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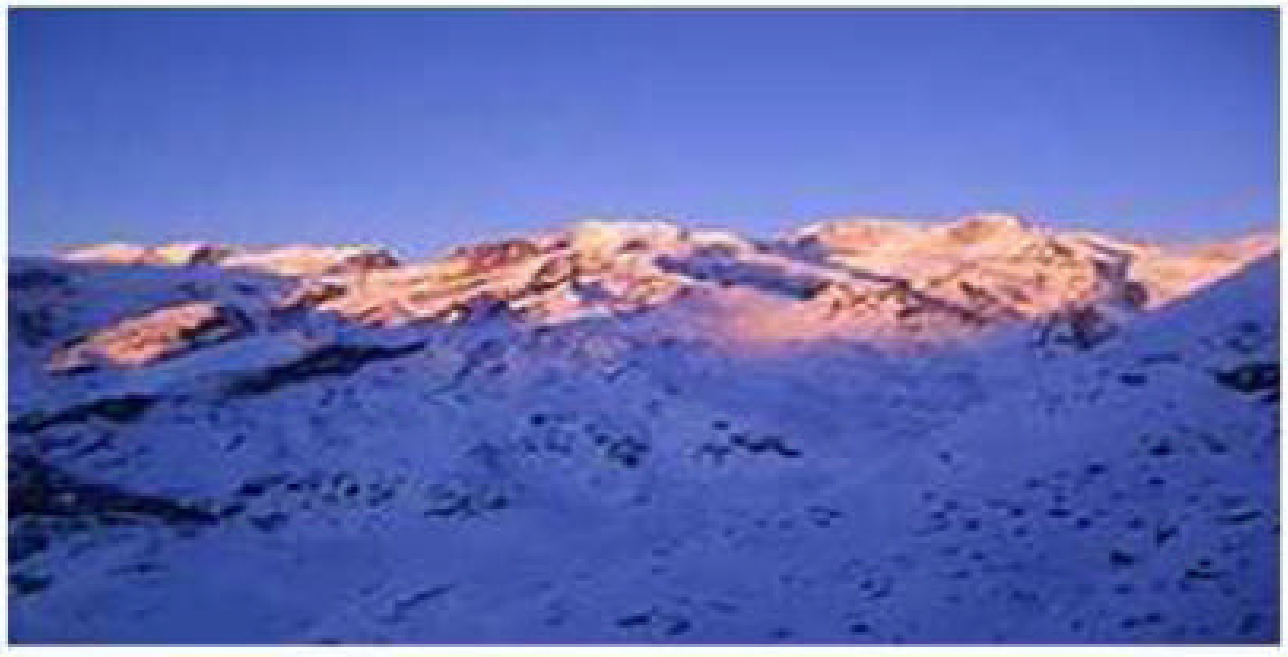
ABSTRACT



Cost inefficiency or just heterogeneity? An application of stochastic frontier models to the Italian water industry

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The question of correctly benchmarking regulated firms operating in different environmental conditions has been extensively debated in the literature. One major problem is the treatment of unobserved heterogeneity and its possible interconnection with structural (persistent) inefficiency (Green, 2005; Filippini et al., 2008). The peculiarity of the reformed Italian water industry (Muraro, 2008), which is based on local authorities defining accurate budget plans over a long period of time, provides a suitable field to test the performance of several frontier models incorporating different specifications for observed and unobserved heterogeneity and efficiency estimates. We gathered information from 46 local regulatory plans that typically unfolded over a 20-30 year period, providing a rich panel data that also includes information on time-invariant environmental factors (i.e. observed heterogeneity). The empirical analysis subsequently proposed in this paper contributes to the literature in two key ways. From a methodological point of view, we provide a comparison of several alternative cost frontier models, presenting the impact on the efficiency estimates of their different hypotheses on the error term and showing the effects of either including or excluding specific regressors in the models that account for the observed heterogeneity. In particular, the aim is to discuss which part of the cost differences for each model are attributable to the environmental condition rather than to efficiency, stressing the difficulty of distinguishing between heterogeneity and persistent inefficiency. From a policy point of view, interesting considerations come to light from the analysis of the time-trend of the efficiency component and the evaluation of the incentives to efficiency improvements intrinsically included in plans by local regulators. The results also shed some light on the potential role of ex-post benchmarking by a single national Authority.

Keywords :Stochastic cost frontier, heterogeneity, water industry.

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Monitoring the avalanche activity in the MonterosaSki resort with the GB-SAR LISA.

