

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

Final Report

Name of the Institute: Institute of Atmospheric Physics of the CAS, v. v. i.

Evaluated teams and their leaders:

1. Department of Climatology (Jan Kyselý)
2. Department of Ionosphere and Aeronomy (Jan Laštovička)
3. Department of Meteorology (Pavel Sedlák)
4. Team of Space Weather and Planetary Environment (Ondřej Santolík)

Part A: Evaluation of the institute

Strengths:

This unique institute spans the range of atmospheric processes from the ground up into the solar system. It covers both regional and global spatial scales, and a wide range of time scales (from those relevant to turbulent processes to those relevant to climate change), using experimental, theoretical, statistical and modelling methods. Despite this large span, the institute contributes relevant and high-quality science in all Departments. A strong programme can be envisaged over the coming years, especially in the fields of climatology, ionospheric and space physics. Electrical effects in atmospheres develop as an overarching theme and allow for collaboration between the four Departments. The long record of observations at the Milesovka Observatory must be continued and developed to use modern instruments capable of making observations under all meteorological conditions. The very practical and relevant to society “Road Meteorology” ICEWARN programme is another strength.

Weaknesses:

There is strong thematic overlap with the „Czech Hydrometeorological Institute“, „Global Change Research Institute of the CAS“ and the Department of Atmospheric Physics at the Faculty of Mathematics and Physics (Charles University); direct collaborations with those Institutes should be substantially improved. New research directions should be initiated wherever possible. Outreach activities could be strengthened.

Opportunities:

Climatological research should be developed to include mathematical and physical investigations (i.e. numerical Regional Climate Models) besides those based upon statistical analysis. There are opportunities for studies of the atmosphere within larger European field programmes. Studies of the interaction of atmosphere and biosphere could be strengthened. Continue and expand contributions to European Programs, e.g., ACTRIS. Advertise leadership positions (Young investigator groups, etc.) for young scientists worldwide (as is already pursued in the Department of Climatology). The new field of Biometeorology offers good opportunities for public outreach. A course for Mathematics and Physics university students on The Earth’s Climate and Climate Change could be prepared and delivered. When vacancies occur, personnel for the institute should be recruited widely, not narrowly.

Threats:

Long term financial support for the observatories is not secured. Observatories should not be funded according to the rules of science funding – this a specific example of a general problem.

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

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| H1.1 | Quality of selected outputs of Phase I |
| The quality of the outputs is generally very good, and there are several world class publications. | |
| H1.2 | Contribution of workers on the outputs reached |
| The staff of the Institute of Atmospheric Physics generally take the lead in most of their outputs. | |

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| H1.3 | Quality of all outputs and results |
| Very productive. The increasing number, and high quality, of the outputs is generally very impressive, with publications in journals with high to very high Impact Factors. | |
| H1.4 | The most valuable discoveries and findings in the fields, their importance for the field |
| The ongoing contributions to European Ionospheric and Space Physics programs is at the highest level. Also noteworthy is the work on cloud electricity and cloud microphysics that was taken up at the Milesovka Observatory. It combines state of the art observations at a unique location with modelling. It also builds a bridge from Departments dealing with the electrically neutral atmosphere to the excellent Departments of Ionosphere and Space Physics studying the ionized atmosphere. Despite its comparatively small size, the Department of Climatology excels with important statistical analyses, particularly of Circulation type, that gain high international visibility. | |
| H1.5 | Contribution of the participation of the authors in large collaborations |
| The ongoing contribution to European Ionospheric and Space Physics programs is at the highest level. The planned contribution of the Department of Meteorology to the ACTRIS programme is important. In cases of meteorological data from larger regions or on longer time scales, the data preparation and the analysis needs cooperation with larger groups. The institute as a whole is involved in this area very efficiently. | |

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

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| H2.1 | Societal relevance of outputs and results pursuant to CAS and institute mission |
| Wide ranging studies of meteorology and of both regional and global climate change are of very high societal relevance. The studies of Aeronomy and Ionospheric Physics as well as of Space Physics give the Czech Republic access to the Frontier Technology developed worldwide. Here the institute is on a good track. | |
| H2.2 | 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 |
| The system of science in the CAS in general should not be targeted on transfer of knowledge into practice, but should concentrate upon research. Wherever feasible, transfer projects should be supported, however. Improved weather forecasting and forecasting of hazards are of real benefit to society at large. | |
| H2.3 | Relation to practice |
| An excellent example for successful transfer is the project on road icing; also noteworthy are projects on air pollution, hail prediction and wind energy assessment. The institute has produced a successful educational movie about the first Czech satellite, MAGION 1. More transfer projects should be brought forward in the future. | |
| H2.4 | Participation in AV21 strategy |
| The institute participates successfully in the AV21 programme “Space for the mankind” and has contributed to the programme “Natural Hazards”. | |

