

# **Evaluation of research and professional activity of research-oriented institutes of the Czech Academy of Sciences for the period 2015–2019**

## **Summary Final Report**

**Name of the Institute: Institute of Geonics of the CAS, v. v. i.**

**Evaluated teams and their leaders:**

1. Laboratory Research on Geomaterials (Jiří Ščučka)
2. Material Disintegration (Libor Sitek)
3. Geomechanics and Mining Research (Lubomír Staš)
4. Applied Mathematics and Computer Science & IT4Innovations (Radim Blaheta)
5. Environmental Geography (Petr Klusáček)

## Part A: Evaluation of the institute

### Strengths:

Long tradition in coal mining research and strong position in the Czech coal-mining region. Capable to carry out multi-disciplinary research related to Engineering, Applied Mathematics and Computer Science as well as to address problems of local industry and, more general, society needs. Diverse funding sources, close relation to IT4I centre, participation in large international projects and other cooperation.

### Weaknesses:

Relatively small Institute with limited capabilities to lead large programs or large projects or to create a „critical mass“. Generally, rather low number of internationally excellent outputs, except in the Environmental Geography area. Difficulties to hire new recognised researchers and PhD students in spite of cooperation with VSB-Technical University of Ostrava and other local universities. Lack of fundamental research, except in the Environmental Geography area. Relatively large portion of institutional support (58%) despite the dominance of applied and industry-focused research.

### Opportunities:

Diversification into important environmental issues such as new technologies for geothermal energy utilization, safe deposition of high-level nuclear waste in underground depositories, new environmentally friendly methods of extraction of raw materials, CO<sub>2</sub> sequestration, compressed air energy storage, landscape evolution. Promising opportunities to develop international collaborations in these fields. This could be achieved by a combined effort of Engineering, Mathematics and IT research teams of the Institute. Collaboration with IT4I could be further strengthened.

### Threats:

Decline in coal mining related research might be faster than establishing a firm position in new research topics. The Institute has to compete with local universities and other research groups. Limited prospects to become a leader at national or international level. The Institute may be faced with losing experience-based knowledge and expertise in the near future.

## Main criterion: 1. Quality of results (H1.1-H1.5)

|   |   |
|---|---|
| <b>H1.1</b>   | <b>Quality of selected outputs of Phase I</b>         |
| The quality of selected outputs is below average. No marked changes in comparison with the previous evaluation period (2010 – 2014).  |   |
| <b>H1.2</b>   | <b>Contribution of workers on the outputs reached</b> |
| Low publication rate and low citation score (total 370 in 5 years).   |   |
| <b>H1.3</b>   | <b>Quality of all outputs and results</b>             |
| <p>The number of publications has been increased but is still low at about 2 outputs per FTE in 5 years. The average quality of the all outputs is relatively low with only few outputs in the first quartile. With respect to Team 4 (Applied Mathematics and Computer Science &amp; IT4Innovations), this can be partly attributed to the research topics that are traditionally less prolifically published. Here possibly other metrics (by e.g. classifying software as a research outcome) may be more appropriate.</p> <p>In any case, the quality of publications exhibits an upward trend, and might be considered as average on the national level.</p> |   |

|   |   |
|---|---|
| <b>H1.4</b>   | <b>The most valuable discoveries and findings in the fields, their importance for the field</b> |
| The most valuable discoveries and findings of the Institute are related to the same criterion for the specific teams. To avoid duplicity of the comments this is only stated for the Teams. |   |
| <b>H1.5</b>   | <b>Contribution of the participation of the authors in large collaborations</b>                 |
| Again, to avoid duplicity of the comments this is only stated for the teams.  |   |

## Main criterion: 2. Societal relevance (H2.1-H2.5)

|   |  |
|---|--|
| <b>H2.1</b>   | <b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>   |
| The Institute research directions and outputs address important social and environmental problems of the Czech Republic and a wider region. All research teams, except “Material Disintegration”, contribute to the mission and principal research directions of the Institute.   |  |
| <b>H2.2</b>   | <b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the institute’s activity on proper practice in society in the area of social sciences and humanities</b> |
| It is difficult to comment as some of these aspects have not been well discussed or documented during the evaluation. However, it seems that the knowledge transfer of the Institute towards practical application and towards university education is useful for society.  |  |
| <b>H2.3</b>   | <b>Relation to practice</b>  |
| The Institute focus is on the solution of practical issues. Therefore, its activity is closely related to practice. Knowledge transfer especially of Team 2 is noteworthy.  |  |
| <b>H2.4</b>   | <b>Participation in AV21 strategy</b>  |
| Participation in research programs : <ul style="list-style-type: none"> <li>• Hopes and Risks of the Digital Era (program no. 1)</li> <li>• Natural Hazards (program no. 4)</li> <li>• New Materials Based on Metals, Ceramics and Composites (program no. 5)</li> </ul> The Institute is involved in the AV21 strategy with 4 Application Labs: <ul style="list-style-type: none"> <li>• Laboratory of X-ray computer tomography</li> <li>• Water Jet Workplace</li> <li>• Laboratory of mechanical and transport processes in rocks</li> <li>• Laboratory of identification and characterization of geomaterials</li> </ul> |  |
| <b>H2.5</b>   | <b>Cooperation with regions of the Czech Republic</b>  |
| The nature of research activities facilitates the cooperation with different regions of the Czech republic. In particular, the Institute is involved in the project “Analysis of the spatio-temporal changes and the survey of underground mine Hraničná to ensure safety for opening mine to public”. However, the cooperation could be intensified.   |  |

### Further criterion: 1. Position in international and national context (D1.1-D1.3)

|   |   |
|---|---|
| <b>D1.1</b>   | <b>Comparison of the teams and the institute with similar international and national institutes</b>   |
| It is difficult to compare the Institute to similar institutes in other countries as the mission and field of research are constrained by the requirements of the particular country considered. However, the international standing of the Institute has some room for improvement in terms of the involvement in international projects and in international leadership in research topics related to the mission of the Institute.   |   |
| <b>D1.2</b>   | <b>Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation</b> |
| The institute has a supporting role in national and international projects and programs. It participates in a variety of national projects (e.g. Decovalex) and research of joint research centres. There are a number of current international projects (e.g. Horizon 2020 project or EURAD) and bi-lateral agreements (e.g. Kumamoto University, Japan). However, the latter had no significant impact on research outputs so far.    |   |
| <b>D1.3</b>   | <b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>                          |
| Several conferences, seminars and workshops have been organised or co-organised by the Institute during the evaluation period. The institute is also involved into research popularisation by organising various events for the public. It is actively involved into production of the Moravian Geographical Reports with a good IF = 2.5. This journal is No. 1 of all Czech journals (12) indexed in the category of Social Sciences. |   |

### Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

|  |  |
|--|--|
| <b>D2.1</b>  | <b>Direction in line with the perspective of the planned research directions</b> |
| All research groups perform in accordance with the planned research directions.  |  |
| <b>D2.2</b>  | <b>Assessment of the previous research objectives and their achievement</b>      |
| The objectives were formulated in a qualitative way (improve, enhance, etc.). Therefore, it could be said that research objectives have been partially achieved.   |  |
| <b>D2.3</b>  | <b>Assessment of implementation of recommendations from past evaluation</b>      |
| The Institute has generally complied with the recommendations from past evaluation and successfully implemented some of them. For example, a “Mobility and Excellence Fund” has been established to support some research activities. The Institute supports financially the development of new collaborations and high-quality outputs. |  |
| <b>D2.4</b>  | <b>Success in receiving grants</b>   |
| Research teams have obtained 50 grants with the overall funding of 4.3M EUR. Having 75 full FTE, this results into ~ 11K EUR per FTE per year. It is quite low in comparison with other institutes of CAS as well with international establishments working in the same area.  |  |

|   |   |
|---|---|
| <b>D2.5</b>   | <b>Adequacy of instrumental equipment</b>   |
| Based on the presentation and documentation, it is believed that the Institute is well equipped. However, all equipment is quite standard and none of the experimental tools represents the cutting edge for research.  |   |
| <b>D2.6</b>   | <b>Effectiveness of management</b>  |
| It is surprising that the ratio of the number of the researchers to the number admin staff is quite high. This might indicate the effectiveness of the management at the institutional level. The Institute is lacking a strategic plan to establish the leadership in the relevant research areas, nationally and internationally.<br>Administrative project management is needed to support scientists.   |   |
| <b>D2.7</b>   | <b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>                 |
| Good HR strategy is in place. However, there is a lack of PhD students, young researchers and a relatively low number of female researchers. The latter is common across almost all engineering institutes/universities and needs basic societal changes. Pushing the gender balance issues (if the number of University female graduates is low) on the Institute level can generate another misbalance in terms of the quality and equality of job opportunities. |   |
| <b>D2.8</b>   | <b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>   |
| Judging from the documents and the virtual Institute meeting, it seems that the Institute has a good balance. In particular we refer to the statement: "Harmonization of work and family life is a priority, and researchers with families can adjust their working hours according to their needs. Home office (arrangement) is also supported".   |   |
| <b>D2.9</b>   | <b>Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b> |
| Not relevant.   |   |

### Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

|   |   |
|---|---|
| <b>D3.1</b>   | <b>Scope of cooperation with universities on national and international level</b> |
| The Institute has a broad national collaboration with local universities, particularly with VSB-Technical University of Ostrava. The international collaboration is not very well developed and is limited to visits and agreements. Stronger cooperation at the international level, as stated in the strategy plan for the next period, will be important in view of the declining importance of the coal mining industry and may help in developing new research directions. |   |
| <b>D3.2</b>   | <b>Effectiveness of joint research centres</b>                                    |
| Several projects and grants have been completed within the joint research centres. It is difficult to evaluate their effectiveness. It is believed that the joint research centres are important in the development of and access to advanced research infrastructure such as the Large Research Infrastructure CzechGeo/EPOS.  |   |

|   |  |
|---|--|
| <b>D3.3</b>   | <b>Success rate in supervision of PhD students</b>                                   |
| 10 PhD theses have been completed over the evaluation period, which is quite low. The success rate of PhD completions has not been reported. This is an area, which needs to be addressed in the future.  |  |
| <b>D3.4</b>   | <b>Participation of PhD students in the outputs</b>                                  |
| There is some involvement of PhD students into research publications. However, because of the low number of PhD students their contribution is limited.   |  |
| <b>D3.5</b>   | <b>Participation of the institute in master or bachelor studies</b>                  |
| The Institute is involved in teaching and supervision of undergraduate and master students across 15 Czech universities and 1 Polish university. This is important for recruitment of prospective master and PhD students.  |  |
| <b>D3.6</b>   | <b>Assessment of cooperation intensity with universities in the form of teaching</b> |
| The Institute has strong collaboration with the local VSB-Technical University of Ostrava in teaching at the master level. The institute has 7 employees with the academic rank of professor and another 12 employees with the academic rank of Associate Professor, which may be taken as a signature of good cooperation with universities. |  |

#### Further criterion: 4. Outreach activities (D4.1-D4.3)

|   |  |
|---|--|
| <b>D4.1</b>   | <b>Sufficiency of media strategy and activities in the area of research popularisation</b> |
| Difficult to comment, but the Institute has reported some media coverage (press, radio and TV programs).  |  |
| <b>D4.2</b>   | <b>Publishing activities and its quality</b>   |
| <p>The Institute has mentioned special publications, but it is difficult to find these publications and evaluate their quality. The Institute also publishes an international peer-reviewed journal, Moravian Geographical Reports (MGR), which is of good quality.</p> <p>The teams of the institute were also involved in a number of outreach activities towards popularisation of science to public which may be considered as very satisfactory.</p> |  |
| <b>D4.3</b>   | <b>Participation in professional organisations in the area of research and development</b> |
| <p>The Institute organises seminars, conferences, workshops and other events in the area of research and development.</p> <p>The participation of team members in professional organisations is not well explained in the submitted documents/presentations and cannot be judged.</p>   |  |

### **Other comments of the commission:**

In view of the decline of the coal mining related research, the Institute might consider establishing a strategy to encourage new fields of research in line with the mission of the Institute, e.g. by setting aside (institutional) start-up funds for new research topics.

There seems to be some overlap of research topics of Teams 1 and 3 in geomaterial characterization. Specifically, it is not clear, why the “Laboratory of X-ray computer tomography” (Team 3), and the “Laboratory of mechanical and transport processes in rocks” as well as the “Laboratory of identification and characterization of geomaterials” (both in Team 1) are in different teams/departments.

It might be useful to consider merging the laboratories of Team 1 and 3 together, and to develop a new unit (department/team) focusing on innovative research and future technologies including post-mining, geothermal, nuclear waste, clean water, CO<sub>2</sub> sequestration, etc. The Institute might consider to expand its expertise e.g. by hiring experts in the corresponding research fields and to strengthen fundamental research. This would allow the Institute to develop larger-scale research programs and to establish a strong position in these important fields on the national as well as the international level.

As explained in more detail below, Team 2 (Material Disintegration) does not have a very strong link to the Institute’s mission, as well as to other teams. A different funding model (partially self-funded) and affiliation with the Institute (e.g., as spin-off company) could be considered in the future. The current institutional support of the Team could be re-directed as suggested above.

Team 4 (Applied Mathematics and Computer Science & IT4Innovations) could play an important role in the modeling and simulation of nuclear waste deposits, and also in controlling hazards. The Team could benefit from closer links with the IT4 Innovations Supercomputing Center in Ostrava by making greater use of high-performance computing in their work.

Due to the expected continuing limitations of institutional funding, the Institute might consider professionalizing project administration, e.g. by establishing a project initiation and administration office as well as an Intellectual Property (IP) policy.

Minor point: The Institute may consider updating the (English) designations of the Teams, e.g. Team 1 - Geomaterials and Minerals, and Team 2 – Water Jet Technology.

Concluding Remark: The Commissions are aware of the fact that virtual site visits cannot replace person-to-person meetings. Nevertheless, based on the documentation provided and the virtual site visits, the Commissions have made every effort to arrive at an objective and comprehensive Evaluation of the Institute.

## Part B: Evaluation of teams

### 1. Laboratory Research on Geomaterials

#### Strengths:

Multi-disciplinary team, wide expertise, good experimental facilities.

#### Weaknesses:

Lack of young researchers, relatively weak publishing activity. No technical workers (from “Personal structure of team” - description) despite largely experimental activities. In the .ppt presentation a number of about 6 FTE of support staff is mentioned. It is not clear which information is correct.

#### Opportunities:

Involvement into post-mining research, nuclear waste management and geo-deep thermal challenges.

#### Threats:

Lack of young researchers could have a significant negative impact on future activities in the new research areas (as listed in “Opportunities”). These areas need the development of new expertise and dynamic teams to utilise the momentum. Lack of world-class researchers capable to develop and lead large projects/programs.

#### Main criterion: 1. Quality of results (H1.1-H1.5)

|   |   |
|---|---|
| <b>H1.1</b>   | <b>Quality of selected outputs of Phase I</b>   |
| The quality is quite low even at the national level.  |   |
| <b>H1.2</b>   | <b>Contribution of workers on the outputs reached</b>   |
| It seems the contribution is not uniform, see Evaluation of Phase I.  |   |
| <b>H1.3</b>   | <b>Quality of all outputs and results</b>   |
| A large portion of the research outputs in 3 and 4 quality groups. Low citation score.  |   |
| <b>H1.4</b>   | <b>The most valuable discoveries and findings in the fields, their importance for the field</b> |
| Most probably the discoveries in the paper entitled “Turning of wood plastic composites by water jet and abrasive water jet” as it has the highest citation number (29) (in collaboration with Team 2). |   |
| <b>H1.5</b>   | <b>Contribution of the participation of the authors in large collaborations</b>                 |
| Membership in RINGEN consortium and contribution of authors resulted in 7 joined publications, which may be considered as satisfactory.   |   |