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Ski resorts offer many kilometers of pists, which must be well-maintained and safe for the users. This often implies the evaluation of the avalanche situation in the surrounding of the beaten tracks. There exists different ways of controlling the avalanche situation, from surveys on the terrain to remote system technique. In this work, an innovative monitoring system is presented. It is a ground-based synthetic aperture radar (GB-SAR LISA), which has been used for two winter seasons in the Olen Valley (Alagna Valsesia) within the MonterosaSki resort in the North-western Italian Alps and it is still working in the current winter 2008-2009. It allows to acquire - 24 hours a day in every weather condition - 1 image every 10 minutes to be compared with the previous ones, detecting all the surface changes. It is located at the opposite site of a well-known avalanche slope, where different avalanches can release and eventually reach the pist. Usually, the security personnel artificially trigger these avalanches in critical situations. As the radar is working continuously, it is able to recognize avalanches and be a support for the security personnel also in bad weather conditions. In the two operating seasons, the avalanches detected by the radar have been checked with surveys on terrain, in order to find a match between the different types of data to understand the quality of the system. Such a monitoring system, which is still at a preliminary stage and could be improved, might be very useful to evaluate the avalanche activity and to identify avalanche terrain.

Keywords: Avalanche activity, monitoring, radar.

Noise impact of an international traffic corridor in alpine environment: traffic scenarios and population exposure in Mont Blanc area

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The purpose of this project is to estimate the percentage of population exposed to the traffic noise produced by a transalpine transit corridor in Courmayeur, an Italian town situated near the Mont Blanc Tunnel. The analysis involves a typical alpine valley and it is based on a noise propagation model, with care on the 3D terrain digital map. The variation of the population exposure to noise classes on different traffic scenarios is evaluated through the estimate of the acoustic levels on the buildings façade and the number of exposed inhabitants. Sound levels were estimated using a deterministic numeric model. Acoustic descriptors were calculated upon the base of the sound source pressure and other factors relative to sound propagation. They are expressed in terms of diurnal and nocturnal noise levels, as requested by the Italian law, and of new acoustic indicators Lden and Lnight, defined in the European Directive 2002/49/CE. The results of the elaborations consist on acoustic maps of the analysed area. The evaluation of population exposure is performed crossing these maps with the distribution of the population in the area of interest. This is evaluated by distributing on the territory the total number of people for each census section (village or street) proportionally to the volume of residential buildings, by the following steps: - evaluation of the total volume of all the residential buildings - calculation of inhabited volume density for each village and street - evaluation of the average number if inhabitants for each building - evaluation of

the population exposed to the different sound classes on the basis of the result of noise mapping - consideration for tourist attendance in hotel or holiday houses.

Keywords: Population noise exposure, Noise mapping, Acoustic modeling.

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How can Computational Biology help the fight against Global Warming?

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Global Warming (or Greenhouse Effect) is one of the most relevant and in perspective dramatic ecological phenomena. It involves all the Planet and is enhanced by deforestation, pollution, bad ecological policies and so on and by the high release of CO2 (carbon dioxide) in the atmosphere by oil-based industrial activities, cars etc. To assess the impact of deforestation and the possible benefits of reafforestation, as well as to define the best land-use management methods, it is essential to understand exactly how the carbon cycle works. It is well known that plants are a fundamental element in the carbon cycle, thanks to photosynthesis. The recent developments in genomics and proteomics has allowed researchers to better understand, at intracellular level, which mechanisms and reactions are involved in photosynthesis [1]. In this paper mathematical models of the photosynthesis are shown, together with some numerical simulations. Moreover, with the aim of understanding carbon cycle, we focus our attention on some mushrooms, which play a key role in the forest ecosystem as decomposer fungi. They reduce the plant material completely into tiny particles, which can then be absorbed by plants, to start the cycle all over again. Mushrooms use a highly specialised arsenal of enzymes and metabolic pathways to do this. To understand how mushrooms break down plant matter is of increasing interest also for the fact that biomass is a highly promising source of energy for the post-oil age. However, we still need to be able to extract this energy efficiently and completely. This is where the mushroom's metabolism, with its miraculous enzymes, could prove a valuable ally.

Keywords: Global Warming, Photosynthesis, Computational Biology

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Modelling fluids flow and heat transfer in geothermal reservoirs

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Geothermal energy is a clean and sustainable energy source and its exploitation is still under development. Nevertheless, some impact on the environment may occur, especially concerning possible interactions with the phreatic water supplies and/or subsidence phenomena. Therefore, the positive and negative aspects of the environmental impact have to be considered during the development of a geothermal field. The mathematical modelling is an helpful tool to forecast such types of effects, and they can be used to assess the generating capacity of a geothermal field, to design production and injection operations and to plan various reservoir management decisions. In this study we review the main features of the models widely used in geothermal engineering and then we present a case-study worked out for investigate the geothermal reservoirs located in Tuscany (Italy). The aim is to simulate the present state of the reservoir and forecast the effect of the geothermal exploitation in the future, so that the mathematical simulation might be a useful instrument for controlling the reservoir exploitation. This work is part of the larger project MAC-GEO, recently financed by Regione Toscana to carry out an exhaustive research work on the geothermal fields located in Tuscany.

