DAM/MR/0201/3

DAMOCLES

DEBRISFALL ASSESSMENT IN MOUNTAIN CATCHMENTS FOR LOCAL END-USERS

Contract No EVG1 - CT-1999-00007

COORDINATOR'S MANAGEMENT REPORT FOR THE THIRD PROGRESS MEETING WITH ATTACHED CONTRACTOR AND ASSISTANT CONTRACTOR PROGRESS REPORTS FOR THE PERIOD 1 March – 31 October 2001

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Project web site : http://damocles.irpi.pg.cnr.it/

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COORDINATOR'S MANAGEMENT REPORT

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1.1 OBJECTIVES OF THE REPORTING PERIOD

This report covers the period 1 March – 31 October 2001. The main project objectives, by workpackage, were:

WP1 : Completion of fieldwork in Upper Aragón and Gallego river basins, preparation of a database on debris flow characteristics and analysis to establish statistical relationships for predicting these characteristics. Delivery of preliminary debris flow relationships.

WP2 : Development and testing of the STONE rockfall model. Development of simple physically-based hillslope stability models for comparison with the statistical multivariate model for debris flow probability. Application of the probabilistic modelling approach in the Benasque valley, Spanish Pyrenees. Delivery of a review on granular flows and numerical modelling of landslides.

WP3 : Improvement and preliminary validation of the one-dimensional channel routing component of the debris flow impact model, for the Rio Lenzi test site (Italy). Development of the two-dimensional model component for debris flow propagation and sedimentation in the fan area. Selection of a model test site in the Benasque valley. Delivery of a debris flow database for the impact model.

WP4 : Data assembly (including field and laboratory work) for the Valsassina (Italy) and Ijuez (Spain) focus basins. Creation of the SHETRAN model files. Preliminary simulations for both basins.

WP5 : Continued maintenance of the project website and testing the use of GIS-based web technology for publishing thematic and landslide hazard maps on the internet. Continued liaison with the project end-users. Preliminary preparation of Year 3 training programme.

1.2 SCIENTIFIC/TECHNICAL PROGRESS

1.2.1 Gantt Chart

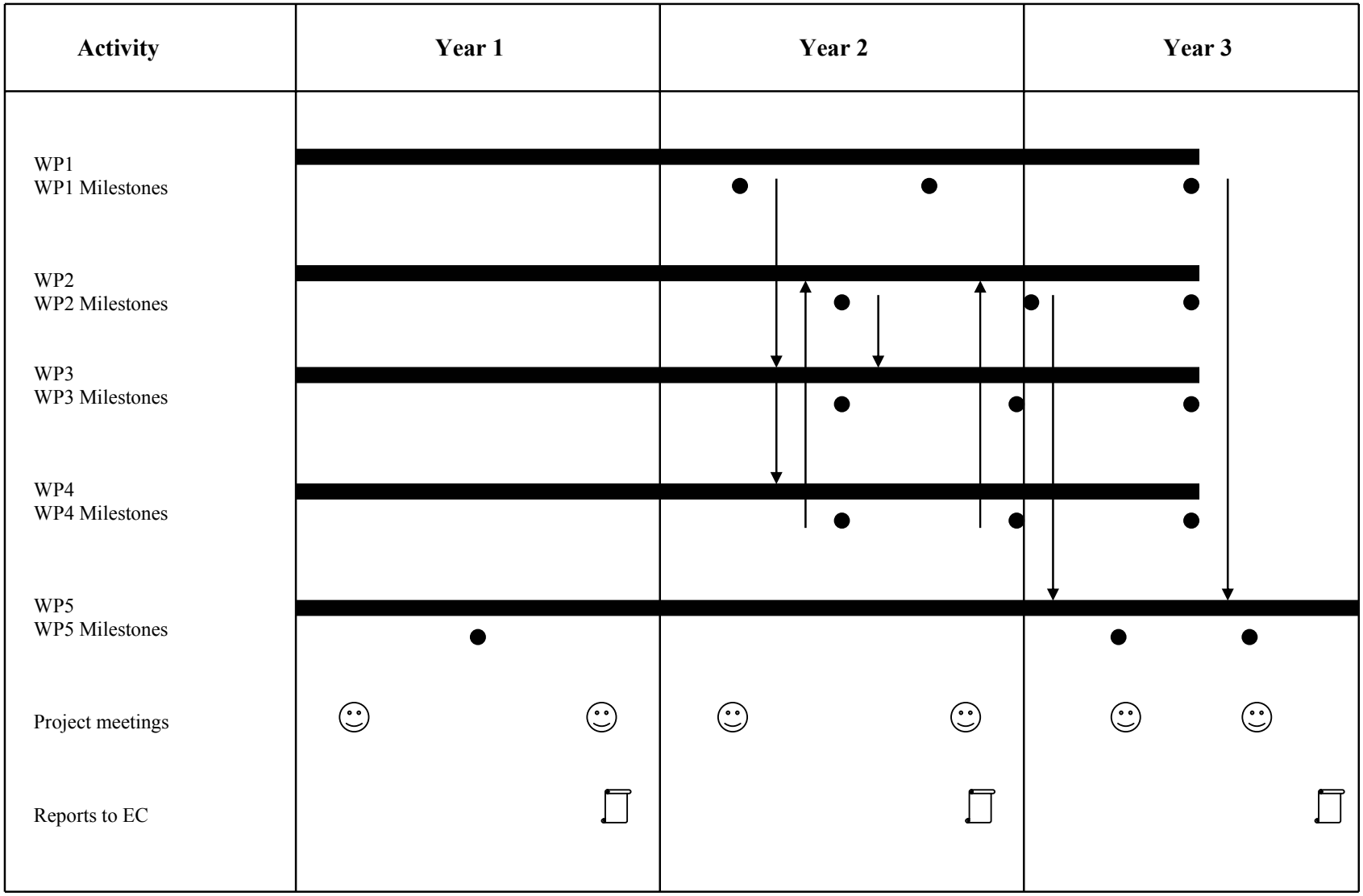
The project Gantt Chart is attached. This remains correct for the reporting period. However, a revised version will be produced in the next reporting period to accommodate the problems described in Section 1.4.