## Main criterion: 2. Societal relevance (H2.1-H2.5)

|   |   |
|---|---|
| <b>H2.1</b>   | <b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>  |
| The scope of research activities is well aligned with the mission and principal research activities of the Institute.   |   |
| <b>H2.2</b>   | <b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities</b> |
| The team conducts comprehensive material research on rocks and minerals, energy raw materials, modified geomaterials and selected building materials. This research is readily convertible to practice. However, the impact on social sciences and humanities is difficult to evaluate. The group collaborates with National Heritage Institute and archaeologists. |   |
| <b>H2.3</b>   | <b>Relation to practice</b>   |
| As mentioned above, all activities of the team are relevant to practical applications. However, the foundation of these activities/relevant theories have been developed 50-60 years ago.   |   |
| <b>H2.4</b>   | <b>Participation in AV21 strategy</b>   |
| The team participates in AV21 strategy through the Application Labs "Laboratory of mechanical and transport processes in rocks" and "Laboratory of identification and characterization of geomaterials".  |   |
| <b>H2.5</b>   | <b>Cooperation with regions of the Czech Republic</b>   |
| Several multidisciplinary projects suggest existing cooperation with regions of the Czech Republic, specifically the research directed on geomechanical characterisation, repair of heritage building and archaeology.  |   |

## Further criterion: 1. Position in international and national context (D1.1-D1.3)

|   |  |
|---|--|
| <b>D1.1</b>   | <b>Comparison of the team with similar international and national institutes</b>   |
| The team is average at the national level if compared against several local universities. The team has no critical mass and world-class researchers to compete at the international level.  |  |
| <b>D1.2</b>   | <b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b> |
| The team has collaborators at the institutional level, nationally and internationally (e.g. Kumamoto University or James Hutton Institute, Aberdeen, Scotland). However, the team has a supporting role in international projects and programs.     |  |
| <b>D1.3</b>   | <b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>                     |
| The members of the team organise and participate in numerous scientific community activities, e.g. in the 10th Czech and Polish Conference "Geology of Coal Basins" or the International Conference "EUROCK 2017" in Ostrava, to name a few events. |  |

## Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

|  |  |
|--|--|
| <b>D2.1</b>  | <b>Direction in line with the perspective of the planned research directions</b>   |
| The research directions are well aligned with the planned research. The team stated “all projects granted to the institute in the evaluated period were in full compliance with the strategy plan of the institute.”   |  |
| <b>D2.2</b>  | <b>Assessment of the previous research objectives and their achievement</b>  |
| The team highlights that it accomplished all planned research “both in terms of its scientific content and in terms of quality research results and publication outputs”.  |  |
| <b>D2.3</b>  | <b>Assessment of implementation of recommendations from past evaluation</b>  |
| The team has made some steps towards the development of international collaboration as recommended by the past evaluation. Specifically, long-term visits were organised during the evaluation period.   |  |
| <b>D2.4</b>  | <b>Success in receiving grants</b>   |
| In accordance with Document 3.2 “List of grant and programme projects”, the Team has received 430K EUR over the past 5 years, which is below the Institute average. There is only one GACR grant where the team members are co-investigators. The team led only 5 grants.            |  |
| <b>D2.5</b>  | <b>Adequacy of instrumental equipment</b>  |
| It seems the team owns or has access to modern experimental facilities. However, almost all these facilities are standard mechanical testing equipment.  |  |
| <b>D2.6</b>  | <b>Effectiveness of management</b>   |
| It seems the lab and equipment are well managed; the management complies with the regulations.   |  |
| <b>D2.7</b>  | <b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>            |
| In accordance with recommendations of the last evaluation period, the team employed a strategy to attract best scientists and young talents. This is indeed an urgent problem, which needs an effective solution (e.g. attracting international researchers and PhD students, etc.). |  |
| <b>D2.8</b>  | <b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>  |
| The team has an excellent gender balance with 7 men and 10 women (from .ppt presentation). The gender balance does not seem to be an issue.  |  |
| <b>D2.9</b>  | <b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b> |
| This programme is not specifically addressed in the presentation and documents. The team participates in MEYS LO1406 “Institute of Clean Technologies for Mining and Utilization of Raw Materials for Energy Use – Sustainability Program” (2015-2019).                              |  |

### Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

|   |  |
|---|--|
| <b>D3.1</b>   | <b>Scope of cooperation with universities on national and international level</b>    |
| The team collaborate with 10 Czech Universities and 4 international research institutes, which may be considered as satisfactory in terms of quantity. The quality of the collaboration is difficult to evaluate. |  |
| <b>D3.2</b>   | <b>Effectiveness of joint research centres</b>                                       |
| The participation in two joint research centres (ICT and RINGEN) has been quite effective regarding the number of joint publications and conference contributions.  |  |
| <b>D3.3</b>   | <b>Success rate in supervision of PhD students</b>                                   |
| Success rate in PhD completions is not specified. Only 2 PhD theses have been completed in the evaluation period.   |  |
| <b>D3.4</b>   | <b>Participation of PhD students in the outputs</b>                                  |
| Insignificant participation as the number of PhD students is low.   |  |
| <b>D3.5</b>   | <b>Participation of the team in master or bachelor studies</b>                       |
| The participation is quite limited. 3 master theses have been completed and no undergraduate students have been supervised.   |  |
| <b>D3.6</b>   | <b>Assessment of cooperation intensity with universities in the form of teaching</b> |
| 19 lectures have been given during the evaluation period, which are around 4 per year. The involvement into undergraduate and graduate programs is rather limited.  |  |

### Further criterion: 4. Outreach activities (D4.1-D4.3)

|   |  |
|---|--|
| <b>D4.1</b>   | <b>Sufficiency of media strategy and activities in the area of research popularisation</b> |
| Team members have been actively pursuing popularisation activities. These activities include both regular and one-time popularization events and projects.  |  |
| <b>D4.2</b>   | <b>Publishing activities and its quality</b>   |
| No publishing activities reported. However, the team members were involved in at least 3 outreach activities towards popularisation of science to public, which may be considered as very satisfactory. |  |
| <b>D4.3</b>   | <b>Participation in professional organisations in the area of research and development</b> |
| Team members participate in national and international professional societies and review research articles.   |  |

**Other comments of the commission:**

These comments are concerning both Team 1 and Team 3:

The teams work in well-established research areas, Geomaterials (Team 1) and Geomechanics (Team 3). In general, the teams operate with specific expertise on a good technical level, which addresses the current industrial needs. The teams are relatively well equipped to work on common industry-funded projects. However, there is a threat of marginalisation and decay of these research activities in the near future, and this level of research may not be sufficient to conduct research and developments capable to transform (or help to transform) the relevant Czech industrial sectors.

It seems, some significant structural changes may be necessary to achieve a new level of research, which can include (but are not limited to):

- (1) Establishing and funding new unit(s) focusing on innovative and future technologies (post mining, geothermal, waste management to list a few);
- (2) Expanding the expertise in the corresponding research fields in order to be able to develop, manage and lead big industry-funded projects, collaborative research programs and large national and international grants;
- (3) Attracting young enthusiastic researchers;
- (4) Facilitating more focus on the fundamental research, which will eventually result into high-quality publications, stronger international collaborations as well as to gaining access to the state of the art experimental facilities worldwide.

## 2. Material Disintegration

### Strengths:

Applied research, which led to the development of new technologies, patents and strong collaboration across many industries and applications. Above average performance at the institutional level. However, the research is rather far from the mission and principal research directions of the Institute. Good experimental facilities, excellent expertise in water jet cutting.

### Weaknesses:

Very narrow area of research, not relevant to other research groups of the Institute, and may be not sustainable in a longer perspective without a strategic plan.

### Opportunities:

Application of the developed jet cutting techniques to new areas and applications.

### Threats:

Sustainability of the narrow research field in a long-term future.

