Work Plan

The Centre will work in geodynamics, seismology, dynamic climatology and air-quality problems, each one covered by 2-3 work packages. All together, there will be nine work packages as follows:

WP1 Thermal convection (O. Cadek)
WP2 Viscoelastic response of the Earth (O. Cadek)
WP3 Temporal changes of the gravitational field (Z. Martinec)
WP4 Seismic waves: Theory (V. Cerveny and L. Klimes)
WP5 Seismic waves: Observations (J. Zahradnik)
WP6 Earthquakes (J. Zahradnik)
WP7 Climate system (T. Halenka)
WP8 Air quality (J. Brechler)
WP9 Research and technical management (C. Matyska and J. Zahradnik - project leader)

All work packages have been prepared to meet criteria of the EC call for creating the Centres, i.e., they focus on: a) a well defined scientific target and clear objectives, b) complementary efforts, and, c) specific measures to reach the objectives. The topics are chosen according to the European science interest, with enough previous research and enough unsolved basic research questions. At the same time they have a strong potential for multidisciplinary approach and practical applications. Methodical complementarity is necessary to enrich all partners involved in the work of the Centre by sharing new ideas and results. The organisation aspects describe the measures envisaged to reach the objectives, such as relation to ongoing EC projects, planned workshops, study visits, etc.

Thermal convection in deep Earth's interior (WP1) is behind the processes forming the Earth's surface. Those processes are monitored by seismic, geodetic and geological observations. It means that fundamental practical questions of seismology (WP4-6), geodesy (WP3), but also tectonophysics, and climatology (WP7), cannot be answered without understanding the deep Earth's interior. Modelling the interior processes should include complex mineralogical, rheological and geochemical information. Besides other, the thermal convection may provide verification of the viscosity models derived from the postglacial uplift data (output of work package WP2). Theoretical tools for describing chaotic systems, developed in WP1, may be used to study other chaotic phenomena, such as the atmospheric circulation (linked to work package WP7).

The WP2 addresses viscoelastic relaxation of the Earth, playing a key role in variety of geophysical processes with important environmental implications, for example the sea-level variations, related to the global climate change, or redistribution of tectonic stresses after large earthquakes. The recent years have seen remarkable progress in the viscoelastic modelling, independently achieved by different European geophysical laboratories. A logical next step is to create a European network of the researchers working on this topic. Besides other, the networking will strengthen the co-operation between modellers and field researchers (e.g. data on seismic activity in the Gulf of Corinth, WP5), and can even initiate new geophysical observations to decide between existing physical models.

The latest satellites sample not only spatial but also temporal variations of the external gravitational field, with high resolution and accuracy. The WP3 (co-operation with satellite missions GRACE, and GOCE) will solve the satellite gradiometric boundary-value problems. The aim is to construct the downward-continuation operators that will be used to compute the gravitational field on land from the satellite gradiometric data. This will enable us to combine the temporal changes of the gravitational field with repeated and permanent GPS observations. The ultimate goal of this effort is to improve our knowledge on the viscosity distribution beneath the Fennoscandia, see also WP1-2. Participation in the projects SEAL, Germany, and co-operation with project BIFROST, Sweden will be enhanced.

Turning to the viscoelastic response in a short time scale, we move into the field of seismology. Three work packages, WP4-6, are devoted to this broad topic. The central role of theory is emphasised in WP4, where new simulation methods in complex 3D media are to be developed. The international role of the Centre should improve interaction between theoreticians and practicians, both in exploration and earthquake seismology. While the oil, and coal exploration links this package with Energy programme of EC, the earthquakes hazard applications and modelling (WP6) obviously belong to ESD programme. As the theory has no meaning without observations, WP5 takes care of necessary data flow from modern broad-band systems recently built by the Charles University in Greece, in the region which is also focus of a cluster of the EC projects, the Corinth Rift Laboratory (CRL). Our data of course will be made available not only to the CRL, but to the whole seismological community via ORFEUS data centre. The integrated approach of the Centre to the earthquake modelling (WP6) makes it perfectly suited for our networking with ongoing 5th framework programmes PRESAP, DGLAB, MEREDIAN, SHIELDS, SAFE, and SESAME. On the other hand, possible exploration applications of WP4 make the Centre attractive for international oil companies.

By sharing development in evolution problems of the continuum mechanics and hydrodynamics, by means of the finite difference or finite element methods, the Centre will bridge the gaps between the solid Earth dynamics (WP1-6) and atmospheric dynamics (WP7-8), which naturally enrich each other. Although the climate system modelling (WP7) addresses long-term environmental problems, such as global climate change (tightly related also to WP2), the global models represent an input for the regional weather-forecast models, with short-term practical implications. Finally, the regional processes affect the local air circulation, chemistry and air quality (WP8), thus addressing the pollution transport, with significant health impact. The past EC project EASE, as well as the submitted project IMPACT serve as a basis to further strengthen international recognition of the Charles University in this field.

To achieve full integration into European Research Area, new projects will be submitted within the 6th framework of EC programmes as a result of the co-operation within the MAGMA Centre. For example, WP2 and WP6 include specific plans of such kind. According to the Prague experience, we think that an efficient 'recipe' to prepare a strong project proposal are the so-called minisymposia. Those are small informal meetings of invited researchers, based on previous contacts, with strong participation of MSc and PhD students, having a short duration of 2-3 days, and organised at the premises of the Charles University without any relation to a larger conference. Nevertheless, for other purposes, our working plan also includes two larger international conferences in Prague (within WP1, WP7 and WP8), in which the Centre will participate as one of the organisers. Naturally, we also count with participation at major events, such as the assemblies of the European Geophysical Society, where the results should be reported and the Centre should attract new partners. By new partners we mean, in particular, the PhD students who will enrich the Centre (and vice versa) during their 1-3 month working stays in Prague. The same applies for young post-doctoral researchers on which the Centre relies to guarantee the long-lasting existence and dynamics. Organisation of these measures, including web page information policy of the Centre, will be subject of the last work package, WP9, whose tasks include also the necessary management and reporting activities.

As compared to standard RTD projects, the present project of the Centre is simpler in that sense that there is no strong dependence between the individual work packages in the sense of their temporal succession or the required inputs/outputs. Instead, all work packages go in parallel, from the commencement to the end. However, the work packages do have important links, either by subject (e.g. climate change, chaotic behaviour in WP2 and WP7), method (e.g. theoretical hydrodynamics, numerical methods in WP1 and WP7-8), physical parameter (mantle viscosity in WP1-3) or data (e.g. earthquakes in WP2, 4-6).