1.2.2 Resources Used

A comparison of the originally planned and actual use of manpower resources is shown in Table 1. Several partners are contributing more than originally envisaged (but without requiring additional EC funding).

A comparison of the originally planned and actual use of financial resources is shown in Table 2.

Gantt Chart for the DAMOCLES Project



Vertical arrows indicate exchanges between workpackages at the times indicated by the milestones.

Table 1 Manpower resources used from the start of the project to Month 20 and comparison with the originally planned use

WORK PACKAGE	RESOURCE USE IN PERSON-MONTHS FOR PARTNER									TOTAL
	1-UNEW		2-UNIBICO		3-CNR-IRPI	4-UNIPD		5-CSIC-IPE	6-IGME	
	Add*	Perm*	Add*	Perm*		Add*	Perm*			
Coordination	4	1.67								5.67
WP1	0	0	3	9	0	3	2.5	46.25	12.34	75.59
WP2	0	0	15	23	5.6	0	0	1	1.84	46.44
WP3	0	0	0	0	0	8	31	1	2.19	42.69
WP4	18.5	2	0.5	1.5	0	0	0	2	0	24.5
WP5	0.1	0.6	0.6	1.0	4.8	0	0.5	1.5	2.33	11.43
Total Use to Month 20	22.6	4.27	19.1	34.5	10.4	11	34	51.75	18.7	206.32
Original Planned Use to Month 20	28.33	5	13.33	11.6	4.33	27	31.33	43	3.33	167.3

*Add = additional personnel; Perm = permanent personnel

Table 2 Financial resources used from the start of the project to Month 20 and comparison with the originally planned use

EXPENDITURE TYPE	EXPENDITURE IN EUROS FOR PARTNER							TOTAL
	1-UNEW		2-UNIBICO	3-CNR-IRPI	4-UNIPD	5-CSIC-IPE	6-IGME	
	Coord*	Proj*						
Actual Total	9,906	106,590	112,752	53,089	59,600	201,688	34,414	578,039
Original Planned Total	12,860	148,460	148,795	49,168	116,764	220,503	37,290	733,840

* Coord = DAMOCLES coordination; Proj = Newcastle project

1.2.3 Highlights of Progress in Each Workpackage

Following the emphasis on data assembly in Year 1, there has been increasing work on model development and testing. Full details of the work are given in the attached partner reports. The main achievements for each workpackage are summarised as follows.