Keywords : geothermal reservoirs; modelling; flow in porous media

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A new model for snow avalanche dynamics based on Bingham fluids

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The purpose of this presentation is to describe the snow avalanche dynamics emphasizing the phenomenon of entrainment, the shape variation and the velocity profile thanks to the peculiar features of the Non-Newtonian fluids, in particular those showing shear thinning and Bingham constitutive behaviour. Two different approaches are proposed to simulate the avalanches numerically: the determination of the relations to transform the avalanche domain in a simple shape domain that doesn't change in time and the level set method, suitable for the free boundary problems. Finally, the characteristics of the variation of the interface between avalanche and snowcover under a similarity hypothesis is put forward. A further refinement of those methodologies, coupled with experimental data, will eventually allow to validate the model proposed.

Keywords : Snow avalanches; Shear thinning; Level set.

Territory vulnerability analysis and support to mobility management during flood events

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When managing an emergency, a fundamental role is played by the efficient control of mobility, in order to guarantee timely and safe rescue operations and to reduce the difficulties of the normal road users. A study of a complex system is required which comprehends not only the road system but also the surrounding environment and the activities that the Civil Protection carries out during emergencies. In particular the road network is the tool with which the Civil Protection can perform the operations of evacuation and of succour to the people and the system restoring. In this context the requirements to be satisfied are: - knowledge of practicability of a given area; - knowledge of its propensity to be damaged on the basis of its physical, functional and systemic characteristics; - analysis of systemic vulnerability of such road network, i.e. the relation between the damage caused to some road network link and its influence on the mobility in the whole road network. For this reason we build a mathematical tool for the analysis of systemic vulnerability both in the prevention phase and in the emergency management phase. Modelling the road network by a graph, such tool is based on graph theory algorithms allowing efficiently to detect disconnections and minimal cuts (arcs whose removal disconnect the graph). The study is focused on floods risk since it represents the main threat for the Italian territory. Anyway, the work provides flexible tools that could be applied also to other hazards. This approach has been successfully applied to the case of the flood of San Rocco al Porto, a village of Lodi province in Italy, by way of historical data collection through interviews to the inhabitants and through the journals.

Keywords :systemic vulnerability, flood, graph theory.

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A bilevel programming approach to tunnel restriction for hazardous material transportation

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According to the ADR 2007 [3] all European tunnels have to be classified into five categories which are more and more restrictive on the passage of vehicles carrying hazardous materials that may lead to an explosion, a toxic release or a fire. In particular the ADR 2007 states that the competent authority has to assign each road tunnel to one of the five possible categories based on the tunnel characteristics and risk assessment including availability and suitability of alternative routes. On the other hand the carriers are free to route the hazardous materials through the network along the most profitable path, i.e. the minimum cost path. This work aims at providing a decision support model to establish which hazardous material category should be allowed to transit across the tunnels while minimizing the total transport risk taking into account how the combination of such choices affect the carrier routes. Unlike [2], here we do not consider the origin-destination shipment requests as input data since this point-to-point information is often not available for every hazardous materials. Indeed as noticed in [1], so far there is no obligation of registration for hazardous material transportation. For this problem we propose a bilevel mathematical programming model. The outer problem is the one faced by the authority that has to decide which tunnels should be forbidden to each hazmat category so as to minimize the total risk of the routes which will be chosen by the carriers. The inner problem is the one of the carriers who aim at routing the hazardous materials though the resulting network at minimum cost. By exploiting the total unimodularity of the inner program we show that the above bilevel optimization model can in fact be reduced to a single level optimization problem that can be solved through a state of the art Mixed Integer Linear Programming solver (e.g. CPLEX).

Keywords: bilevel programming, tunnel restrictions, ADR 2007.

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Collective risks in local administrations: can a private insurer be better than a public mutual fund?

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In this paper we consider the institutional arrangements needed in a decentralised framework to cope with the potential adverse welfare effects caused by localized negative shocks (e.g., natural disasters, terrorist attacks, or even clinical errors), that can be limited by precautionary investments. We model the role of a public mutual fund for covering these "collective risks". We start from the under-investment problem, stemming from moral hazard by Local administrations when the fund is managed by Central government, which takes into account also the equalisation of resources across administrations. We then study the potential role of private insurers in solving the under-investment problem. Our analysis shows that the public fund is always superior to the private insurance solution in the presence of hard-budget constraints. However, when the Central government cannot credibly commit to an optimal transfer rule, private insurers are sometimes able to improve on the mutual public fund solution by inducing a higher level of investments.

Keywords : intergovernmental relations, private insurer, collective risks.

