2001) and in the List of lectures of the Faculty of Science, Charles University, for the year 2001/2002. A list of academic workers of the Department of Physical Geography and Geoecology {Faculty of Science, Charles University in Prague} as of October 1, 2001 is given in Table 1.

Table 1 Academic members of the Department of Physical Geography and Geoecology (Faculty of Science, Charles University in Prague) and their research specializations, October 2001

RNDr. Břetislav Balatka, CSc. (*geomorphology, regional physical geography*)
RNDr. Pavel Červinka, Ph.D. (*regional physical geography, geoecology*)
Ing. Josef Hladný, CSc. (*hydrology*)
Mgr. Zbyněk Engel (*geomorphology, geodynamics*)
Doc. RNDr. Bohumír Janský, CSc. (*hydrology, regional geography*)
Prof. RNDr. Jan Kalvoda, DrSc. (*geomorphology, physical geography, geodynamics*)
RNDr. Jiří Kastner (*climatology, regional physical geography*)
RNDr. Zdeněk Kliment, CSc. (*hydrology, fluvial geomorphology*)
Mgr. Marek Křížek (*geomorphology*)
RNDr. Jakub Langhammer, Ph.D. (*hydrology, geoecology, GIS*)
Doc. RNDr. Zdeněk Lipský, CSc. (*geoecology, landscape protection*)
Mgr. Mílada Matoušková (*hydrology, geoecology*)
Doc. RNDr. Václav Příbyl, CSc. (*geomorphology, geoecology, regional physical geography*)
RNDr. Luděk Šefma, CSc. (*pedology, pedogeography, biogeography*)
RNDr. Ivan Sládek, CSc. (*climatology, meteorology*)
RNDr. Jiří Stehlík, Ph.D. (*hydrology, hydrogeology*)
RNDr. Vít Vilímek, CSc. (*applied geomorphology, regional physical geography*)
Doc. RNDr. Jan Votýpka, CSc. (*geomorphology, regional physical geography*)

External members:

Ing. Ing. Michael Bartoš, CSc. (*geoecology*)
RNDr. Vilibald Kakos (*climatology*)
RNDr. Daniela Řezáčová, CSc. (*meteorology, climatology*)
RNDr. Martin Šíma (*remote sensing*)
RNDr. Josef Štekl, CSc. (*climatology, meteorology*)
Ing. Jan Těšitel (*geoecology*)
RNDr. Anna Žigová, CSc. (*pedology*)

The scientific activities of the Department of Physical Geography and Geoecology (Faculty of Science, Charles University in Prague) are based on studies of theoretical aspects of physical geography and on the development of basic and applied research in several specializations of this branch of science. Following thematic fields are focused on:

- I. Evolution of the natural environment and the dynamism of interactions of its physical geographical components.
- II. Physical geographical evaluations and synthesis of the results of determination, monitoring and measurement of recent processes and phenomena.
- III. Natural hazards and physical geographical aspects of their risks for society.
- IV. Anthropogenous processes and phenomena within the complex of physical geography and geoecology of model localities and regions.

Scientific papers aimed at these themes follow very similar methodical processes: 1. monitoring and measurements of recent natural processes and phenomena in selected regions and localities, including the manifestations and impacts of human activities; 2. classing and interpretation of the obtained data from the viewpoint of current complex hypotheses and theories, and that with the hope that 3. the verbal, tabular and graphic or other model organization will offer the possibility for a deeper understanding

of regional and global changes of the natural (and general) environment. Partial specialized papers are concentrated in several project and grant units, the themes of which are naturally interconnected and, at the same time, new research methods are being developed and tested: A) geomorphology (analysis and mapping, morpho-structural division, landform evolution in the Upper Cainozoic); B) hydrology (gathering and processing of data on surface water, regional hydrogeography, processing of data on water quality, studies of flooding); C) climatology (regionalization of the climate in the Czech Republic, wind characteristics and usage of wind energy); D) pedology (regional pedology, soil erosion); E) geoecology (anthropogenous impacts and processes in the landscape, regional landscape ecology and landscape development). The main geographic area of all these research themes is naturally Central Europe, but also quite essential is the research that our academic workers and postgraduate students of our Department carry out within international co-operation (see pp. 204–206 in *Geographical Departments in Czechia, 2001*) in other selected regions of Europe, both Americas, in Asia and in Africa. The significant common aspects of these research orientations are the efforts to identify the dynamism of physical geographical processes and phenomena, of their regional and global trends, as well as the research into natural risks and hazards, including the prediction and prognostication of extreme events. A survey of international projects, institutional

Table 2 Main research projects and grants of the Department of Physical Geography and Geoecology, Faculty of Science, Charles University in Prague, 1997–2001