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| H2.5 | Cooperation with regions of the Czech Republic |
| <p>Meteorology in general is a science with a strong link to regions and regional development. This link could be exploited more in the future, but personnel trained in this area will be required. The IAP does not have official cooperation with any of the regions of the Czech Republic.</p> | |

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

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| D1.1 | Comparison of the teams and the institute with similar international and national institutes |
| <p>There are not many Institutes internationally with such a broad scope as the IAP of CAS. Taking its size into account, the Institute performs very well on an international level. The IAP has improved its visibility internationally and nationally quite well. By focussing its goals even further, e.g., defining the programmes which might be reachable in a five year period, the institute may achieve still better visibility.</p> | |
| D1.2 | Scope and quality of international and national cooperation and the role of the institute in such cooperation; engagement in broad international cooperation |
| <p>Good, with a strong representation of IAP staff on the editorial boards of internationally renowned, and well respected, journals, and with a strong participation in international programs on aeronomy and space physics. Further cooperation with European programmes should be encouraged.</p> | |
| D1.3 | Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards) |
| <p>IAP researchers act regularly as conveners of sessions in important international conferences like EGU and IUGG assemblies and organize workshops for their respective international collaborations.</p> | |

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

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| D2.1 | Direction in line with the perspective of the planned research directions |
| <p>We strongly encourage the teams to continue their new developments in biometeorology and in cloud microphysics and cloud electricity. These are important areas with high societal impact. The institute is very succesful in the analysis of the observed meteorological parameters in heat waves and other extreme weather conditions over Europe, or of model outputs against reality.</p> | |
| D2.2 | Assessment of the previous research objectives and their achievement |
| <p>Previous efforts have resulted in growth in the number of publications submitted to prestigious journals.</p> | |

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| D2.3 | Assessment of implementation of recommendations from past evaluation |
| <p>Good progress has been made in all Departments, which is reflected in a growing number of high visibility publications.</p> <p>A good improvement in the hiring of young scientists as successors for senior scientists has been reached, but this has to be followed up.</p> <p>The conditions requiring a secure and stable budget for the operation of the infrastructure (particularly the Observatories) is not yet completely solved – and this is a more general issue.</p> | |
| D2.4 | Success in receiving grants |
| <p>Most of the budget comes from institutional sources. The IAP is quite successful in achieving grants from the Czech Science Foundation (46 % of all grants), from ESA and from the Ministry of Education. This shows, however, the very low number of grants from the EC; attempts to gain these should be intensified in the future.</p> <p>Third party grants are more difficult to obtain in atmospheric science compared to both more fundamental and more applied sciences. Nevertheless, the Institute has a good record of third party projects; the Team of Space Weather and Planetary Environment excels with very substantial funds being received from ESA.</p> | |
| D2.5 | Adequacy of instrumental equipment |
| <p>Instrumentation seems generally to be adequate: the Institute has taken the opportunity to buy several very modern instruments recently, e.g., a cloud profiler and X-band radar</p> | |
| D2.6 | Effectiveness of management |
| <p>Management seems overall to be efficient. The Institute is encouraged to give more responsibility to younger scientists, e.g., by introducing Young Investigator Groups.</p> | |
| D2.7 | Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth |
| <p>The Institute does offer incentives for successful scientists. It is advisable to develop clear career pathways and to have regular personal development interviews with supervisors. Promotion opportunities should be encouraged. Otherwise, very successful young scientists will take up opportunities elsewhere. This should be considered to be a success of the Institute.</p> | |
| D2.8 | Creating work-life balance conditions, assessment of approach towards possible gender issues |
| <p>This area should be developed further; more effort is needed to promote female scientists into leadership positions without compromising excellence.</p> | |
| D2.9 | Relation of the institute with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II. |
| <p>No comment here.</p> | |