WP1 Development of functional relationships for debris flow behaviour derived from field data and existing databases.

(i) Detailed field measurements have been made of debris flow characteristics and a summary table has been produced. Using statistical analysis, predictive relationships for these characteristics have been derived (e.g. debris flow runout distance) for use in refining the models of WP3 and WP4. A project report has been submitted to the Coordinator entitled "Debris Flow Relationships in the Central Spanish Pyrenees". (Pyreneen Institute of Ecology)

(ii) A project report has been submitted to the Coordinator entitled "Distribution of Hillslope Debris Flows in the Flysch Sector of the Central Spanish Pyrenees", which presents a statistical description of the factors determining debris flow location. (Pyreneen Institute of Ecology)

(iii) An analysis has been carried out of the frequency of debris flow occurrence and its relationship to land use and rainfall in the Central Spanish Pyrenees. Rainfall is found to be the bigger influence. In the flysch sector, rainstorms with a return period of 10 years, or even less, are enough to trigger shallow landslides. (Pyreneen Institute of Ecology)

(iv) 188 debris flows have been mapped in the Benasque valley (Spanish Pyrenees) and geomorphological mapping has been carried out to describe the processes and deposits in the area. These data will form the basis for application of a regional model for predicting the spatial distribution of debris flows. (Geological and Mining Institute of Spain)

WP2 Development of a GIS hazard assessment methodology using field data, available databases and model developments

(i) Additional data have been collected in support of the GIS debris flow and rockfall modelling activities. (University of Milan-Bicocca)

(ii) Further experience has been gained with the STONE rockfall model. A capability has been added for random evaluation of model parameters within a user-specified range, to allow for uncertainty in parameter values. Further capability for accounting for natural variability is provided by allowing more than one boulder to be launched from a site. Accurate calibration of the model parameters has been carried out using thematic maps and a database of observed rockfalls. Model performance has been investigated at different spatial scales and with different data availabilities within the 600-km^2 Lecco Province. Demonstration outputs include frequency of rockfall, three-dimensional display of rockfall trajectories (for free-fall, bouncing and rolling) and information such as velocity of fall and height of the trajectory above the ground. A revised rockfall hazard map has been produced for Lecco Province, which could be

used in planning protection measures. (University of Milan-Bicocca, CNR-IRPI Perugia)

(iii) Three simple physically-based, spatially-distributed models of shallow landslide occurrence at the basin scale have been developed and applied to the event of 28 June 1997 in the Valsassina area of Lombardy. The results are being compared with those of the statistical multivariate model. Comparison (and integration) of different modelling approaches is an important project task and the above comparison will eventually be extended to involve SHETRAN (WP4). (University of Milan-Bicocca, CNR-CSITE Bologna)

(iv) A project report (Project Deliverable 5) has been submitted to the Coordinator entitled "Granular Flows and Numerical Modelling of Landslides". (University of Milan-Bicocca)

(v) Preliminary work has been carried out for the application of the regional scale models of debris flow probability and rockfall hazard to the Benasque valley, Spanish Pyrenees. (Geological and Mining Institute of Spain)

WP3 Development of a small basin debris flow impact model using field data and a physically-based modelling approach

(i) The one-dimensional channel routing component (MODDS, Muskingum-Cunge One-Dimensional Debris-flow Simulation) has undergone further development, including routing an arbitrary shape of the debris flow wave, automatic control of the model stability condition, routing with bank overflow, determining superelevation at bends and accounting for potential bridge obstruction. A preliminary validation has been carried out for the Rio Lenzi (Autonomous Province of Trento). (University of Padova)

(ii) The two-dimensional model component for debris flow propagation and sedimentation on the fan area has been developed. The fan is represented by a grid of square cells: transfer of debris flow material from one cell to another occurs under conditions of either uniform flow as a function of gradient or flow over a broad-crested weir. Preliminary simulations have been carried out for the Rio Lenzi fan. (University of Padova)

(iii) The small Sahún basin in the Benasque valley has been selected as a test site for the model in the Spanish Pyrenees. A detailed topographic survey of the main channel and fan area has been carried out. (University of Padova, Geological and Mining Institute of Spain)

WP4 Application of a physically-based, basin scale, landslide erosion and sediment yield model to land use and climate scenario analysis for selected sites