1. International programmes and grants: *Mountain regions programme, Global change in the Mountains (European Network for Research and Global Change, University of Oxford and European Commission); Fleuves et erosion, Utilisation du ¹⁰Be produit in situ pour dater le retrait et de la durée de la dernière séquence glaciaire dans centre de l' Europe (Université Louis Pasteur, Strasbourg, C.N.R.S.); Monitoring system for hazardous tectonic structures (COST, European Union); Barrande project, Géomorphologie comparée de deux massifs hercyniens volcanisés (M.E.N.E.S.R., Paris); African Mosaic Expedition; Hatun Mayu, expedition to the sources of the Amazon River; Elbe Project (Universität Hamburg);*

2. National grants:

a) Grant Agency of the Czech Republic: *Analysis of the evolution of deep deformation of slopes in neovolcanites of the České Středohoří Mountains, Deformation function of tectonic structures in rock massif, Analysis of evidences of the tectonic activity in seismoactive regions of the Bohemian Massif, Evolution of denudation by floods waters, Digital model of the landscape – a perspective instrument of the Earth Sciences;*

b) Grant Agency of Charles University in Prague: *Classification of climate in Prague, Denudation of matter in the Czech part of the Labe river network, Dynamics of siltation in lakes of the Northern Bohemia, Dynamics of erosion processes in the middle part of Ohře river, Dynamics of denudation in networks of geographically different conditions of the Czech Republic, Revitalization of river systems and quality of surface water in the Czech Republic, Erosion and transport of matter in the Blšanka river network, Present-day changes of landuse in the Czech Republic, Typology and protection of the Czech landscape, Research of the quality of water sphere of nature in the Berounka river network, Research of risk processes in the Cordillera Blanca (Andes, Peru);*

c) other educational or applied grants: *Instruments for experimental activities of students in climatology and geomorphology; Geomorphological hazards and risks in localities of the construction and operation of nuclear power-stations; Evaluation of influences of anthropogenic and ecological factors to the production and economic capacity of agricultural soils; Climatological regionalisation of the Czech Republic; System of complex evaluation of the quality of soils in the Czech Republic related to their morphometrical and climatological factors.*

programmes, purpose grants and other research projects in which academic workers of the Department of Physical Geography and Geocology (Faculty of Science, Charles University in Prague) have taken part since 1997, is given in Table 2.

The mentioned research spheres and the European teaching programme ERASMUS are also a base for international co-operation with physical geography and geocology workplaces at the universities in France (Université Louis Pasteur, Strasbourg), Germany (Universitäts Hamburg, Heidelberg, Mainz and Passau), Italy (University of Milano), Peru (Universidad National Mayor de San Marcos, Lima), Switzerland (Universität Bern) and United Kingdom (University of Oxford). Academic workers of the Department of Physical Geography and Geocology (Faculty of Science, Charles University in Prague) are also members of international societies, e. g. Commission for Quality of Waters, Commission on Natural Hazard Studies, International Association of Landscape Ecology, International Association of Geomorphologists, International Geographical Union and Société Pédologique de France.

Scientific activities of this department are aimed at both basic and applied research. In this second group, let us mention especially the hydrological papers on the revitalization of water ecosystems in the Labe catchment area, the studies on natural risks and hazards, geomorphological and geodynamical research in selected regions of Central Europe (tectonically active zones, national parks and protected landscape regions), regionalization of the Czech Republic and the research on air pollution in Prague. The solution of scientific and research themes presupposes the co-operation with specialized institutions, as for instance scientific contacts with the Czech Institute of Geology, the Institute of Geology of the Academy of Science of the Czech Republic, the Institute of the Physics of the Atmosphere of the Academy of Science of the Czech Republic, the Institute of Structure and Mechanics of Rocks of the Academy of Science of the Czech Republic, the Czech Geological Survey, the Czech Institute of Hydrometeorology, the Research Institute of Water Management, the Povodí Ohře and Povodí Vltavy establishments, the Institute of Geodesy, the Institute of Applied Ecology of the Czech Agricultural University, the Research Institute of Soil Reclamation and Protection and with the administration of the Krkonoše and Šumava National Parks.

In 1999, work on the long-term research programme "Geographical structure and development of interactions of the natural environment and society" started at the Faculty of Science, Charles University in Prague. The workers of the Department of Physical Geography and Geocology take part in research activities in at least three of the five integrally organized pillar orientations of the complex structure of this geographic programme. The part of the physical geography oriented thematic spheres is significant in the following pillar orientations of the geographic research intention of the Faculty of Science (Charles University in Prague): 1. the theory of the interaction nature – society from the local to the global level of mutual interaction; 2. physical geographical analysis and integration of the results of the monitoring and measurements of recent geodynamic processes and phenomena and their correlation

with the palaeogeographical record of the evolution of the natural environment in the Quaternary; 3. the state and development of the interactions between society and the natural environment: a) dynamic changes of the natural environment, b) natural risks and hazards of catastrophic processes and events.

