

Review of IDL by the Internal Advisory Committee (IAC) Meeting of 15-16 July, 2013

IAC Committee Members:

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Proceedings

The committee received the following documents prior to the evaluation:

- The IDL Progress Report for 2011-2012
- The EARTHSYSTEMS proposal for a doctoral school

The review committee attended the presentation by the Director of IDL, who reviewed past performance, current structure and a forward look with options for the future. Subsequently, 11 presentations were provided by different expertise groups, both from the current IDL as well as from potential partners for the future configuration of IDL. The latter include CeGUL and CREMINER, as well as the group on renewable energy. These potential partners have already joined IDL in the two doctoral schools (EARTHSYSTEMS, SES-MIT) recently selected for funding by FCT. It should be noted that one of them, i.e. EARTHSYSTEMS, is the only earth science school selected by FCT for funding in this prestigious scheme.

These formal presentations were followed by an open discussion. The meeting was extremely well attended. In addition to senior staff, many young researchers attended. For each group, PhD students and post-doctoral researchers presented some of their results. The committee met informally with individual researchers and studied a series of posters presenting recent research results. During this, the committee explicitly addressed issues related to the synergies between research groups, opportunities for the generation of added value, the optimal use of existing resources, and the need for new initiatives to attract funding.

The committee noted with pleasure that most of its previous recommendations had been partially or fully implemented with the encouragement of IDL's leadership. The committee noticed an overall consensus in the IDL scientific community and its potential partners to strive for further integration in system earth research and its applications for societally relevant issues related to climate change, forecasting of atmospheric extreme events, natural geohazards, as well as scarcity of georesources and geenergy. All these issues require an integrated approach linking fundamental process understanding to state of the art monitoring, observation systems, field studies and laboratory experiments, as well as numerical and analogue modeling. This also provides an attractive research and training environment for young researchers and students.

The current evaluation centers on the future structure of IDL and the plans offered by the IDL leadership to the committee for a critical assessment of and advise on potential, added value and feasibility. In doing so, the committee has attributed great importance to

past and current performance of IDL and its research groups in terms of scientific excellence, societal relevance, and viability.

Mission and structure of IDL

The scientific mission of IDL is to advance the understanding of:

- 1) Climate change at the eastern Atlantic boundary, from coupled atmosphere-ocean processes to multiscale variability and extremes;
- 2) Coupled deep Earth and surface processes and their implications for georesources and natural hazards management, with the Iberian-Atlantic region as a prime natural laboratory;
- 3) Secure and sustainable energy in the 21st century energy transition, incorporating a solid geoscience know-how base into energy strategies and technologies.

This mission is timely and particularly relevant for a country with significant natural geohazards, extreme events, water stress, and a great potential for georesources and energy in its territory, both onshore and offshore. All these domains require geoscience expertise on the highest possible levels, also in view of the international research agenda and the priorities formulated in the EU Horizon 2020.

The structure of IDL derives from its mission: Excellent science providing a know-how base for addressing grand societal challenges.

The committee feels that, following the election of Pedro Miranda as its new Director, IDL has made further excellent progress in consolidating itself in the aftermath of a major and sometimes stressful restructuring. The committee noticed that the new director had started his position with great care and a deep sense of responsibility, adequately supported by the high-level administrative capabilities of Mrs. Celia Lee.

The committee notes that the leadership of IDL is taking a proactive role in developing a strong vision for the future, with the ambition to be the main Portuguese center for integrated Earth System Science and a leading European and International partner in Earth, Climate and Energy research.

The internal organization and structure of IDL is currently being optimized and adjusted to new boundary conditions, opportunities and challenges. Mobility of researchers is an important factor in this very competitive research domain with strong demands on international level for high-quality expertise. IDL researchers have gained important positions abroad, and a strong need exists to replace them with new talents, filling in the gaps. Crucial in this respect is to build out IDL as a top institute with a creative research environment attractive to future ERC grantees and other recipients of major prestigious external funding schemes, including Marie Curie and similar networks.

To this aim, an open and dynamic structure with ample opportunities for bottom-up initiatives and stimulating integration is a prerequisite. As regards the current structuring into a smaller number of research groups, the IDL leadership strives for highest quality, critical mass, and compatibility with the overarching research mission of IDL. The committee strongly supports such a coherent policy. An optimization of the current IDL structure, taking benefit from the integration of groups so far positioned outside IDL, is now very timely and urgent in view of the new funding opportunities and the positioning of IDL in the European research area. It is obvious that fragmentation in

too many subcritical subunits must be strongly avoided, as it would be a threat to the sustainability of IDL. Quality control and identification and remediation of weaknesses and threats are strong priorities in a critical self-assessment of IDL. To be effective at the highest international level, IDL must build on its strengths in a limited number of high-priority areas where it can excel and be of maximum societal benefit.