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A Bilevel Flow Model for Hazardous Material Transportation Network Design

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In this work we consider the following hazmat transportation network design problem. A given set of hazmat shipments has to be shipped over a road transportation network in order to transport a given amount of hazardous materials from specific origin points to specific destination points, and we assume there are regional and local government authorities that want to regulate the hazmat transportations by imposing restrictions on the amount of hazmat traffic over the network links. In particular, the regional authority aims to minimize the total transport risk induced over the entire region in which the transportation network is embedded, while local authorities want the risk over their local jurisdictions to be the lowest possible, forcing the regional authority to assure also risk equity. We provide a linear bilevel programming formulation for this hazmat transportation network design problem that takes into account both total risk minimization and risk equity. We transform the bilevel model into a single-level mixed integer linear program by replacing the second level (follower) problem by its KKT conditions and by linearizing the complementary constraints, and then we solve the MIP problem with a commercial optimization solver. The optimal solution may not be stable, and we provide an approach for testing its stability and for evaluating the range of the its solution values when it is not stable. Moreover, since the bilevel model is difficult to be solved optimally, we provide a heuristic algorithm for the bilevel model able to always find a stable solution. The proposed bilevel model and heuristic algorithm are experimented on real scenarios of an Italian regional network

Keywords : Hazmat transportation network design; Bilevel optimization; Heuristic algorithm.

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Hazardous materials transportation risk assessment in a motorway environment

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Hazardous Materials (HazMat) are transported throughout the world in a great number of road shipments. While HazMat accidents are rare events, the commercial transport of HazMat could be catastrophic in nature and poses risks to life, health, property, and the environment due to the possibility of an unintentional release. In order to avoid the risks turning into real events it is necessary to integrate risk mitigation and prevention measures into the transport management. In this paper we present a bibliographic survey on this argument and particular attention is paid to HazMat on the road. We also propose a model for a quantitative risk assessment of HazMat on the road and specially in a motorway environment. The assessment of risk takes into consideration the length of time in transit, the probability of a collision and the risk of population exposure in the event of an incident. The underlying assumptions, the model specifications and the derived results are discussed.

Keywords : risk assessment, dangerous goods route, hazardous materials transportation.

Natural risks in mountain environment and possible application of mathematics

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"Montagna sicura" Foundation (FondMS) is an operational body of Aosta Valley autonomous Region. It works as a documentation and educational center as well as an applied research board. Its activity focuses on glacial and periglacial environment, natural risks in mountain, environmental-friendly developement and safeness in mountaineering and in winter sports. Many of these items deal with mathematical modelisation or can take advantage of. FondMS does not treat directly this topic but works in cohoperation with Universities and reserch boards. The main activity fields in which mathematical modelisation is – or should be – used are the following: (i) hanging glaciers monitoring and icefall forecast and (ii) ice-snow avalanches spreading; on this topic FondMS works in cohoperation with the WAV of ETH – Zurich; iii) rockwalls stability analysis dealing with

permafrost degradation, by means of photogrammetry and numerical modelisation of rock mass mechanics (distinct elements methods); on this item FondMS works in cohoperation with Parma University; iv) assessment of water-flow in glaciers in order to forecast glacial lakes growing and ice-floods; v) assessment of spatial distribution of snow cover thickness and its application to glaciers mass balance and snow water equivalent extimation (used to extimate water availabiliy in catchment basins). The development of new specific methods or the application of existing mathematical models is required for the last two topics.

Keywords :: natural risks, glaciers, mountain environment.

A game theoretic approach for assessing environmental risk

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We consider a soil contaminated by a mixture of different chemicals. The main aim is to evaluate the relevance of each pollutant in determining the level of risk in the area under investigation, with the final aim of ascertaining which cleaning intervention should be preferable. One of the main problems is due to the different correlation among pollutants. More precisely, simple binary mixtures may cause synergic, independent or antagonistic toxic effects, depending also on the concentration of each pollutant. We propose a game theoretic model, in which in a first step we consider a cooperative game with incomplete information on the correlation among three or more pollutants. The result of this step is an index of relevance of each toxicant. In a second step we analyze the possible remediation strategies, taking into account also the cost.

Keywords : Game theory, Risk assessment, Mixture of pollutants.

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Risk assessment for contaminated sites: presentation of the softwares used and a case study

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Risk assessment for contaminated sites (RA) has been recently introduced in the italian legislation by the D.Lgs. n. 152/06 (Testo Unico Ambientale). Risk assessment can be used to estimate human health (and environmental resources) risk from exposure to contaminated media (soil or groundwater) or to estimate risk-based clean-up levels in various media. The procedure of RA is described in two publications of the ASTM standard Risk-Based Corrective Action (1995, 1998) and it’s commonly known as RBCA. Arguments presented: – Risk assessment for contaminated sites: main concepts and description of RBCA – Risk assessment Level 2: description of the conceptual model, input data and international (and Italian) risk levels goals – Software RISC and