Since 1999, the Department of Physical Geography and Geoecology, Faculty of Science, Charles University in Prague, has also had a laboratory of physical geography which constitutes both a creative and instrumental base for integration of professional training in physical geography and geoecology and research activities of the Department's academic workers. The equipment of the laboratory also includes newly organized archives of degree, master, Ph.D. and dissertation papers of the scientific branch physical geography, and also stores papers from the beginning of the 20th century. Selected scientific publications of the members of our Department since 1991 are given in Appendix. Perspective supports of the scientific activities of the Department of Physical Geography and Geoecology are at present the post-graduate students and teachers of the study programme of physical geography (22 internal and 36 external post-graduate students), then the participation of the academic workers in selected themes with long-term international co-operation and in the solutions of the geographic research aims of the Faculty of Science, Charles University (1999–2004), and since July 1, 2000 their co-founding and active participation in the programme "Research Centre for Earth Dynamics" of the Czech Republic. This programme brings together specialized teams from the Research Institute of Geodesy, Topography and Cartography (Czech Geodetic Survey), the Astronomical Institute and the Institute of Structure and Mechanics of Rocks (Academy of Science of the Czech Republic), the Department of Geodesy (Czech Technical University in Prague), and the Department of Physical Geography and Geoecology (Faculty of Science, Charles University in Prague) in the long-term project "Experimental research of the dynamics of the Earth and its surface".

3. Remarks to the conception of physical geography in the Czech Republic

The informative survey of Geographical Departments in Czechia (2000), prepared for the IGU Congress in Seoul, gives a short description of 14 main geographic workplaces in the Czech Republic. Nearly all of them deal with some of the disciplines of the scientific branch physical geography. Many other physical geographers work in research institutes and in specialized workplaces, including geological, hydrological, meteorological and geodetic services, administrations of national parks, publishing houses and different ministries of the Czech Republic. When discussing and consulting with our colleagues from the main physical geographical workplaces at universities and in the Academy of Science of the Czech Republic, we often saw the harmony of the principal features in the development of the specialized physical geographical teams. Scientific, research and educational activities of physical geographers at universities, in the institutes of the Academy of Science of the Czech Republic and in other workplaces oriented towards natural sciences largely suffer from the quite insufficient enforcing of all geographical

branches at different levels of management and financing of science and research in the Czech Republic. This situation is, in the period of current principal system changes in organisation of universities, science and research, extremely threatening and brings to the geographical branches, including physical geography, basic conceptual problems. For geographical branches, the steadily increasing competition of other natural and social sciences in tenders for participation in institutional and purpose programmes and projects in the whole Europe is also essential.

Another negative aspect of the development of (not only) geographical disciplines is the fact that expert activities of specialized working teams are aimed at creative activities with different periods for implementation and with different financial resources. They are mainly 1. accredited bachelor, master and Ph.D. university study programmes (3 to 5 years); 2. institutional research intentions and long-term scientific programmes (5 to 7 years); 3. international and national (purpose) research grants (2 to 4 years); 4. applied themes of educational and research activities (1 to 3 years). These periods determine administrative rhythms of material covering of scientific and pedagogical work and academic workers respond spontaneously and, from the research point of view, rather ineffectively. For very understandable reasons, they do not stress the long-term solution of priority themes of the basic research with an up-to-now uncertain and feeble economic basis. Academic workers (including geographers) give on the contrary priority to short-term financial resources which are by far the most common (and more easily accessible) in the applied themes of research and educational activities. A substantial negative factor is the quite unbearable situation in material conditions of young specialists, especially assistants and post-graduate students at universities. Under these circumstances it is very difficult to further a long-term orientation of qualified geographers at scientific activities, including their participation in the preparation of Ph.D. students. A great diversity of different expert and research reports, encyclopaedic works, reference and popular-science articles or today already high numbers of pre-graduate students at universities will have a minimal impact on the development of geographical branches in the Czech Republic so long as they are not accompanied by extensive scientific activities with demonstrably good creative and publication results.

To develop the programmes of pre-graduate and post-graduate studies as well as the scientific and educational activities in geographical branches, it is essential to ensure: 1. changes in the structures and implementation of basic research, including efforts to develop well-equipped libraries, laboratories and field stations; 2. optimization of management and mutual support of geographical teams in scientific projects and long-term conception aims and programmes of faculties/universities, research institutes and scientific centres in the Czech Republic; 3. systematic integration of Ph.D. students and young scientific workers into the solution of key themes of basic and applied research in Earth Sciences connected with the effort to substantially increase their material conditions; 4. the consequent implementation and complex support of an active participation of Czech geographers in international programmes, projects and grants. The last mentioned point is an indispensable general condition of the development of science and research in the Czech Republic,

but in geographical branches it also has substantial methodical aspects. The stress put upon global (planetary) and regional dimensions, correlations and specific aspects of our geographic work which has been stimulated since the 1990's by the sensibly larger possibilities of travelling and study stages abroad is enabling progress towards quite essential changes in the conception of pedagogical and scientific activities. This trend is also backed by the participation of Czech students and academic workers in the use of global and European information networks.