The main overarching accomplishments of IDL

The current IDL yields an output of 494 papers in 5 years in ISI-ranked journals. The committee noted with pleasure that most of the papers are published in top international journals, and many are receiving significant impact. A substantial number of these publications are with international partners, demonstrating that IDL scientists are viewed by their potential colleagues as attractive collaborators.

IDL has also shown a strong capability in attracting external funding from different sources, including FCT, EU funding and industry. The total external funding amounts to 4.6M€ in project grants in the period 2008-2012, plus 4.3M€ in the Associated Laboratory contract.

A particularly important achievement of IDL has been its central role in bringing together scientists from different backgrounds and institutions. In this context, the linkage between FCUL (with primary missions in the areas of research and education) and IPMA (with many responsibilities in the areas of operational monitoring and forecasting) is an asset to mutual benefit of both organizations and vital for the functioning of research efforts and optimal use of research infrastructure in this area. This kind of linkage exists in most European countries and it appears to work particularly well in the current IDL.

The new initiatives for the future IDL are building on these successes and are logical next steps in this process towards strengthening the Portuguese know-how base in this domain. It is obvious that Lisbon with its strong concentration of university and non-university research institutes should play a leading role in this process.

Research domains and underlying research groups

IDL gathers expertise in a broad range of Earth System science, incorporating Atmospheric, Oceanic and Solid Earth geophysicists, together with a Geochemists and Geologists, and applied Physicists working on renewable energy technology and energy systems largely driven by geo-energetic resources.

IDL organization in research groups builds on established expertise in a number of disciplines and research topics. However, synergies between related topics, such as Meteorology, Climatology and Oceanography, or Seismology and Marine processes, and even across disciplines, such as between atmospheric and coastal geology groups, or between seismology and meteorology, are crucial for IDL success.

The committee subscribes to the research mission formulated by the IDL leadership to advance earth-process understanding in three closely related domains, each at the forefront of modern integrated earth-system science:

- 1) climate change, climate variability and extreme weather events
- 2) coupled deep-Earth surface processes, georesources and geohazards

3) secure and sustainable energy

In each of these three areas, the committee recognizes adequate critical mass, high level expertise, attractive research opportunities, and funding potential. Each of these domains offers a platform in themselves for the necessary further integration of individual IDL research groups. Each of these domains also strongly benefits from the participation of new members joining IDL from CeGUL, CREMINER and the Energy Efficiency group. This integration process has also consequences for the groups currently active in the present IDL framework. A special effort should be made to connect advances in individual domains to the profile and mission of IDL a large.

1) Climate change, climate variability and extreme weather events

In this domain strong expertise exists in the following topics:

- climate change, variability and extremes
- atmosphere, ocean and climate modeling

These groups conduct studies about the links between climate variability and atmospheric circulation, analysis of extreme events, ocean modeling using the ROMS model, global climate modeling using the EC-Earth model, as well as regional climate modeling using the WRF model. The committee identified a number of significant scientific advances made by these groups. The committee is also pleased with the successful integration of oceanographic expertise in this group.

We consider that the research group on coastal processes (currently CeGUL) is a very attractive partner in this area, both in terms of research quality and added value. This applies in particular to their know-how base in urban hydrogeology, coastal processes in general, sea-level rise – all directly connected to climate change. The focus of this group on short time scales makes them an almost ideal partner in this novel configuration.

We also recommend that the links between the two existing IDL teams in this area will be further intensified, in order to optimally exploit their great potential and quality.

2) Coupled deep-Earth surface processes, georesources and geohazards

In this domain, strong expertise exists in the following current IDL topics:

- marine and continental margin research
- seismology, volcanology and neotectonics
- applied geodesy and geophysics

The committee noticed that the marine and continental margin research community has also very valuable expertise in the domain of sedimentary basin formation and evolution, as well as in analogue modeling of tectonic processes. This group has a strong and successful collaboration with IPMA. The committee is pleased with the successful integration of seismology, volcanology and neotectonics in one formal group, integrating geophysical and geological aspects including active field studies. This group has developed a strong vision towards the future including its potential for synergy with other groups. The committee recognizes the need to make the links between the different research groups more explicit, in order to exploit synergies (e.g. in the field of tsunami research) and exchange and sharing of expertise between the groups. The focus on coupled deep-earth and surface processes and strong orientation towards marine earth sciences provides a very fruitful base from the solid-earth perspective towards such an interface with research on climate, ocean and atmospheric processes.

In addition, the committee was pleased to see a significant strengthening of the solid earth domain by two groups stemming from CeGUL, and one group from CREMINER:
- sedimentary geology - chemical geodynamics - geochemistry, mineral deposits and economic geology.

The committee recognizes for each of these three groups strong added value to the mission of IDL and vice versa.

The expertise on sedimentary geology including basin stratigraphy and clastic and carbonate sedimentology, backed up by a strong embedding in field studies is a very valuable contribution to the IDL research base in sedimentary basin systems, complementary to the existing expertise on tectonics and crustal-lithosphere aspects of basins residing in the realm of marine and continental margin research. The committee recommends these two groups to join forces, also in view of synergy towards industrial partners, and to secure critical mass in terms of publication output.