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

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| D3.1 | Scope of cooperation with universities on national and international level |
| <p>All leading scientists give regular lectures at Charles University or other National Universities. This is a very strong and sustained engagement of the Institute in education. The collaboration in research is less strong, mainly because of the lack of possible collaboration partners for the topics of the Institute at Charles University. However, the leader of the Space Weather Team is also a Professor at Charles University, which is very advantageous for the Institute.</p> | |
| D3.2 | Effectiveness of joint research centres |
| <p>No comment.</p> | |
| D3.3 | Success rate in supervision of PhD students |
| <p>Given the difficulties of finding suitable PhD students and supervisors at the University, 11 successful PhD defenes and two best dissertation prizes constitute a very good output.</p> | |
| D3.4 | Participation of PhD students in the outputs |
| <p>PhD students are very often the lead authors in publications, so their involvement is very good.</p> | |
| D3.5 | Participation of the institute in master or bachelor studies |
| <p>Theses defended: Batchelor 16, Master 27. This demonstrates a very succesful participation.</p> | |
| D3.6 | Assessment of cooperation intensity with universities in the form of teaching |
| <p>As stated in D3.1, the teaching efforts are very high (1 full Professor, 5 Associate Professors, 10 Lecturers).</p> | |

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

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| D4.1 | Sufficiency of media strategy and activities in the area of research popularisation |
| <p>There are good examples of the appearance of the Institute in the National media, which not only occur during severe weather. Nevertheless, the outreach activities should be better coordinated and strengthened. It could be valuable to produce a top quality publication to highlight the activities of the IAP. This could also serve as a template for a better outreach section on the homepage.</p> | |
| 4.2 | Publishing activities and its quality |
| <p>Outreach is organized via the “Days of the open doors”, which resonate with the public and which are very successful. Another good example is the film produced on the first Czech satellite, MAGION 1. Nevertheless the activities could be improved, see 4.1.</p> | |

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| D4.3 | Participation in professional organisations in the area of research and development |
| The leading scientists at the Institute are very active in many branches of the professional organisations which acts for the benefits for the science and for the public. Participation in the activities of the international Committee of Space Research (COSPAR) is a highlight. | |

Other comments of the commission:

Part B: Evaluation of teams

1. Department of Climatology

Strengths:

The research field of climate is continuing to rise among the interests of the public and also of politicians. This is a young and dynamic group, with a very good age structure. High publication output in good journals. Well-developed research plan with promising new developments like Biometeorology.

Weaknesses:

More collaboration with the department of meteorology and more activity in climate modelling would further strengthen the department. Also collaboration with the Department of Atmospheric Physics at the faculty of Mathematics and Physics of Charles University should be initiated. As yet there is not much application of the methods and results of the department for the societal and economic needs of the regions of the Czech Republic. Outreach activities are not well developed.

Opportunities:

Climate Science will have growing importance. If the links to other players in this field in the Czech Republic are developed well, the department can play a leading role.

Threats:

The department needs a strong backing by climate modelling that can only be established through sustained collaborations with other groups. If those fail to materialize, the department may be too small in itself to play a leading role in Czech climate science.

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

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| H1.1 | Quality of selected outputs of Phase I |
| Very good – all graded 2 and 3. | |
| H1.2 | Contribution of workers on the outputs reached |
| Department scientists are usually the lead authors in publications. | |
| H1.3 | Quality of all outputs and results |
| Very good. | |
| H1.4 | The most valuable discoveries and findings in the fields, their importance for the field |
| Thorough assessment, using statistical methods, of heat wave dynamics and their consequences (e.g., number of deaths) in a series of publications (C1, C3, D1, D2) | |
| H1.5 | Contribution of the participation of the authors in large collaborations |
| There is good involvement in large collaborations, like the CORDEX programme of the WCRP or the Multi-City/Multi-Country study on air quality. | |

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

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| H2.1 | Societal relevance of outputs and results pursuant to CAS and institute mission |
| The societal relevance of the work is very high, in particular the work on climate change and on extreme events (heat, drought, severe weather, lightning) and on Biometeorology. | |
| H2.2 | 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 |
| The transfer of the results into practice is partially organized via the large collaborations which the department contributes to. It will be important to intensify these efforts. | |
| H2.3 | Relation to practice |
| The topics of the department are of high relevance for practice, see H2.1. It is envisioned that the links to practice (e.g., planning for the future) will be more and more established in the future. | |
| H2.4 | Participation in AV21 strategy |
| During the reporting period, the department had contributed to the Programme “Natural Hazards”. | |
| H2.5 | Cooperation with regions of the Czech Republic |
| Climatology in general is a science with a strong link to regions and regional development. The team is actively involved in downscaling of global climate trends which will benefit the regions. This link could be exploited more in the future. The department does not have official cooperation with any of the regions of the Czech Republic. | |