RBCA Tool kit used in the RA: a brief description – Risk assessment for contaminated site (human health and groundwater receptor): a case study – Risk assessment for landfills: a brief description of the software Landsim based on the Monte Carlo method

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Design of Buildings under Snow Avalanche Loads

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Avalanche hazard is a complex problem for all mountain countries and it involves several aspects of human life (i.e. transportation, civil constructions, tourism and environment) causing very high social costs. To mitigate avalanche risk in built-up areas, Authorities can exploit only two instruments: urban planning (hazard maps) and defence structures. In the present work, the mitigation of avalanche risk by proper structural design of civil constructions is considered. Thanks to a good design, the structural parts of a building can absorb the avalanche impact with a consequent reduction of vulnerability. Usually, snow avalanche impact pressure is evaluated by means of Bernoulli's law where the avalanche velocity is calculated by means of dynamic models. From the computed impact pressure, a procedure to define the pressure distribution on building's surfaces, based on EuroCode1, is presented and the forces acting on the principal structural components are evaluated by ad hoc structural models. Considering the traditional buildings of Aosta Valley, i.e. their architecture and typical materials, we suggest design requirements to resist powder snow avalanche impact. The structural frame can be designed following the Capacity Design approach and a relationship for column spacing with different materials is derived. The strength of a reinforced wall is assessed referring both to steel and composite reinforcements, and to the use of traditional materials (masonry, timber) coupled with innovative techniques. Only traditional timber roofs are considered, and the strength of bolted and screwed connections is evaluate. Moreover, regarding construction details, which are particularly important in the case of powder avalanche impact, the paper introduces different requirements to design chimney, balcony, windows and doors. In conclusion, an example of avalanche-resistant typical house of Aosta Valley is introduced.

Keywords : avalanche hazard, impact pressure, structural design.

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Risk Management in Power Markets: the Hedging Value of Production Flexibility

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Power Markets are not fundamentally different from other markets. However, electricity trading differs from the usual commodity trading due to the maturity of a supply contract: different market

players enter into the transactions, namely intra-day traders, day-ahead traders (mainly for physical delivery) and on the long-term scale (financial) contract traders. In the first part we will discuss the implications of this heterogeneity for quantitative Risk Management in a business environment of a utility. In particular we address different quantitative approaches based on different models (risk neutral models for derivatives, coherent risk measures for portfolios) for valuating production flexibility of power plants. In particular, we discuss the application of static and dynamic multi-period risk measures for risk assessment in the electricity markets. In the last part of the lecture we will present some recent results concerning the market design for emission trading schemes. The model captures most of the features of the European Emission Trading Scheme. In particular, we confirm the presence of windfall profits criticized by the opponents of these markets. As a result we will discuss alternative allocation schemes which, despite their ease of implementation, lead to smaller windfall profits. The lecture is based on the overview paper Doege J., Fehr M., Hinz J., Luethi H., Wilhelm M. (2008): "Risk Management in Power Markets: The Hedging Value of Production Flexibility" and it can be downloaded from http://www.ifor.math.ethz.ch/publications.

Stochastic Second-Order Cone Programming in Mobile ad-hoc Networks

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We study the semidefinite stochastic location-aided routing (SLAR) model described in Ariyawansa and Zhu (2006) [2] and in Zhu, Zhang, and Patel (2007) [5]. We propose a modification of their model in order to make a better use of the stochasticity inherent in the movements of the destination node. We formulate it as a two-stage stochastic second-order cone programming (SSOCP), see Alizadeh and Goldfarb (2003) [1], where the main first-stage decision variables are the position of the destination node and its distance from the sender node. The movements of the destination node are represented by ellipsoid scenarios randomly generated by uniform and normal distribution in a neighbourhood of the starting position of the destination node. The MOSEK solver (under GAMS environment) allows to solve problems with a large number of scenarios (say 20250) versus the DSDP (under MATLAB framework) solver, see Benson, Ye and Zhang (2000) [3], adapted to stochastic programming framework with 500 scenarios. Stability results for the optimal first-stage solutions and for the optimal function value are obtained.

Keywords : Stochastic Second-order cone programming, mobile ad-hoc networks.