### Main criterion: 1. Quality of results (H1.1-H1.5)

|   |   |
|---|---|
| <b>H1.1</b>   | <b>Quality of selected outputs of Phase I</b>   |
| The quality is below the average national level but still the best among other research teams of the Institute. The number of publications is high.   |   |
| <b>H1.2</b>   | <b>Contribution of workers on the outputs reached</b>   |
| The contribution of workers to the research outputs is significant and mostly above 50 percent.   |   |
| <b>H1.3</b>   | <b>Quality of all outputs and results</b>   |
| The quality of outputs and results in application, if taken together, is above the average national level.  |   |
| <b>H1.4</b>   | <b>The most valuable discoveries and findings in the fields, their importance for the field</b> |
| Most probably the discoveries in papers entitled “Copper alloys disintegration using pulsating water jet” with 64 citations, “Surface integrity in tangential turning of hybrid MMC A359/B4C/Al <sub>2</sub> O <sub>3</sub> by abrasive waterjet” with 34 citations, “Visualisation and measurement of high-speed pulsating and continuous water jets” with 34 citations, and “Ultrasonically generated pulsed water jet peening of austenitic stainless-steel surfaces” with 30 citations. |   |
| <b>H1.5</b>   | <b>Contribution of the participation of the authors in large collaborations</b>                 |
| Not relevant.   |   |

### Main criterion: 2. Societal relevance (H2.1-H2.5)

|   |  |
|---|--|
| <b>H2.1</b>   | <b>Societal relevance of outputs and results pursuant to CAS and institute mission</b> |
| The research of the team is quite far away from the Institute mission, which is “...to carry out scientific research on the Earth's crust and its landscapes, the processes inside it, especially |  |

|  |   |
|--|---|
| those induced by human activity, and the impact of these processes on the environment". However, the team contributes into other activities, e.g. training PhD students, etc.  |   |
| <b>H2.2</b>  | <b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities</b> |
| The research is readily transferable into applications, with important effects on productivity of specialized industries.  |   |
| <b>H2.3</b>  | <b>Relation to practice</b>   |
| The Team is focused on applied research, which is closely related to practice.   |   |
| <b>H2.4</b>  | <b>Participation in AV21 strategy</b>   |
| The team participates in AV21 strategy. It addresses at least two directions: (1) New materials based on metals, ceramics and composites; (2) Possibilities of influencing material surfaces and their properties by continuous and pulsating water jet to create surfaces with desired properties. It operates the Application Lab "Water Jet Workplace". |   |
| <b>H2.5</b>  | <b>Cooperation with regions of the Czech Republic</b>   |
| This is unique team, and it seems to be the only research team working on water jet cutting in the Czech Republic.   |   |

#### Further criterion: 1. Position in international and national context (D1.1-D1.3)

|  |  |
|--|--|
| <b>D1.1</b>  | <b>Comparison of the team with similar international and national institutes</b>   |
| Considering the very narrow area of water jet cutting research and technology, the Team has a strong international reputation and strong researchers in this narrow research area. |  |
| <b>D1.2</b>  | <b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b> |
| The team collaborates almost with all international groups working in the area of water jet cutting.   |  |
| <b>D1.3</b>  | <b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>                     |
| Very good involvement into organisation of conferences, etc. The team members have received awards, present invited lectures, etc.   |  |

#### Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

|   |  |
|---|--|
| <b>D2.1</b>   | <b>Direction in line with the perspective of the planned research directions</b> |
| As mentioned above, the research of the Team seems to be quite far from the main Institute mission.   |  |
| <b>D2.2</b>   | <b>Assessment of the previous research objectives and their achievement</b>      |
| Two recommendations with respect to new partners and publishing activities have been addressed. In particular, new partners in Germany, Switzerland, Japan, Luxembourg, and |  |

|   |  |
|---|--|
| Slovenia have been found, and international funding has been increased as well as the number of publications.   |  |
| <b>D2.3</b>   | <b>Assessment of implementation of recommendations from past evaluation</b>  |
| It seems that the Team managed to meet and implement all recommendations from the past evaluation.  |  |
| <b>D2.4</b>   | <b>Success in receiving grants</b>   |
| Relatively good grant score and high success rate, which is approximately 50 percent.   |  |
| <b>D2.5</b>   | <b>Adequacy of instrumental equipment</b>  |
| Custom-made experimental equipment and rigs are available together with extensive experimental facilities of geomaterials lab.  |  |
| <b>D2.6</b>   | <b>Effectiveness of management</b>   |
| It seems the management is quite effective; all key indicators are above the Institute average.   |  |
| <b>D2.7</b>   | <b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>            |
| The Team is the smallest research unit of the Institute. It currently consists of seven full-time researchers, two part-time researchers, two technicians and one or two PhD students. The team was successful in attracting new young researchers. |  |
| <b>D2.8</b>   | <b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>  |
| This is seemingly in line with the Institute policy.  |  |
| <b>D2.9</b>   | <b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b> |
| The Team participated in projects funded by the Institute of Clean Technologies for Mining and Utilization of Raw Materials for Energy Use – Sustainability program, but it is not clear if it is the same program as Sustainability II.            |  |

### Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

|  |   |
|--|---|
| <b>D3.1</b>  | <b>Scope of cooperation with universities on national and international level</b> |
| The team has established broad collaboration on the national and international levels. The team collaborates with 20-30 research centres and universities worldwide.   |   |
| <b>D3.2</b>  | <b>Effectiveness of joint research centres</b>                                    |
| The team participated in the joint research centre “Institute of clean technologies for mining and utilization of raw materials for energy use - Sustainability program”, thereby producing a number of outputs indicating satisfactory effectiveness. |   |
| <b>D3.3</b>  | <b>Success rate in supervision of PhD students</b>                                |
| Success rate is unknown, 8 PhD students were involved in research activities. During the evaluation period, 4 of them were already awarded with the degree, while 4 others continue in PhD programs.   |   |

|   |  |
|---|--|
| <b>D3.4</b>   | <b>Participation of PhD students in the outputs</b>                                  |
| The team claims a significant involvement of PhD students into research activities.   |  |
| <b>D3.5</b>   | <b>Participation of the team in master or bachelor studies</b>                       |
| 22 Masters theses and 16 Bachelor theses have been completed, which is quite impressive taking into account that it is the smallest team. |  |
| <b>D3.6</b>   | <b>Assessment of cooperation intensity with universities in the form of teaching</b> |
| The involvement into teaching activities at the undergraduate and graduate levels is quite high.  |  |

#### Further criterion: 4. Outreach activities (D4.1-D4.3)

|  |  |
|--|--|
| <b>D4.1</b>  | <b>Sufficiency of media strategy and activities in the area of research popularisation</b> |
| Media strategy has not been described. Presumably, the team participate in the popularisation activities run by the Institute. |  |
| <b>D4.2</b>  | <b>Publishing activities and its quality</b>   |
| The team has no publishing activities.   |  |
| <b>D4.3</b>  | <b>Participation in professional organisations in the area of research and development</b> |
| Very extensive participation.  |  |

#### Other comments of the commission:

The team is strong in terms of industry-focused research and technical developments. The developed research/business/development model may be partially utilised by other teams or senior management.



### 3. Geomechanics and Mining Research

#### Strengths:

Some unique expertise and capabilities as many researchers have a background of operational practice in mining companies.

#### Weaknesses:

Lack of leadership and abilities to develop and lead large national/international research programs/projects.

#### Opportunities:

Involvement into post-mining research, nuclear waste management and geo-deep thermal projects.

#### Threats:

Slow decay of research activities as these are largely focused on traditional directions.

#### Main criterion: 1. Quality of results (H1.1-H1.5)

|   |   |
|---|---|
| <b>H1.1</b>   | <b>Quality of selected outputs of Phase I</b>   |
| The quality of the selected outputs is below the average national level (if normalised by FTE) but a bit better than Geomaterials team (Team 1).  |   |
| <b>H1.2</b>   | <b>Contribution of workers on the outputs reached</b>   |
| It seems the contribution from 100 to 50 percent, which is quite high.  |   |
| <b>H1.3</b>   | <b>Quality of all outputs and results</b>   |
| The quality is average on the national level.   |   |
| <b>H1.4</b>   | <b>The most valuable discoveries and findings in the fields, their importance for the field</b> |
| Most probably the discoveries in paper titled “Stress changes and seismicity monitoring of hard coal longwall mining in high rockburst risk areas” with the highest citation number (20). |   |
| <b>H1.5</b>   | <b>Contribution of the participation of the authors in large collaborations</b>                 |
| The team members have been involved in several large cooperation with regular contribution as a partner, which may be considered as satisfactory.   |   |