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

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| D1.1 | Comparison of the team with similar international and national institutes |
| The team is very successful in the fields of research it is pursuing and very visible e.g., COST, CORDEX. Compared to similar teams worldwide, the output and the focused strategy is very good. | |
| D1.2 | Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation |
| The team has established collaborations with renowned groups worldwide. It also contributes well to large international collaborations (see H1.5). On the national level, the cooperation with the Charles University is quite strong, but the cooperation with the Faculty of Mathematics and Physics should be strengthened. | |
| D1.3 | Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards) |
| Researchers from the team act as Editors in leading Journals and as conveners of sessions in important international conferences like EGU and EMS assemblies. Members of the team have received and organize workshops of their respective international | |

collaborations. Several young scientists from the team have received prestigious prizes. This in total shows an excellent involvement of the department in the scientific community.

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

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| D2.1 | Direction in line with the perspective of the planned research directions |
| The planned research directions (in particular the assessment of extreme events and biometeorology) are excellent choices which will attract young scientists and secure and extend the departments position within the national and international climate science community. The use of newer climate models, such as AR6 and Aladin, and their application to questions of regional relevance is important. | |
| D2.2 | Assessment of the previous research objectives and their achievement |
| The department has a very good publication record, with strong international visibility, and it has achieved all its major research objectives in the past. The track record is very good. | |
| D2.3 | Assessment of implementation of recommendations from past evaluation |
| Recommendations from the previous evaluation have been considered. The new topic biometeorology was taken up as recommended in a past evaluation. | |
| D2.4 | Success in receiving grants |
| The department has received continuous support in grants mainly through the Czech Science Foundation (GAC). For its size, this is a very good funding record. Grants from the EC should be sought. | |
| D2.5 | Adequacy of instrumental equipment |
| The department works in modelling and data analysis only. The computing resources seem to be sufficient. | |
| D2.6 | Effectiveness of management |
| The department is managed efficiently. The careers of bright young members should be regularly observed and supported. | |
| D2.7 | Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth |
| The department has a very good HR structure, allowing young scientists to promote their ideas and their careers. The age structure is ideal to make this a very successful department in the future. It is valuable for young scientists to work abroad for a period early in their careers. | |
| D2.8 | Creating work-life balance conditions, assessment of approach towards possible gender issues |
| The department has a well-balanced gender distribution. It is important for females to have the necessary maternity breaks. | |
| D2.9 | Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II. |
| No comment. | |

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

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| D3.1 | Scope of cooperation with universities on national and international level |
| Scientists from the team teach a considerable number of courses at the Charles University and other Czech universities. The number of Bachelor, Master and PhD theses supervised and defended by members of the department is excellent. Students from the team have won several prizes. Teaching is seen as an important for attracting the best students. | |
| D3.2 | Effectiveness of joint research centres |
| None at present. | |
| D3.3 | Success rate in supervision of PhD students |
| The number of PhD theses supervised and defended by members of the department is excellent, (but apparently only at the Faculty of Sciences and none at the Faculty of Mathematics and Physics) | |
| D3.4 | Participation of PhD students in the outputs |
| PhD students appear on the publications of the team and very often take the lead. | |
| D3.5 | Participation of the team in master or bachelor studies |
| The number of Bachelor and Master theses supervised and defended by members of the department is excellent. | |
| D3.6 | Assessment of cooperation intensity with universities in the form of teaching |
| See D3.1. | |

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

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| D4.1 | Sufficiency of media strategy and activities in the area of research popularisation |
| There are good examples for the appearance of the team in the national media. The team has created a climatology webpage mainly for students. Nevertheless, the outreach activities should be better coordinated and strengthened. This could also serve as a template for a better outreach section on the team's homepage. | |
| D4.2 | Publishing activities and its quality |
| Outreach is organized via the "Days of the open doors" of the institute and via the CAS science fair, which both are very successful. Nevertheless the activities could be improved, see D4.1. | |
| D4.3 | Participation in professional organisations in the area of research and development |
| The leading scientists are very active in many branches of the professional organisations, such as the European Geophysical Union, which is a benefit for the public. Participation in the activities of the WRCP CORDEX programme is a highlight. | |

Other comments of the commission:

2. Department of Ionosphere and Aeronomy

Strengths:

Several “in house” data series of comparatively long term, enabling studies of long-term trends to be made. World leading in ionospheric Doppler sounding. Studies of infra sound are important. Good connections to the international community. Participation in the development of the International Reference Ionosphere

Weaknesses:

Lack of a course on climate science and climate change (in the widest sense), with lecturers from this Department, to be given to University students in mathematics and physics, in order to encourage them and prepare them for work on this important topic

Opportunities:

New analyses of the Department’s own and other available sets of data. External funds should also be sought

Threats:

Insufficient number of students and young employees to continue and to develop these crucial studies

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

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| H1.1 | Quality of selected outputs of Phase I |
| | 6 evaluated papers, by journal ranking, in the top decile, which is very good 1 evaluated paper, by intensity of citations, in the top decile, which is good 17 evaluated papers in A1 group, in a collaboration exclusive to the Institute of Atmospheric Physics, which is excellent 9 evaluated papers, in C group, in international collaborations with, e.g., South Africa and Taiwan, which is excellent 2 evaluated papers, in D group, in large (> 5) collaborations, which is good |
| H1.2 | Contribution of workers on the outputs reached |
| | Imaginative researchers leading these studies |
| H1.3 | Quality of all outputs and results |
| | Excellent, over a broad range of topics, of which some relate to the coupling between phenomena at different levels of the atmosphere. |
| H1.4 | The most valuable discoveries and findings in the fields, their importance for the field |
| | The team may be considered to be the world leader in ionospheric Doppler sounding; it has made unprecedented observations on ionospheric dynamics (gravity waves, tides and planetary waves) Observation and modelling of long-term changes of ionospheric electron densities, probably related to climate change Infra sound studies Influences of surface weather on the ionosphere; vertical coupling in the atmosphere-ionosphere system Contributions to the International Reference Ionosphere Ionospheric disturbances due to both nearby and distant earthquakes, and to space weather phenomena Studies of stratospheric winds and ozone distribution |

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| Variations of the position of the magnetopause (outer boundary of magnetosphere). | |
| H1.5 | Contribution of the participation of the authors in large collaborations |
| Excellent, as has been shown above. | |

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

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| H2.1 | Societal relevance of outputs and results pursuant to CAS and institute mission |
| Very good, especially relating to studies of the effects of climate change in the Earth's upper atmosphere, and the effects of various space weather phenomena on the ionosphere. | |
| H2.2 | 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 |
| The transfer of the results into practice is partially organized via the large collaborations that the department contributes to. It will be important to intensify these efforts. | |
| H2.3 | Relation to practice |
| Currently there seems to be not much transfer of knowledge into society or the economy. This could be strengthened in the future. | |
| H2.4 | Participation in AV21 strategy |
| The department participates successfully in the AV21 programme "Space for the mankind" and has contributed to the programme "Natural Hazards". | |
| H2.5 | Cooperation with regions of the Czech Republic |
| Ionosphere Research and Aeronomy is generally of a global nature. The department does not have official cooperation with any of the regions of the Czech Republic | |

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

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| D1.1 | Comparison of the team with similar international and national institutes |
| Extremely good. | |
| D1.2 | Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation |
| The Department performs very well in this sphere of activity. There is strong representation of IAP staff on the editorial boards of internationally renowned, and well respected, journals | |

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| D1.3 | Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards) |
| Very favourable. | |

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

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| D2.1 | Direction in line with the perspective of the planned research directions |
| The very successful work of the department should be continued in its main research areas. Additional work on atmospheric electricity will strengthen the connections to the other departments of the Institute. | |
| D2.2 | Assessment of the previous research objectives and their achievement |
| Good, with improved interdepartmental links and stronger international collaborations. | |
| D2.3 | Assessment of implementation of recommendations from past evaluation |
| Good progress has been made. | |
| D2.4 | Success in receiving grants |
| Good. | |
| D2.5 | Adequacy of instrumental equipment |
| Specialist equipment is used effectively. | |
| D2.6 | Effectiveness of management |
| Good. | |
| D2.7 | Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth |
| Very good | |
| D2.8 | Creating work-life balance conditions, assessment of approach towards possible gender issues |
| Good | |
| D2.9 | Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II. |
| Not applicable | |

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

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| D3.1 | Scope of cooperation with universities on national and international level |
| Satisfactory. | |