The CREMINER group has considerable expertise in geochemistry, natural resources on land and in the deep sea, with strong efforts in deep-sea resources, hydrothermal fields and environmental geochemistry. This group has marine components, obviously linking directly to the mission of the existing IDL marine and continental margin research group. The committee noticed this group is very motivated to join IDL in its mission to further integrate geology and geophysics. The group has recently received a major grant from the European Union in the domain of research on deep-sea mining.

The CeGUL group on chemical geodynamics with a strong emphasis on geochemistry and raw materials as well as high-quality analytical equipment could make a very valuable contribution to IDL's overall mission, and become the nucleus of a strong research group in the domain of mineral resources, with particular economic relevance for Portugal.

The committee also took notice of existing IDL expertise in the domain of tectonics and mineral resources.

The committee recommends the research efforts of the different groups to be integrated in the novel research configuration provided by the future IDL. This integration should strive for highest quality, critical mass, and compatibility with the overarching research mission. . This appears logic in terms of high-level lab infrastructure

3) Secure and sustainable energy

The present society is facing a very challenging energy transition in the decades to come. The research portfolio of the existing IDL groups is strong in a number of geoenergy resources, crucial for this transition. These include knowledge on the formation of deep-water basins and continental margins, which are sites of active hydrocarbon exploration. In addition, high-level expertise exists at IDL on renewable energy sources, including geothermal energy, hydroelectric dams and water resources, as well as climatological information on wind power and solar energy.

The research carried out in domains (1) and (2) with their primary focus on scientific excellence and novel process understanding have direct bearing for building up the knowledge base in the domain of geoenergy and georesources.

The committee noticed that a research group with a focus on solar energy and energy environments in buildings has expressed a strong interest in joining IDL. The committee has taken notice of a large number of PhD and MSc students attracted by this program, as

well as by relatively high level of European funding. This group is also involved in one of the newly selected doctoral schools (SES-MIT). The committee has been informed about existing cooperation on the use of IDL climate models for the development of climate performance indicators, and the joint supervision of three PhD students between current IDL and the renewable energy group. In order to lead to successful integration and added value for IDL at large, considerable efforts should be made to realize a beneficial integration of this group, so far residing in the engineering domain, into the research portfolio on energy resources of IDL. In this context, IDL should carefully assess the prospects and long-term potential of the contribution of this group to a coherent mission of IDL. Various geometries of optimal collaboration should be explored to secure the coherence and focus of IDL.

Synergy between the three domains

The IDL leadership should make a special effort to develop strong interfaces between its three domains. The committee is aware of some first attempts in this direction.

IDL is probably one of the first organizations of its kind where research efforts connecting natural hazards, climate change and georesources are pursued in an integrated fashion. This is a prerequisite for future policy decisions on cost benefits of different scenarios figuring in the energy and climate transitions facing mankind in the coming decades.

Other aspects

IDL as a training center

IDL will be leading the new FCT Doctoral Program EARTHSYSTEMS (Lisbon Doctoral School on Earth System Science) and will work towards establishing a number of relevant connections with leading European programs in related areas, with exchange and co-supervision of students. IDL aims to transform the EARTHSYSTEMS program into a truly international research training program and will try to gather external funding to guarantee its support.

In the Energy area IDL will be co-promoting a second FCT Doctoral School on Sustainable Energy Systems (MIT-Portugal), in close connection with engineering research groups in the 3 Engineering schools in Portugal.

IDL, together with the incoming CeGUL groups, are also actively promoting an integrated MSc program in petroleum geosciences, to start in September 2013.

IDL infrastructure

With the integration of its new groups, IDL will host a significant research infrastructure, including an advanced computing facility, analytical laboratories for Solid Earth studies, geophysics and geological field equipment, a geomagnetic laboratory, and a number of applied physics laboratories. This infrastructure is in many ways unique in Portugal and of great potential for the Portuguese participation in the European plate observing system (EPOS), selected for the EU-ESFRI road map for large-scale European research infrastructure. With the increasing role of numerical modeling studies, high-performance computing hardware and expertise will increasingly become important. A well-established connection between IDL and IPMA, also gives IDL researchers easy access to

cost-intensive equipment, including research vessels and networks of geo-monitoring equipment; as well as access to unique meteorological and climate data sets through IPMA's partner institutions (e.g. ECMWF).

IDL governance

The undergoing reshaping of IDL will be accompanied by progressive changes of the IDL coordination system and of its governance. Those changes intend to guarantee a transparent decision system, offering an appropriate and open environment for a large group of researchers in the process of building long-term working relationships, and to gradually enhance the scientific productivity of current and prospective IDL team members, and to attract the best scientists in their fields.

Outreach

The committee believes that IDL shares with other institutions a responsibility to engage in the public debate on the detection and attribution of climate change and seismic and volcanic hazards. The committee noticed a strong motivation in the IDL community to contribute to this activity.