#### Main criterion: 2. Societal relevance (H2.1-H2.5)

|  |   |
|--|---|
| <b>H2.1</b>  | <b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>  |
| Prevention of rock bursts as well as safety and risk management have a large societal relevance and impact. Other areas are safe storage of nuclear fuel in the deep underground, in post-mining areas are another example. The research fully supports the Institute mission. |   |
| <b>H2.2</b>  | <b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team’s activity on proper practice in society in the area of social sciences and humanities</b> |

|   |   |
|---|---|
| The team addresses practical problems in mining and relevant areas with important impact on society.  |   |
| <b>H2.3</b>   | <b>Relation to practice</b>                           |
| The team is focused on applied research and many outcomes have a direct relation to practice.   |   |
| <b>H2.4</b>   | <b>Participation in AV21 strategy</b>                 |
| The team participate in AV21, in particular, in collaboration with the Institute of Rock Structure and Mechanics - international project LASMO + AV21 “Natural threats”. It operates the Application Lab “Laboratory of X-ray computer tomography”. |   |
| <b>H2.5</b>   | <b>Cooperation with regions of the Czech Republic</b> |
| The field work of the team (e.g. at the Bukov Underground Research Facility or related to nuclear waste utilisation) is affecting different regions of the Czech Republic.  |   |

#### Further criterion: 1. Position in international and national context (D1.1-D1.3)

|   |  |
|---|--|
| <b>D1.1</b>   | <b>Comparison of the team with similar international and national institutes</b>   |
| It is an industry-focused team, participating in a number of commercial and international projects. The team can be characterised as average on the international level.        |  |
| <b>D1.2</b>   | <b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b> |
| Average international cooperation (China, Austria, Japan, Australia, Poland, etc.) and wide national cooperation (The Institute of Geology, commercial partners to name a few). |  |
| <b>D1.3</b>   | <b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>                     |
| Good involvement into scientific community activities and editorial boards of research journals.  |  |

#### Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

|  |  |
|--|--|
| <b>D2.1</b>  | <b>Direction in line with the perspective of the planned research directions</b> |
| The direction is well aligned with the planned research activities.  |  |
| <b>D2.2</b>  | <b>Assessment of the previous research objectives and their achievement</b>      |
| It seems that the previous research objectives have been achieved.   |  |
| <b>D2.3</b>  | <b>Assessment of implementation of recommendations from past evaluation</b>      |
| Two recommendations regarding the number of publications and international collaboration have been addressed during the evaluation period. |  |
| <b>D2.4</b>  | <b>Success in receiving grants</b>   |
| Good grant score of around 1.2M EUR.   |  |

|   |  |
|---|--|
| <b>D2.5</b>   | <b>Adequacy of instrumental equipment</b>  |
| It seems the team owns or has access to modern experimental facilities. |  |
| <b>D2.6</b>   | <b>Effectiveness of management</b>   |
| Good project management.  |  |
| <b>D2.7</b>   | <b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>            |
| No young researchers (<30), which is alarming.                          |  |
| <b>D2.8</b>   | <b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>  |
| Relatively good gender balance.   |  |
| <b>D2.9</b>   | <b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b> |
| Not relevant.   |  |

### Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

|   |  |
|---|--|
| <b>D3.1</b>   | <b>Scope of cooperation with universities on national and international level</b>    |
| The pedagogical activity is quite weak, with no PhD completion during the evaluation period.  |  |
| <b>D3.2</b>   | <b>Effectiveness of joint research centres</b>                                       |
| The team has been involved into Joint Research Centre: "Laboratory of Seismic Loading of Objects by Technical and Natural Seismicity" and Joint Research Project: Institute of Clean Technologies for Mining and Utilization of Raw Materials for Energy Use – Sustainability project (2015 – 2019). It is difficult to comment regarding the efficiency. |  |
| <b>D3.3</b>   | <b>Success rate in supervision of PhD students</b>                                   |
| This is an area, which needs to be improved as no PhD completions over the evaluation period are reported.  |  |
| <b>D3.4</b>   | <b>Participation of PhD students in the outputs</b>                                  |
| Very limited.   |  |
| <b>D3.5</b>   | <b>Participation of the team in master or bachelor studies</b>                       |
| Very limited.   |  |
| <b>D3.6</b>   | <b>Assessment of cooperation intensity with universities in the form of teaching</b> |
| There is limited involvement, which needs being improved in view to recruitment of PhD students.  |  |

#### Further criterion: 4. Outreach activities (D4.1-D4.3)

|   |  |
|---|--|
| <b>D4.1</b>   | <b>Sufficiency of media strategy and activities in the area of research popularisation</b> |
| There were some media coverage e.g. “Talking about the earthquake” in the Czech television “Good morning program” but there is no media strategy as the team is quite small.  |  |
| <b>D4.2</b>   | <b>Publishing activities and its quality</b>   |
| The team does not publish but participate in reviewing and editorial activities of a number of international journals.  |  |
| <b>D4.3</b>   | <b>Participation in professional organisations in the area of research and development</b> |
| Very broad and extensive participation in professional national and international organisations. Examples are the International Society for Rock Mechanics and Rock Engineering and the Scientific Commission on Hazards in Mines (Poland). |  |

#### Other comments of the commission:

See comments to Team 1.

## 4. Applied Mathematics and Computer Science & IT4Innovations

### Strengths:

The main strengths are the combination of basic research in numerical mathematics with the solution of complex multiphysical problems and cooperation with other departments of Institute of Geonics on the solution of real-life problems. Moreover, the collaboration with IT4I computer centre in the area of HPC is fruitful. The teaching activities and the supervising of PhD thesis are frequent and beneficial.

### Weaknesses:

Although the age structure of the team is much better than five year ago, it still exhibits the main weakness of the department. The key persons are close to retirement age and the persons around the middle of the professional career are almost missing.

### Opportunities:

The main opportunity is the deepening of the cooperation with other institutes of CAS, Czech universities and IT4I centre. The connection of real applications, research in numerical mathematics and HPC is a large opportunity. Applications for national and international grant projects are perspective. The team has to continue in the effort of attracting young talented people and prospectively also experienced researchers.

A particular challenge and opportunity for the department is to be directly involved in research on the following problem areas:

- deep geological deposition of nuclear waste,
- dealing with the consequences of mining closures

These are nationally and internationally vital problems that require mathematical modelling, analysis, numerics, optimisation, statistics and data processing and simulations, also on high-performance computers. Close cooperation within the framework of a national and international research network is essential for mastering the tasks at hand.

### Threats:

Attraction of new researches is necessary in order to keep the quality of the team and it requires support and sufficient funding from the side of the Institute of Geonics and also it depends on the success in applications of grant projects.

### Main criterion: 1. Quality of results (H1.1-H1.5)

| Main criterion - Quality of results (H1.1-H1.3)   |  |       |        |  |
|---|--|-------|--------|--|
| H1.1  | Quality of selected outputs of Phase I         |       |        |  |
| The team achieved the following distribution of ratings   |  |       |        |  |
| 1   | 2  | 3     | 1 or 2 |  |
| 9,5%  | 52,4%  | 38,1% | 61,9%  |  |
| 1 „world leading“, 2 „internationally excellent“, 3 „recognized internationally“  |  |       |        |  |
| The quality of the outputs evaluated in Phase I is a little lower in comparison to the other evaluated mathematical institutes. There are a few world-leading outputs and almost one half of the evaluated outputs belong among the internationally excellent ones.   |  |       |        |  |
| H1.2  | Contribution of workers on the outputs reached |       |        |  |
| The contribution of team members to the evaluated outputs is comparable to the other mathematical departments. However, the substantial part of the evaluated results was achieved by the researchers having only a partial job in the institute or are close to the retirement age. This exhibits a threat for the future. |  |       |        |  |
| H1.3  | Quality of all outputs and results             |       |        |  |

|   |   |
|---|---|
| <p>The total number of outputs was 73, the number of outputs evaluated in Phase I was 21. According to the bibliometric data (journal ranking and the intensity of citations), the average quality of the all outputs is smaller in comparison to the other mathematical departments. We however point out that the quality of computational science research, as conducted by the department is not fully characterized by conventional publication output. For a more comprehensive assessment, also other research artefacts, such as software and libraries must be taken into account.</p> |   |
| <b>H1.4</b>   | <b>The most valuable discoveries and findings in the fields, their importance for the field</b> |
| <p>There are several recognized results, particularly those ones arising within the DECOVALEX 2015 and 2019 projects concerning the solution of thermo-hydro-mechanical problems related to underground deposition of the spent nuclear fuel. The used, rather engineering, approach was further analyzed numerically. Moreover, the development of parallel methods for the solution of demanding coupled problems in geotechnical applications is the next achievement.</p>   |   |
| <b>H1.5</b>   | <b>Contribution of the participation of the authors in large collaborations</b>                 |
| <p>The team participated in several large collaborations, namely DECOVALEX project (2016-2019), NESUS - Network for Sustainable Ultrascale Computing (2015-2018) and EURAD European Joint Programme on Radioactive Waste Management within H2020 (2019-2024).</p>   |   |