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| D3.2 | Effectiveness of joint research centres |
| Not relevant. | |
| D3.3 | Success rate in supervision of PhD students |
| Three PhD thesis have been defended during the reporting period, signifying the success of the department, although finding adequate PhD candidates from the national Universities is not without problems . | |
| D3.4 | Participation of PhD students in the outputs |
| Good, PhD students appear on the relevant publications and sometimes take the lead. | |
| D3.5 | Participation of the team in master or bachelor studies |
| Good, in particular for Bachelor studies. | |
| D3.6 | Assessment of cooperation intensity with universities in the form of teaching |
| There could be opportunities for staff in the Department to teach in Universities. | |

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

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| D4.1 | Sufficiency of media strategy and activities in the area of research popularisation |
| Very good; there is a long list of outreach activities from the Department that stands out compared to the other Departments. | |
| D4.2 | Publishing activities and its quality |
| Satisfactory. | |
| D4.3 | Participation in professional organisations in the area of research and development |
| Good. | |

Other comments of the commission:

3. Department of Meteorology

Strengths:

Longstanding observational time series, Modern instruments, Strong applied research.

Weaknesses:

Limited collaboration with the Czech Meteorological Service, not well integrated in European or other Large Scale Research programs

Opportunities:

Become more visible in European research via, e.g, ACTRIS. Collaborate within IAP, nationally and internationally on regional effects of climate change.

Threats:

High costs of running observatories.

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

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| H1.1 | Quality of selected outputs of Phase I |
| Good. It is clear that the outputs in meteorology are partially more of regional interest and therefore not all are targeted at a global community. | |
| H1.2 | Contribution of workers on the outputs reached |
| Very good. In most cases, the team has the lead in its publications. | |
| H1.3 | Quality of all outputs and results |
| Good. It is clear that the outputs in meteorology are partially more of regional interest and therefore not all are targeted at a global community. | |
| H1.4 | The most valuable discoveries and findings in the fields, their importance for the field |
| Models of the atmosphere for central Europe Evaluation of extremes of precipitation and floods Nowcasting of hailstorms, and of precipitation as rain Forecasting of road surface temperatures Improvements of weather forecasts High temperature extremes at the Earth's surface Radar observations of clouds at the Milešovka Mountain. | |
| H1.5 | Contribution of the participation of the authors in large collaborations |
| Successful hail prediction with COSMO NWP. First results on the correlation between cloud electrification and precipitation coming from the new instrumentation at Milesovska | |

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

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| H2.1 | Societal relevance of outputs and results pursuant to CAS and institute mission |
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| Societal relevance of the output is very high, be it on extreme weather, road icing, hail detection and prediction or lightning. | |
| H2.2 | 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 |
| Very good. The team supports transfer of knowledge into society in many ways and very successfully, see H2.3 | |
| H2.3 | Relation to practice |
| Very good. The department is very active in applied research, for example, in road ice warning, wind energy prediction, cooling tower assessment and water managing issues. There are a total of 11 “research for practice” projects from this team, which is 100% of all of such projects from the Institute. | |
| H2.4 | Participation in AV21 strategy |
| The institute participates successfully in the AV21 programme “Natural Hazards”. | |
| H2.5 | Cooperation with regions of the Czech Republic |
| Meteorology in general is a science with a strong link to regions and regional development. The team is actively involved in severe weather, hail and precipitation prediction that benefit the regions. The department does not have official cooperation with any of the regions of the Czech Republic. | |

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

| | |
|--|--|
| D1.1 | Comparison of the team with similar international and national institutes |
| Good. The team compares favourably with similar teams of meteorology worldwide. Team members are active and visible internationally. | |
| D1.2 | Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation |
| Good. The team has good collaborations with renowned groups abroad. They are engaged in a series of European projects | |
| D1.3 | Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards) |
| Good. Several scientists from the team are members of international Editorial Boards and national Scientific Boards. | |