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Avalanche dynamics model to assess avalanche hazard on roads: a case study in the Aosta Valley

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Assessing avalanche risk on roads is a major problem in mountain areas as for example the Aosta Valley.The Alpine Municipalities have to guarantee the safety of the population also during hard winter conditions, when the accessibility to the villages is often fundamental for the tourism activity. . Historical data are important for recognizing dangerous places where avalanche can reach roads, while numerical models can give more information about avalanche velocity, pressure and run-out distance of avalanches with different return period. In this work the avalanche dynamic model AVAL-1D (Bartelt et al., 1999; Christen et al., 2002) was used to asses the avalanche impact on the road connecting the small village of Niel (1535 m asl) to the municipality of Gaby (1045 m asl) in the Lys Valley (AO,NW-Italy). This road crosses different avalanche tracks and traditionally it was opened only during the summer season. Recently, due to the increase of inhabitants in Niel, the road needs to be open also during winter. The major problem is related to an avalanche track which develops for more than 1000 m with a release area of about 45000 m2. The track begins on an open slope but continues mostly on channelled terrain and crosses the road in a gully 20 m wide. Different solutions were thought to protect this part of the road: active defence structures in the release areas or passive defence structures along the path. The best protection is considered to be a tunnel where the channelled avalanche cross the road. Numerical simulations were then performed to calculate the velocity and the pressure of an extreme avalanche in order to dimension the protective tunnel. Moreover, sensitivity analysis were made to address uncertainty and be able to be on the safe side if constructing the tunnel.

Keywords : avalanche dynamic, viability, numerical model .

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Financing the Adoption of Environment Preserving Technologies: a Contract Theoretic Approach

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In this paper we study a setting with polluting firms and risk averse consumers which suffer from pollution. Each firm may choose to adopt a clean technology by bearing a cost, and we employ a mechanism design approach to provide (i) adequate incentives to firms to switch to clean

technologies, and (ii) an insurance scheme for consumers which eliminates their exposure to risk. We study when the consumers' willingness to pay for a lower probability of pollution and for insurance allows to raise enough money to subsidize firms' change of technology. In particular, we study the optimal mechanism from the point of view of consumers, the optimal mechanism from the point of view of firms, and point out the relationships between them.

Representation of Linear Terrain Features in a 2D Flood Model with Regular Cartesian Mesh

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The failure of water control infrastructures, such as dams and levees, leads to highly transient floods with considerable destructive potential. Accurate and realistic numerical simulation of such flows constitutes the first step in carrying out risk and vulnerability analyses and planning for emergency management. The available digital elevation maps (DEM) can be directly used as computational mesh. However, the direct use of DEM also presents some drawbacks. Depending on the resolution, certain linear features, such as roads, railroads and dikes, that may act as obstacles and modify the flow paths and depths, may not always be accurately captured. The present paper describes the use of a cut-cell boundary technique in a 2D shallow water flood simulation model that uses a cell-centered conservative upwinding finite volume scheme. The linear terrain features to be represented in the model are projected onto the regular Cartesian mesh from a GIS shape layer. Flux computation for cells that are affected by the cut-lines is carried out using the Ghost-Fluid method. The overtopping of the cut-lines is allowed and the overtopping discharge is computed using a weir equation. A special version of cut-line method in order to couple This 1D and 2D models to simulate levee overtopping floods. Results assesing the effectiveness of method are presented

Keywords : Shallow Water, Floods, Cut cell.

Long Term Effects Evaluation of a National Typhoon/Flooding Protection Program

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This paper discusses the need to integrate potential risks in any decision and human endeavor: that means to be able to measure and evaluate the effects of a long term mitigation program in order to understand if it actually represents a wise social investment. The Japanese Typhoon mitigation program started in the 50s and is still active. It is studied as an example. In this study the evaluation of the efficiency of the mitigation program is carried out by determining the “investment” necessary to “save a life”. The data used in this study were all derived by publicly available information sources spanning more than half a century (from 1951 to 2005), mainly the http://agora.

ex.nii.ac.jp/digital-typhoon/. When data were missing or were unavailable assumptions and hypotheses were made to bridge the informational gap and still allow to bring forward the discussion. The study follows the general steps of a Quantitative Risk Assessment, insofar it: • Defines the system to be studied • Identifies the hazards (typhoon) in terms of probability of occurrence and magnitude. • Evaluates consequences • Evaluates short and medium term risks. • Examines the effect of the national mitigative policies • Discusses societal benefits vs mitigative investments.

Keywords : disaster, policies, evaluations.

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Rational Methodologies for Land Mines/Unexploded Ordnance Contaminated Land Release or Clearing Decision Making

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Over recent years, the community working towards the aims of the Anti-Personnel Mine Ban Convention (APMBC) has begun to struggle with fundamental questions related to the efficiency of clearance efforts and the need to release land in countries facing strong demographic and social pressures. In a series of studies on Lao PDR it was found that physically cleared ground more than 292 km2 was less than 2% contaminated with Explosive Remnants of War (ERW), denoting a rampant and chronic waste of resources and life-saving efficiency in an industry that lives on the good will of international donors. Very costly mistakes are by and large made at tactical (local/community) decision making level, i.e. when deciding whether to clear, sample or release a SHA . This appears to be indicative of operators clearing ground where, in all likelihood there may be no ERW , instead of undertaking a reasonable, transparent and sustainable analysis of available information and then allocating resources that would maximize the result. Thus various entities worldwide are interested in releasing land and allowing clearance resources to be deployed to areas where mines and UXO presence is most likely. However, unless the consequences of an ERW initiation are included in the information analysis (impact on population, development etc.), i.e. unless “Risk Based Decision Making (RBDM) for Land Clearing and Releasing” is performed, then rational, transparent and sustainable portfolio prioritization at local, regional or national scale cannot be achieved. The Lao PDR case is brought forward as an example and studied in detail. Public awareness and enhanced perception about the effects of mines, driven by media and humanitarian organizations, led to a strong political movement that generated enough agreement and goodwill to ensure a significant number of nations supported an international treaty outlawing anti-personnel mines. This treaty, known informally as the Anti-Personnel Mine Ban Convention (APMBC), was signed by 122 States in December 1997 in Ottawa, Canada. Suspected Hazardous Area (SHA). L. Geddes, Seeking a safe path through the landmine debate, New Scientist, 26 November 2005