## Main criterion: 2. Societal relevance (H2.1-H2.5)

|  |   |
|--|---|
| <b>H2.1</b>  | <b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>  |
| <p>The direction of research and the achieved results are in line with the mission of Institute of Geonics and CAS. Although the achieved results are not breakthroughs from the point of view of mathematics, the contribution of the team to the outputs of large collaboration is unarguable.</p> |   |
| <b>H2.2</b>  | <b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities</b> |
| <p>The participation of the team to the large collaborations concerns the mathematical aspects, the knowledge transfer into practice is mostly done by the other teams.</p>  |   |
| <b>H2.3</b>  | <b>Relation to practice</b>   |
| <p>The research of the team is based on practical applications, namely the modelling and solution of thermo-hydro-mechanical processes, e.g., realization of deep nuclear waste repositories and the stability assessment of underground openings, slopes or foundations.</p>                        |   |
| <b>H2.4</b>  | <b>Participation in AV21 strategy</b>   |
| <p>Institute of Geonics participates in the research program "Hopes and risks of the digital era" of AV21 strategy. The team organised two workshops "Mathematics for industry" in 2018 and 2019 by EU-MATHS-IN.cz network which were supported by the programme AV21.</p>                           |   |
| <b>H2.5</b>  | <b>Cooperation with regions of the Czech Republic</b>   |

The team is active in several national research centres, namely IT4I, Regional Research Centre with TU in Ostrava, "Czech national initiative for research and development of mathematical methods and tools in HPC " and the National Network EU-MATHS-IN.cz. Among others, Universities in Plzen and Opava are involved in these projects.

#### Further criterion: 1. Position in international and national context (D1.1-D1.3)

|   |  |
|---|--|
| <b>D1.1</b>   | <b>Comparison of the team with similar international and national institutes</b>   |
| Activities and outputs of the team are comparable with similar international and national institutes.   |  |
| <b>D1.2</b>   | <b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b> |
| The team participates in international as well as in national cooperation. National level: Centre of Excellence IT4Innovations, and cooperation with Czech universities. International level: projects DECOVALEX, NESUS, "CT and computational micromechanics of rocks", and EURAD. In addition, collaboration at the level of individuals. The list of collaborative partners is long, and the quality of cooperation is high. |  |
| <b>D1.3</b>   | <b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>                     |
| Members of the team have been active regarding this issue. The activity includes editorial work (inc. guest editors for special issues), memberships in scientific societies, organising conferences and workshops, invited lectures and earned awards, and awards.   |  |

#### Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

|   |  |
|---|--|
| <b>D2.1</b>   | <b>Direction in line with the perspective of the planned research directions</b> |
| Research activities have been in line with the planned research directions.   |  |
| <b>D2.2</b>   | <b>Assessment of the previous research objectives and their achievement</b>      |
| List of the objectives of the research plan for the period 2015-2019 includes eight items. According to the report all planned research topics are fulfilled.   |  |
| <b>D2.3</b>   | <b>Assessment of implementation of recommendations from past evaluation</b>      |
| The list of recommendations includes five items. All of them are carefully implemented and the vitality and sustainability of the team have been increased significantly compared with the last evaluation. |  |
| <b>D2.4</b>   | <b>Success in receiving grants</b>   |
| The number of grants is 13 and the total amount is 800 000 Euro. That's a pretty good result.   |  |
| <b>D2.5</b>   | <b>Adequacy of instrumental equipment</b>  |
| The instrumental equipment is adequate for achieving research objectives.   |  |
| <b>D2.6</b>   | <b>Effectiveness of management</b>   |

|   |  |
|---|--|
| The management of the team have been effective enough during the evaluation period, see e.g. D2.3 and D2.4  |  |
| <b>D2.7</b>   | <b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b>            |
| The age structure is much better than 5 years ago, i.e. very positive changes have been taken place. However, the age structure is still problematic, because there is only one person aged 45-50 and nobody aged 55-60. The number of involved PhD students is increasing. |  |
| <b>D2.8</b>   | <b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>  |
| Work-life seems to be balanced, but because of the specificity of the research field (i.e. mathematics) the number of female researchers is limited. However, this is a global problem.   |  |
| <b>D2.9</b>   | <b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b> |
| The team has been involved in projects related to the National Programme of Sustainability II: IT4Innovations Centre of Excellence and LQ 1602.   |  |

### Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

|  |   |
|--|---|
| <b>D3.1</b>  | <b>Scope of cooperation with universities on national and international level</b> |
| National level: teaching and supervising of students (including PhD).<br>International level: participation in international project and joint research<br>There are good cooperations with Brno or Prague, and the importance of this to be emphasized given the regional location of the Institute.  |   |
| <b>D3.2</b>  | <b>Effectiveness of joint research centres</b>                                    |
| The team is involved in several joint research centres with universities. <ul style="list-style-type: none"> <li>▪ IT4Innovations - Excellence in science</li> <li>▪ Regional Research Centre "Institute of Clean Technologies for Extraction and Use of Energy Raw Materials"</li> <li>▪ Project "Czech national initiative for research and development of mathematical methods and tools in HPC "</li> <li>▪ National Network EU-MATHS-IN.cz</li> </ul> |   |
| <b>D3.3</b>  | <b>Success rate in supervision of PhD students</b>                                |
| Three PhD theses were defended in 2015—2019. Five students are under supervision currently.  |   |
| <b>D3.4</b>  | <b>Participation of PhD students in the outputs</b>                               |
| All PhD students are involved in the research projects undertaken by the team and therefore they contribute actively in the outputs.   |   |
| <b>D3.5</b>  | <b>Participation of the team in master or bachelor studies</b>                    |



|  |  |
|--|--|
| Teaching on master level and supervising BSc and MSc theses. Two BSc theses and six MSc theses were supervised in 2015—2019. |  |
| <b>D3.6</b>  | <b>Assessment of cooperation intensity with universities in the form of teaching</b> |
| The cooperation is sufficiently intensive and mutually beneficial.   |  |

#### Further criterion: 4. Outreach activities (D4.1-D4.3)

|  |  |
|--|--|
| <b>D4.1</b>  | <b>Sufficiency of media strategy and activities in the area of research popularisation</b> |
| Members of the team participate continuously in research popularisation. This includes popular lectures and workshops, supervising secondary school students research for Young Scientists Content, etc. |  |
| <b>D4.2</b>  | <b>Publishing activities and its quality</b>   |
| No outreach activities related information have been provided for the present item.  |  |
| <b>D4.3</b>  | <b>Participation in professional organisations in the area of research and development</b> |
| No outreach activities related information have been provided for the present item.  |  |

#### Recommendations:

1. Continues in the process of hiring new researchers, namely in the area of high-performance computing.
2. Increase the cooperation with IT4I centre on one side and the Czech universities on the second one.
3. Cooperate with Universities in the training and supervisions of PhD students.
4. Keep balance between the basic research in applied mathematics and the solution of real-life engineering problems.