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

| | |
|---|--|
| D2.1 | Direction in line with the perspective of the planned research directions |
| <p>Very good. The team has entered a very ambitious strategy to sustain science at the Milesovka Observatory. The new instrumentation and the research on cloud microphysics and electrification is an excellent choice to secure the scientific work at the station within the ACTRIS framework. This development is augmented by incorporating a cloud electrification module in the ICON numerical weather prediction model. This new development opens the possibility for future cooperation within the Institute (atmospheric electricity), within the CAS (ICPF, ITAM) and internationally (ACTRIS).</p> | |
| D2.2 | Assessment of the previous research objectives and their achievement |
| <p>The team has achieved all previous research objectives and has successfully entered new directions of research (see D2.1).</p> | |
| D2.3 | Assessment of implementation of recommendations from past evaluation |
| <p>The recommendations from past evaluations have been met, in particular many new collaborations have been started. (see D2.1)</p> | |
| D2.4 | Success in receiving grants |
| <p>Good. The team has secured grants for basic research mainly from GACR. In addition, a large number of applied research grants has been acquired from many sources.</p> | |
| D2.5 | Adequacy of instrumental equipment |
| <p>The team has had the opportunity to acquire new radar systems and other sensors in order to modernize the Milesovka station. They will be a great asset in the future.</p> | |
| D2.6 | Effectiveness of management |
| <p>The department seems to be managed well. It is encouraged to give more responsibility to younger scientists, e.g., by introducing Young Investigator Groups.</p> | |
| D2.7 | Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth |
| <p>The professional structure seems adequate, but it is encouraged to advertise more leadership positions (Young Investigator Groups) internationally.</p> | |
| D2.8 | Creating work-life balance conditions, assessment of approach towards possible gender issues |
| <p>The work/life balance seems to be well addressed, Gender balance is good, but more effort should be made to bring female scientists in leadership positions.</p> | |
| D2.9 | Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II. |
| <p>Not appropriate.</p> | |

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

| | |
|--|--|
| D3.1 | Scope of cooperation with universities on national and international level |
| Very good as far as teaching is concerned. Many team members teach an impressive number of courses at Charles University and other universities. As far as research is concerned, University cooperation is limited. | |
| D3.2 | Effectiveness of joint research centres |
| None. | |
| D3.3 | Success rate in supervision of PhD students |
| Very good in comparison to other IAP teams. | |
| D3.4 | Participation of PhD students in the outputs |
| Very good. PhD students are authors and first authors on a large number of publications. | |
| D3.5 | Participation of the team in master or bachelor studies |
| Very good in comparison to other IAP teams. | |
| D3.6 | Assessment of cooperation intensity with universities in the form of teaching |
| Very good. Many team members teach an impressive number of courses at Charles University and other universities. | |

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

| | |
|--|--|
| D4.1 | Sufficiency of media strategy and activities in the area of research popularisation |
| Very good. There is a lot (more than a one page list) of media appearances and outreach activity from the team. | |
| D4.2 | Publishing activities and its quality |
| Very good. Brochures and leaflets as well as multimedia content and videos for science popularisation have been published. | |
| D4.3 | Participation in professional organisations in the area of research and development |
| None. | |

Other comments of the commission:

4. Team of Space Weather and Planetary Environment

Strengths:

Several excellent and productive research physicists in the Team.

Many novel observations of the properties of electromagnetic waves occurring in the Earth's atmosphere, magnetosphere and nearby interplanetary space, and in planetary magnetospheres.

Strong funding from ESA.

Numerical modelling of space plasma processes.

Weaknesses:

Need to train more doctoral students.

Opportunities:

Solar Orbiter and ExoMars are expected to provide novel observations and new results.

External funds should be sought for several future new space missions, the Lagrange mission being particularly important.

Threats:

Loss of well qualified staff.

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

| H1.1 | Quality of selected outputs of Phase I |
|------|--|
| | 40 evaluated papers, by journal ranking, in the top decile, which is outstanding in top quality journals 11 evaluated papers, by intensity of citations, in the top decile, which is excellent 5 evaluated papers in B group, in national collaborations, which is good 17 evaluated papers in C group, in international collaborations, particularly ESA (Europe) and USA, which is excellent 7 evaluated papers, in D group, in large (> 5) collaborations, e.g., with ESA, which is very good |
| H1.2 | Contribution of workers on the outputs reached |
| | Outstandingly good researchers in this Team, led by an outstanding (on the international scene) physicist. A very strong team, which has complementary strengths to those of the Department of Ionosphere and Aeronomy. |
| H1.3 | Quality of all outputs and results |
| | Superb in all respects. |

| | |
|--|---|
| H1.4 | The most valuable discoveries and findings in the fields, their importance for the field |
| Physical processes occurring in lightning on Earth. Statistics of occurrence of lightning on Jupiter Low plasma density regions in Jupiter’s magnetosphere Electromagnetic waves observed just outside Saturn’s magnetosphere Detailed mathematical analyses of the polarization, and Poynting vector, of electromagnetic waves received aboard satellites Contribution of whistlers (from lightning), chorus and also quasi-periodic emissions, to the intensity of whistler mode waves in the Earth’s magnetosphere, and associated energetic charged particles Electromagnetic ion cyclotron waves in the Earth’s magnetosphere Numerical modelling of plasma processes occurring in interplanetary space Statistical study of Coronal Mass Ejections (CMEs) in interplanetary space originating from the Sun | |
| H1.5 | Contribution of the participation of the authors in large collaborations |
| Extremely good. | |