Keywords : humanitarian, risk, landmines.

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Sustainable Risk and Crisis Management Ensure Proper Mining Development

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Mining is an ancient occupation, long recognized as being arduous and liable to injury and disease, then exposed to environmental (compliance) liabilities and catastrophic accidents and more recently to public scrutiny and media pressure . Nowadays it can be easily said that there is no mine in this world that can escape public and media scrutiny. Mergers and acquisitions in foreign countries and overseas only contribute to further increasing the resulting exposures, especially when cross cultural aspects complicate communication and understanding of stakeholder positions . Accidents of all kinds remain a significant problem and range from the trivial to the (multiple) fatalities and/or large environmental contamination like in some well renowned underground and tailings failures in various countries in the world . Common causes of fatal injury include rock fall, fires, explosions, mobile equipment accidents, falls from height, entrapment and electrocution. Less common but recognized causes of fatal injury include flooding of underground workings, wet-fill release from collapsed bulkheads and air blast from block caving failure. Finally, tailings dams failures such as for example: • Marcopper, Philippines • Omai, Guyana • Los Frailes , Spain • Merrispruit, South Africa • Baya Mare, Romania represent an important class of well publicized failures often bringing critical consequences to their operators, also from a share valuation point of view. http://www.thedailygreen.com/environmental-news/latest/mining-law-47121101 Mining Companies Use Your Land for Free, and You Pay to Clean Up- Top 10 Most Polluting Mines. http://www.cbc.ca/money/story/2007/12/12/xstrata.html Xstrata in 'consolidation' talks. http://www.ohscanada.com/issues/ISArticle.asp?id=77240&issue=12042007 Third miner death in four months in northern Ontario http://www.wise-uranium.org/mdaflf.html The Los Frailes tailings dam failure (Aznalcóllar, Spain)

Keywords: crises, mines, development.

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Thermal Diffusivity Variability in Alpine Permafrost Rockwalls

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High mountain regions has revealed to be extremely sensitive to increasing temperatures due to global warming and one of the main causes of rockfalls and rockwall instabilities observed in the last years in such areas has been hypothesized to be the permafrost degradation of ice-filled discontinuities. Currently studies on evolution and distribution of permafrost in high mountain regions are mainly based on models driven by few instrumented sites because of the lack of systematic observations caused by the difficulties in making in situ measurements. From the beginning of 2006 within the European project PERMAdataROC (Interreg IIIA, ALCOTRA program), many temperature sensors have been installed on steep rockwalls of the western European Alps in order to acquire hourly rock's temperature values at different depths. Collected data are used to describe rockwall thermal regimes: in this context, heat transfer at depth occurs mainly by conduction and thermal diffusivity is one of the key parameters to be considered because of changes in pore water saturation or phase change of interstitial ice can lead to strong variations of this parameter. The main purpose of this work is to evaluate the temporal course of thermal diffusivity and its variability related to environmental conditions. Thermal diffusivity calculation has been performed over sample periods characterized by heterogeneous atmospheric conditions (sunny, snowy, rainy, dry, damp, etc…) inferred from in situ meteorological collected data. Low frequency periodicities have been removed from measured data series by running mean method in order to de-trend the signals from annual and seasonal oscillations. An harmonic analysis has been performed to define amplitude and phase of the hourly temperature waves at different depths, by means of a least square minimizing optimization procedure. Such optimized signals have been used for thermal diffusivity calculation following amplitude dumping-depth approach.

Keywords : harmonic analysis, rock temperatures, permafrost .