#### Other comments of the commission:

## 5. Environmental Geography

### Strengths:

- The multi-disciplinary composition of the Team, i.e., an ability to react flexibly to new research agendas
- Outstanding researchers with internationally acknowledged expertise in brownfield regeneration research
- Pioneers in some research agenda
- Promising topic for interdisciplinary research: renewable energy, land use and social conflicts
- Promising age structure for the future
- Journal Moravian Geographical Reports (WoS, Scopus)
- International Advisory Board of the Institute of Geonics
- well balanced composition of teaching activity

### Weaknesses:

- The desired greater collaboration with other Institutes of the Czech Academy of Sciences (as well as potential collaboration with other Departments of the Institute of Geonics) is significantly limited. The reason for the lack of cooperation as seen by the team is the limited option in obtaining a joint research project (due to the strict division of scientific panels and specific programs according scientific disciplines provided by the two main Czech grant agencies – the Czech Science Foundation and Technology Agency of the Czech Republic, the reduced funding for larger multidisciplinary projects, and support of small-scale and specific projects).
- Shortages in collaboration between physical and human geographers in the department
- Lack of longitudinal research and research themes,
- The research topics are determined by the project funding obtained (due to the need for financing)
- Lower visibility of members' presence internationally (invited lectures, leading collaborations)

### Opportunities:

- In 2019, three new projects were initiated and another two grant proposals have been accepted for financing (from 2020) by the Czech Science Foundation and the Technology Agency of the Czech Republic.
- The Journal Moravian Geographical Reports (WoS, Scopus) run by the team has shown to be able to attract foreign contributors and thus provide a solid basis for networking and further cooperation. The team shall make use of the Journal as a basis for networking and agenda-setting (Annual international conferences?)
- Although Brno might not be so attractive as Prague for international scholars, the job market is to a certain extent less competitive than in Prague, which could have a positive effect on PhD recruitment
- high value research - brownfield regeneration
- the focus on Energy Geographies
- new research areas with a high societal impact identified: pioneers in geographical research on the spatial behaviour of disabled persons
- strong local presence - cooperation with a group of architects currently limited to presentations might well evolve in further cooperation urban research, planning and architecture, geo-trails might evolve into other similar publicity events (human geographers?)

### Threats:

- The perils of acting local: the team shall not be satisfied and turn to the local level presence and to provide support for local and regional authorities;
- balancing local presence and local societal impact with excellent research;
- Some fragmentation of the research foci due to the prioritization of the need to raise funds from different sources (and limited institutional funding), compared to more in-depth and longitudinal research on specific problems of current concern for the Team.
- Limited options for research collaborations among individual Departments of the Institute, as well as between human and physical geographers (in part also due to reduced funding for larger multidisciplinary projects and the strict division of scientific panels of Grant Agencies according to scientific disciplines);
- A less clear articulation of a leading research agenda for the times to come, a “grand theme” (as has been the brownfield regeneration or flash floods) that would attract international attention, the team seems to confront the threat by focusing on Energy Geographies, renewable energies and land use and social conflicts - an overarching research that would be strongly enhanced by an intensive cooperation with the Institute of Sociology.

### Main criterion: 1. Quality of results (H1.1-H1.5)

|  |   |
|--|---|
| <b>H1.1</b>  | <b>Quality of selected outputs of Phase I</b>   |
| Total number of outputs: 90, 30 evaluated with a Gaussian distribution of quartiles. 15 of 30 evaluated outputs are in the second quartile (decile) according to journal ranking. The quality of publications, measured by scientometric standards has highly improved since the last evaluation. Contributions in leading journals are rare, but existent. The significance of bibliometrics in this field of research and development is very limited.   |   |
| <b>H1.2</b>  | <b>Contribution of workers on the outputs reached</b>   |
| There is only one evaluated output prepared by a single author, all others outputs are written by multiple co-authors with a variable share of a team member's contribution. There is a roughly equal distribution of the role of team members in the evaluated outputs. The members are corresponding or majority authors and also partial contributors.  |   |
| <b>H1.3</b>  | <b>Quality of all outputs and results</b>   |
| <p>As for the quantity and quality of outputs in comparison to the previous evaluation period, the team has published more than twice as many articles in WOS-indexed journals (26 papers in 2010-2014, compared to 65 papers in the period 2015-2019). Of these 65 outputs, one quarter was published in journals ranked in the first quartile (Q1) in the relevant WOS categories, according to the journals' Impact Factors.</p> <p>The team presents itself with a strategic targeting of publications into highly-ranked journals in the fields of Geography, Environmental Sciences and Environmental Studies.</p> |   |
| <b>H1.4</b>  | <b>The most valuable discoveries and findings in the fields, their importance for the field</b> |
| <p>Research results have a strong impact on society and on the scientific field.</p> <p>Direct impact on the European Research Agenda for research in spatial planning and management.</p> <p>Creation of a set of maps and data sets used by the national, regional and local authorities (brownfield regeneration, flash floods, military training grounds, local agenda).</p> <p>Research in brownfield regeneration internationally acknowledged.</p>  |   |

|  |   |
|--|---|
| Pioneers in some research agendas: geographical research on the spatial behaviour of disabled persons.   |   |
| <b>H1.5</b>  | <b>Contribution of the participation of the authors in large collaborations</b> |
| Most of the evaluated publications are the result of a broader cooperation, as are the research projects. Most of the evaluated outputs have been co-authored with research team members having a major share in the contribution. |   |

## Main criterion: 2. Societal relevance (H2.1-H2.5)

|   |   |
|---|---|
| <b>H2.1</b>   | <b>Societal relevance of outputs and results pursuant to CAS and institute mission</b>  |
| <p>The results have a significant societal relevance (brownfield regeneration - sets of maps, Energy Geographies, renewable energies and related land use, urban planning). Pioneers in geographical research on the spatial behaviour of disabled persons with impact on urban planning.</p> <p>The research appears to have policy shaping effects: The participation in an international Inspiration project has shaped the European Research Agenda for research in spatial planning and management.</p> <p>The Institute, through its Department of Environmental Geography, publishes an international peer-reviewed journal, Moravian Geographical Reports, which has been published in English continuously since 1993 (WoS, Scopus).</p> |   |
| <b>H2.2</b>   | <b>System functionality for knowledge transfer into practise, its usefulness for society. The impact of the team's activity on proper practice in society in the area of social sciences and humanities</b> |
| <p>The team has shown strong devotion for knowledge transfer, the research results are widely accessible and made use of by national, regional and local stakeholders (maps).</p> <p>Team members are also engaged in teaching, including courses in methodology and thus promoting proper practice in area of social sciences.</p>   |   |
| <b>H2.3</b>   | <b>Relation to practice</b>   |
| Research results have a significant societal relevance and thereby also impact on practice.   |   |
| <b>H2.4</b>   | <b>Participation in AV21 strategy</b>   |
| Actively participating in joint research activities and projects within the Strategy AV21: 'Natural Hazards' (Czech Academy of Sciences, Strategy AV21: Natural Hazards, Theme: Man and landscape transformation, 2016-2020). For the upcoming period (2020-2024), a new project has been prepared on 'Foods for the Future?' (Czech Academy of Sciences, Strategy AV21, Theme: Societal and geographical aspects of food systems, 2020-2024).  |   |
| <b>H2.5</b>   | <b>Cooperation with regions of the Czech Republic</b>   |
| No formal cooperation was identified. The regions are beneficiaries of some of the research outputs. The regional authorities make use of a set of specialized maps focused on brownfields regeneration and a set of specialized maps and popularization presentations regarding future planning of military training areas.  |   |

### Further criterion: 1. Position in international and national context (D1.1-D1.3)

|  |  |
|--|--|
| <b>D1.1</b>  | <b>Comparison of the team with similar international and national institutes</b>   |
| <p>The research team members appear to collaborate with the Universities on a personal level (teaching courses and supervising theses).</p> <p>The research activity of the team is competing with research activities of Universities. The joint papers and projects indicate the acceptance and collaborative position of the team at national level. Team members are active in the international collaboration (projects, publications).</p>   |  |
| <b>D1.2</b>  | <b>Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation</b> |
| <p>In the last five years (2015-2019), the EG-Team members have been involved in four large European projects and research platforms as co-investigators and working group leaders or co-leaders</p> <p>joint international research projects and co-authored research papers published in some of the highest-ranked journals in relevant scientific categories</p> <p>Team members as leaders or co-leaders of working groups in international projects</p> <p>Scholarships and Fellowships at prominent geographical workplaces</p> <p>Increased visibility by participating in Annual Meetings of the American Association of Geographers, International Geographical Union conferences</p> <p>EG-Team members were invited to participate as partners and work package leaders in three new H2020 projects, however these were not financed.</p> <p>The involvement in the project Inspiration and COST Action projects is also worth mentioning.</p> |  |
| <b>D1.3</b>  | <b>Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards)</b>                     |
| <p>Team members are leaders or co-leaders of multiple international working groups.</p> <p>The entire branch of the Department of Environmental Geography is a collective member of the Czech Geographical Society and researchers are members of multiple international and national scientific societies and formal communities.</p> <p>Two members of the team have given invited lectures.</p> <p>A national award to an external collaborator is listed in the documents provided.</p>  |  |