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

| | |
|---|---|
| H2.1 | Societal relevance of outputs and results pursuant to CAS and institute mission |
| Good, because novel space results appeal to the public’s imagination and interests The success of the film about the Czech satellite Magion 1 is a highlight | |
| H2.2 | 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 |
| The studies performed are more of an academic nature than of direct practical importance, although space weather processes do impact upon society via disruptions to satellite communications and long conducting systems (e.g., electrical power lines, oil pipe lines). | |
| H2.3 | Relation to practice |
| Sufficient scientific knowledge exists in order to provide studies of practical space weather problems, should they be required in the future. | |
| H2.4 | Participation in AV21 strategy |
| The institute participates successfully in the AV21 programme “Space for the mankind”. | |
| H2.5 | Cooperation with regions of the Czech Republic |
| Good. | |

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

| | |
|---|--|
| D1.1 | Comparison of the team with similar international and national institutes |
| Outstandingly good. This Team performs excellently on the international stage. | |
| D1.2 | Scope and quality of international and national cooperation and the role of the team in such cooperation; engagement in broad international cooperation |
| Broad scope and top quality of international collaborations which include this Team Considerable engagements in broad international cooperation. | |
| D1.3 | Participation of the workers in scientific community activities (organizing of conferences and workshops, invited lectures, awards) |
| Extremely good in several areas here. | |

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

| | |
|--|--|
| D2.1 | Direction in line with the perspective of the planned research directions |
| Excellent, in one word Instruments are now operating in space aboard the ESA missions Solar Orbiter and ExoMars, plus there are opportunities for other novel developments Experimental and theoretical plasma studies will continue and develop There are applications in society for improved knowledge of space weather effects Computer simulations of solar wind plasma processes | |
| D2.2 | Assessment of the previous research objectives and their achievement |
| Excellent in every way. | |
| D2.3 | Assessment of implementation of recommendations from past evaluation |
| Excellent, with improved interdepartmental collaborations being welcomed. | |
| D2.4 | Success in receiving grants |
| Extremely successful. | |
| D2.5 | Adequacy of instrumental equipment |
| Novel instrumentation is being developed In particular, the prototype of the Team's TARANIS (CNES, France) space instrument has carried out observations at ground sites, and has made important discoveries concerning the physics of lightning initiation; this provides a good opportunity for working with the Department of Meteorology (CRREAT) Because the rocket carrying the TARANIS spacecraft exploded on 17 November 2020 before reaching orbit, it has already been decided that a replacement mission will be carried out A replacement instrument will be built for launch in 2025 | |
| D2.6 | Effectiveness of management |

| | |
|--------------------|--|
| Very effective. | |
| D2.7 | Assessment of professional structure, development strategy and the strategy of keeping best scientists, age structure, career and qualification growth |
| Very good. | |
| D2.8 | Creating work-life balance conditions, assessment of approach towards possible gender issues |
| Very good. | |
| D2.9 | Relation of the team with regard to the integration, development and sustainability of the research centre funded by the National Programme of Sustainability II. |
| Could be stronger. | |

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

| | |
|--|--|
| D3.1 | Scope of cooperation with universities on national and international level |
| Good, especially with the leading space science and instrumentation Department at the University of Iowa in the USA. | |
| D3.2 | Effectiveness of joint research centres |
| Not applicable. | |
| D3.3 | Success rate in supervision of PhD students |
| Good. | |
| D3.4 | Participation of PhD students in the outputs |
| Good. | |
| D3.5 | Participation of the team in master or bachelor studies |
| Satisfactory. | |
| D3.6 | Assessment of cooperation intensity with universities in the form of teaching |
| Good with Charles University in Prague. | |

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

| | |
|---|--|
| D4.1 | Sufficiency of media strategy and activities in the area of research popularisation |
| Good. | |
| D4.2 | Publishing activities and its quality |
| An outstandingly good record of top-quality papers published in top quality journals. | |

| | |
|-------------|--|
| D4.3 | Participation in professional organisations in the area of research and development |
| Good. | |

Other comments of the commission:

Final report was elaborated by:

Commission 4 - Earth and environmental sciences

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