Protection strategies for critical infrastructure systems and supply chains

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A crucial issue in today's distribution, supply and emergency response systems is to guarantee continuity and efficiency in service provision in the face of a variety of potential disruptions. Planning against possible disruptive acts of nature or sabotage is an enormous financial and logistical challenge, especially if one considers the scale and complexity of today's logistic systems. Since it is generally impractical to secure all assets, it is important to devise systematic approaches for identifying critical elements and optimize the protection of key system components. Planners have a range of options available to them in designing the protection of supply chain networks, and their choice of approaches will depend on the financial resources available, the decision maker's risk preference, the type of network under consideration, and other factors. We quantify quantitative models for improving the reliability of infrastructure systems along three axes [1]: 1. Design vs. fortification. Is the model intended to create a new network which is inherently reliable, or to fortify an existent network to make it more reliable? 2. Underlying model. Reliability models generally have some classical models as their foundation. We consider examples based on facility location and network design models. 3. Risk measure. Modelling uncertain disruptions of infrastructure systems requires some measure for evaluating risk. Examples include expected cost and worst-case cost. This talk will mainly focus on models for identifying efficient investments in protection and security measures to enhance the reliability of existing infrastructure sytems. The first basic model

(RIMF) aims at identifying the optimal allocation of limited protective resources among the P facilities of a median system so as to minimize the total transportation costs among facilities and customers in the event of a worst-case loss of R facilities [2,3]. This type of protection models against worst-case disruptions can be formulated as tri-level mixedinteger programs: the top level problem involves the system planner's decisions about which facilities to secure (defender problem); the intermediate level problem models the worst-case scenario loss of R unprotected facilities (attacker model); the bottom level problem reflects the fact that the system users try to operate within the system in an optimal way after the disruption (user model). RIMF can be represented simply as a bilevel model by opportunely formulating the lower level attacker-user problem and solved through an implicit enumeration algorithm. We present some possible variations of the basic RIMF model aiming at capturing additional level of complexity and realism. This includes: a capacitated version where the facilities have limited capacity and customer demand can be lost in case of disruptions [4]; a stochastic version where the number of possible losses is uncertain [5]; a network version where the objective is to harden some network components (nodes or links) so as to minimize the traffic flow delay resulting from a disruption or to maximize the flow of goods or services that can be routed through the supply network after a worst-case loss of some components [6]; an expected-case variation where each facility has a given probability of failure, protection can reduce the failure probability and the objective is to minimize the expected transportation costs by optimally allocating the protection resources [7]. We show some implicit enumeration, reformulation and bounding techniques to solve the resulting multi-level, combinatorial or non-linear problems and report computational results on several geographical data sets with different structural characteristics.

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Dynamics of CO2 prices and implications for optimal producer policies

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In the EU Emissions Trading Scheme CO2 emissions trade allowances (EUA) were introduced as a new tradeable asset, with the aim of reducing CO2 emissions. Market participants face the question how to manage the risk of fluctuating EUA prices and require appropriate tools to hedge and diversify. The issue is relevant for energy producer companies, who need, for a given output, a

specified number of emission certificates that are consumed in the production process. Moreover, evidence shows that the cost of CO2 emission certificates have been incorporated in power prices (Uhrig-Homburg and Wagner, 2008). In this paper, after a preliminary analysis of the dynamics of CO2 spot and forward prices, we suggest how to introduce the cost of CO2 emission certificates in the optimal policy of an energy (non.monopolist) producer. To outline the optimal policy, we follow the approach of integrated risk management as in Falbo et al. (2008).

Keywords : Emission Certificates, Optimal Policies, Energy Producers.

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Asymptotic methods applied to tsunami waves

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A particular asymptotic expansion of the solution of the Shallow Water equations in a small parameter is discussed. This expansion is particularly useful for describing the phenomenology of the tsunami waves. It is gives also in a natural way the integration along the characteristics of the governing equations. The algorithm can be easily implemented on a PC and gives the amplitude and form of the front in few minutes. Using thesemethods it is possible to construct a system of alarm in real time.

A short-term scheduling model for a Generation Company operating on Day-Ahead and Physical Derivatives Electricity Markets

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A decision support procedure is developed for the short-term hydro-thermal resource scheduling problem of a Generation Company operating in the liberalized electric energy market and aiming at profit maximization. The generation company is supposed to be a price-taker, i.e. without influence on the electricity market price: therefore the profit maximization model of the problem faced by the GenCo must take into account both technical problems of generation and uncertainty of electricity prices. The power producer may hedge against the significant risk factor represented by energy market-price by participating in the Derivatives electricity Market. The derivatives products

considered in this work are the futures contracts. These contracts can be either physical or financial. The financial ones are not taken into account in this work, because they are just an exchange of money and do not affect the generation company short-term operation. By contrast, a physical futures contract entails a quantity of energy that has to be produced mandatorily by the generation company so it changes the daily operation of the units and therefore have to be taken into account in the short-term scheduling model. In the short-term horizon the generation company has to solve the unit commitment problem for the thermal units and the economic dispatch problem for the available hydro plants and the committed thermal units, with decisions being compatible with both technical constraints and market constraints. Numerical results obtained by the model on realistic case studies are presented.

Keywords : short-term scheduling, electricity markets, futures contracts.

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