4. Conclusions

The progress in physical geography and the changes of its structure are a consequence of an expansion of theoretic conceptions and technologic means used in Earth and Space sciences. This has sensibly increased the extent of space and time in which it is possible to observe and investigate natural processes and objects. The application of mathematical and physical approaches and exact methods with specialized techniques and devices for determination, description and measurement of the components of the natural environment stimulates the interpretation transition from the analytical research to the construction of models and to the synthesis of global changes and dynamics of natural systems. At the same time, different natural systems may have their own groups of effective laws, the fundamental feature of which is the ability of their self-organization, that is of the origin and development of diverse structures in space and time. The physical models conceived in such a way emphasise the interactions and co-operation of natural systems when safeguarding the autonomy of their structure and dynamics.

Physical geography is a complex scientific branch in the progressively developing integrated system of natural and social sciences. It thus contributes to the knowledge of the current state of nature and its sovereign domain is the research into environmental systems at the dynamical boundary and the intersection between society, biosphere, lithosphere, hydrosphere and atmosphere. Moreover, it deals with palaeogeographic and recent changes of the space and time structure of the landscape due to natural and anthropogenous processes and with their impacts for society. One of the priority themes of physical geography is the studying of the stability and resistance of the environmental systems to the disturbances of the frequency, size and extent of natural events and processes, including human activities. The interpretation and correlation of findings on the history and dynamism of environmental systems in all observably accessible space and time scales motivate specialisation trends which, above all, strengthen the specialization and the integration aspects of physical geography.

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R é s u m é

Pokrok ve fyzické geografii a změny její struktury jsou důsledkem expanze teoretických koncepcí a technologických prostředků využívaných ve vědách o Zemi a vesmíru. Takto se podstatně zvětšil rozsah prostoru a času, v nichž je možné pozorovat a zkoumat přírodní procesy a objekty. Uplatňování matematicko-fyzikálních přístupů a exaktních metod se specializovanými technikami a přístroji při zjišťování, popisu a měření složek přírodního prostředí stimuluje interpretační přechod od analytických výzkumů k vytváření modelů a k syntéze globálních změn a dynamiky přírodních systémů. Přitom různé přírodní systémy mohou mít vlastní skupiny efektivních zákonů, jejichž fundamentálním rysem je schopnost jejich samoorganizace, tedy vzniku a vývoje rozmanitých struktur v prostoru a čase. Takto pojaté fyzikální modely zdůrazňují interakce a kooperace přírodních systémů při zachování autonomie jejich struktury a dynamiky.

Jako příklad postupně realizované varianty rozvoje fyzickogeografického pracoviště jsou shrnuty obecné rysy koncepce a aktivity vědecké činnosti na katedře fyzické geografie a geoekologie Přírodovědecké fakulty Univerzity Karlovy v Praze od roku 1991. Stručně jsou popsány hlavní vědecké programy této katedry, včetně výukových a výzkumných projektů mezinárodní spolupráce. Dále jsou uvedeny poznámky k aktuálním aspektům rozvoje fyzické geografie v České republice, zejména s ohledem na základní výzkum a výuku na univerzitách.

Fyzická geografie je komplexním vědním oborem v postupně se vyvíjejícím integrovaném systému přírodních a společenských věd. Takto přispívá k poznání vzniku současného stavu přírody a její výsostnou doménou je výzkum environmentálních systémů na dynamickém rozhraní a průniku mezi společností, biosférou, litosférou, hydrosférou a atmosférou. Dále se zabývá paleogeografickými a současnými změnami prostorové a časové struktury krajiny, způsobenými přírodními a antropogenními procesy a jejich důsledky pro společnost. Jedním z prioritních témat fyzické geografie je studium stability a rezistence environmentálních systémů vůči perturbacím četnosti, velikosti a rozsahu přírodních událostí a procesů, včetně aktivit člověka. Interpretace a korelace poznatků o historii a dynamice environmentálních systémů na všech observačně dostupných prostorových a časových škálách motivují specializační trendy, které však především upevňují kooperaci specializací a integrační aspekty fyzické geografie.

Appendix

Key research papers published by members of the Department of Physical Geography and Geoecology (Faculty of Science, Charles University in Prague) in the period 1991–2001.

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