### Further criterion: 2. Vitality, sustainability and strategy (D2.1-D2.9)

|   |  |
|---|--|
| <b>D2.1</b>   | <b>Direction in line with the perspective of the planned research directions</b> |
| <p>The Team's principal strategic objective for the next five years is to maintain and strengthen its position as an internationally recognised centre for original and significant research in Environmental Geography. Specifically, the Team aims to continue to be a strong location for agenda-setting research and scholarly debates in Energy Geographies, Urban Geographies and the spatial management of cities and rural areas. The current steps and the research proposals and financed projects described are in line with the perspective research.</p> |  |

|   |   |
|---|---|
| <b>D2.2</b>   | <b>Assessment of the previous research objectives and their achievement</b>   |
| Previous research agendas on flash floods, brownfield regeneration, urban and spatial planning and other research topics have brought an impressive volume of results.  |   |
| <b>D2.3</b>   | <b>Assessment of implementation of recommendations from past evaluation</b>   |
| <p>The main recommendations have been fulfilled.</p> <p>Senior researchers were attracted via research projects and the natural course of things.</p> <p>The Commission welcomes that the team developed further cooperation with prestigious geographers from workplaces in Western Europe and the USA.</p> <p>The interdisciplinary collaboration between Human Geographers and Physical Geographers in the Department has been intensified by means of joint research projects, however, there is still room for improvement.</p> <p>In the previous evaluation, the Commission expressed certain doubts on the viability of the Journal Moravian Geographical Reports and on the efforts vs. benefit ratio. However, the journal has obviously evolved into an internationally acknowledged journal and the efforts put into this endeavour did not limit other research activities of the team.</p> <p>The collaboration with other CAS Institutes is still limited, due to various reasons.</p> |   |
| <b>D2.4</b>   | <b>Success in receiving grants</b>  |
| <p>The team is successful in receiving grants. The majority of grants appears to be of medium volume. The team is also actively participating in international research projects (EU Cost Action projects, team members as leaders or co-leaders of working groups). Among the national projects, there are also projects funded by other stakeholders than research agencies (i. e. 'Inventory of pre-industrial landscape in Moravia and public information ensuring about it as cultural heritage' Ministry of Culture Czech Republic)</p> <p>In 2019, three new projects were initiated and another two grant proposals have been accepted for financing (from 2020) by the Czech Science Foundation and the Technology Agency of the Czech Republic.</p>   |   |
| <b>D2.5</b>   | <b>Adequacy of instrumental equipment</b>   |
| No issues identified.   |   |
| <b>D2.6</b>   | <b>Effectiveness of management</b>  |
| No issues were identified, apart from the fact that the research team is located apart from the Institute. The management is however effectively using methods of distant participation, which are now the new standard (facing the Covid-19 pandemics).  |   |
| <b>D2.7</b>   | <b>Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth</b> |
| <p>The development strategy adheres to the CAS strategies.</p> <p>The age structure has two peaks. A significant number of researchers is in retirement age (3 researchers over 65 and 2 researchers over 70) is supplemented by the majority of researchers ranging from 35 to 45 years with promising possibilities of career growth. Researchers in the age range 50-60 years are underrepresented (only 1).</p> <p>The career and development growth does not stand out of national standards.</p>  |   |
| <b>D2.8</b>   | <b>Creating work-life balance conditions, assessment of approach towards possible gender issues</b>   |
| No issues identified.   |   |

|               |  |
|---------------|--|
| <b>D2.9</b>   | <b>Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II.</b> |
| Not relevant. |  |

### Further criterion: 3. Cooperation with universities and participation in education (D3.1-D3.6)

|   |  |
|---|--|
| <b>D3.1</b>   | <b>Scope of cooperation with universities on national and international level</b>    |
| <p>Most of the EG-Team members cooperate with universities on a rather personal basis particularly universities in Brno and Olomouc). Five members are involved in teaching to a significant extent (3-5 classes). Teaching is aligned to the research activities. The team has also identified joint research projects with universities.</p> <p>The interaction with foreign universities seems limited, however one team member is actively participating in significant teaching activities in Cardiff via COFUND Marie Curie Fellowship.</p> |  |
| <b>D3.2</b>   | <b>Effectiveness of joint research centres</b>                                       |
| The team has described multiple joint research projects with universities. No formal joint research centre was identified.  |  |
| <b>D3.3</b>   | <b>Success rate in supervision of PhD students</b>                                   |
| According to the information provided, there is a general success in the supervision of PhD students (3 supervisors and 3 defended theses identified in the relevant time period).  |  |
| <b>D3.4</b>   | <b>Participation of PhD students in the outputs</b>                                  |
| According to the data provided, PhD students participate as co-authors. Their involvement in field research and data gathering is dominant.   |  |
| <b>D3.5</b>   | <b>Participation of the team in master or bachelor studies</b>                       |
| Five team members appear to be engaged in lecturing activities, and team members are acting as supervisors or consultants to bachelor or master theses. The number of theses defended is impressive (27).   |  |
| <b>D3.6</b>   | <b>Assessment of cooperation intensity with universities in the form of teaching</b> |
| The research team closely cooperates with universities. The courses taught stretch from the general courses, to courses devoted to the team's research activities and round up in theoretical courses focusing on methodology of research. This composition of teaching activity is well balanced and opens the door to research careers of master students.  |  |

#### Further criterion: 4. Outreach activities (D4.1-D4.3)

|   |  |
|---|--|
| <b>D4.1</b>   | <b>Sufficiency of media strategy and activities in the area of research popularisation</b> |
| <p>A rich variety of popularization activities (lectures, exhibitions, field trips, public discussions, etc.). Strong local presence and activities for locals (geo-trips, urban architecture and planning), but also presentations on the national level.</p> <p>Strong media presence (interviews, discussion, presentations)</p> <p>Open Days of the Department of Environmental Geography and involvement in the CAS science popularisation activities.</p> |  |
| <b>D4.2</b>   | <b>Publishing activities and its quality</b>   |
| <p>The general publishing activity is sufficient, both scientific and popularisation.</p>   |  |
| <b>D4.3</b>   | <b>Participation in professional organisations in the area of research and development</b> |
| <p>The entire branch of the Department of Environmental Geography is a collective member of the Czech Geographical Society. The team is also active in multiple international and Czech scientific societies.</p>   |  |

#### Other comments of the commission:

The evaluated team emphasized the administrative burden – an increase of administration. However, big EU projects include a budget on administration (internal and external). CAS should encourage the cooperation between the institutes and provide sufficient administrative support and to raise awareness of the current possibilities.

Collaboration with other CAS institutes should be intensified. New momentum might be gained by a much closer cooperation with the Global Change Institute (from the last Evaluation) and the Institute of Sociology.

Two different groups of researchers make the cooperation in national funding schemes problematic (as the scientific panels of research agencies are split into fields)



## **Final report was elaborated by:**

### **Commission 1 - Mathematics and computer sciences**

**Evaluated teams No.: 4**

**Commission Chair: Professor Edwin Hancock**

Commission Deputy Chair: Vít Dolejší

Commission Members:

Francesc Josep Ferri  
Gilles Godefroy  
Xiaoyi Jiang  
Willi Jäger  
Dorothee Knees  
Izak Moerdijk  
Krzysztof Podgorski  
Leon Rothkrantz  
Ulrich Ruede  
Andrus Salupere  
Richard Wilson

### **Commission 7.2 - Engineering and technology**

**Evaluated teams No.: 1, 2, 3**

**Commission Chair: Prof. Dr.-Ing. Manfred H. Wagner**

Commission Deputy Chair: Jaroslav Kováč

Commission Members:

Andrei Kotousov  
Andrés Fabián Lasagni  
Axel Loewe  
Jožef Predan  
Dieter Roehrich

### **Commission 9 - Social sciences**

**Evaluated teams No.: 5**

**Commission Chair: doc. Kristian Csach**

Commission Deputy Chair: -

Commission Members:

Bedanna Bapuly  
Thomas Cooley  
Lydia Coudroy De Lille  
Eleanore Kofman  
György Lengyel  
Maria Lewicka  
Anna Marzecová  
Patrick O'Farrell  
Jiri Priban  
Artem Prokhorov  
Assaf Razin  
Stein Ringen  
Louis-André Vallet