(i) Field visits to the Valsassina (Italy) and Ijuez (Spain) focus areas were carried out to collect soil property data, to measure channel dimensions and sediment characteristics and to be familiarized with the areas. Soil samples were brought back to the University of Newcastle for laboratory analysis and soil property maps have been

completed. (University of Newcastle, University of Milan-Bicocca, Pyreneen Institute of Ecology)

(ii) Catchment time series and property data have been assembled for both focus areas and used to create the necessary files for running and testing the SHETRAN landslide model. The data include precipitation and evaporation records, runoff records, topographic, soil and vegetation maps and landslide inventories. (University of Newcastle, University of Milan-Bicocca, Pyreneen Institute of Ecology)

(iii) Preliminary SHETRAN simulations have been carried out for the two focus areas. (University of Newcastle)

(iv) Validation of the SHETRAN landslide model for the Llobregat catchment has been completed. The results demonstrate an ability to bracket the observed occurrence of debris flows with simulated distributions and to determine catchment sediment yield within the range of regional observations. (University of Newcastle)

WP5 Dissemination of the project deliverables via training courses, workshops, implementation by end-users and placement of demonstration material on a web site

(i) The project website has been upgraded to improve its readability and speed of access. It is frequently updated and, in particular, contains all the progress reports and progress meeting minutes. The GIS-based web technology for publishing thematic and landslide hazard maps on the internet is provided by the ArcIMS™ internet map server. This has already been used to publish maps for the Valsassina focus area and maps for other project sites are in preparation. (CNR-IRPI Perugia)

(ii) The partners remain in contact with their end-users. The Padova team meets once a month with its end-users, who want to use the debris flow model. The Milan-Bicocca team is in continuous contact with its end-user, who would like to learn how to use its hazard analysis technique. The Pyreneen Institute of Ecology team is in contact with its Aragón end-users but with not very frequent meetings; the end-users prefer maps and results rather than models. The Geological and Mining Institute of Spain is both a partner and an end-user; they are already learning how to use the WP3 debris flow model and the Pyreneen Institute of Ecology mapping techniques. (University of Milan-Bicocca, University of Padova, Pyreneen Institute of Ecology, Geological and Mining Institute of Spain)

(iii) A joint programme for a training course on the WP3 debris flow model and the WP2 GIS-based statistical multivariate model has been prepared. Ten trainees will attend the course in Padova and Milan during 9-13 September 2002. (University of Padova, University of Milan-Bicocca)

(iv) Two workshops for publicising the project results will be held at Zaragoza in May 2002 and Milan at the end of 2002.

1.2.4 Workpackage Integration

Integration of modelling approaches

The previous management report described the complementary characteristics of the WP2, WP3 and WP4 models. This complementarity is to be demonstrated as follows.

The local scale debris flow model of WP3 provides a means of investigating in detail the hazard (in terms of sediment deposition) at sites identified from the WP2 statistical multivariate model as requiring attention. A demonstration link is proposed for the website, in which the user will be able to select a site from a WP2 regional hazard assessment map, run the WP3 model for that site for different debris flow inputs and view the impacts.

The SHETRAN basin scale, landslide sediment yield model can investigate patterns of debris flow occurrence for possible scenarios of future climate and land use and thereby provide a basis for recalibrating the WP2 model for future altered conditions. It is proposed to demonstrate this process for the Valsassina focus area.

Integration of debris flow relationships with models

The WP1 data and process relationships form the basis of, or will improve, the model developments of WP2, WP3 and WP4. The WP2 hazard assessment model requires data on the spatial distribution of debris flows and the controlling factors for discriminant analysis. The WP3 local scale debris flow model needs information on debris flow characteristics as its input. The WP4 SHETRAN model will use the WP1 debris flow relationships to improve its current rule-based description of debris flows.

Integration of the end-users within the project

This is covered in Section 1.2.3, WP5.

1.3 MILESTONE AND DELIVERABLES

The project has successfully met its milestone (shown on the Gantt chart) and deliverable deadlines through the reporting period, as follows:

Month	Date	Workpackage	Milestone/ Deliverable	How Provided
6	November 2000	WP5	Website on line	Website
15	May 2001	WP1	Preliminary debris flow relationships	Report to Coordinator
18	August 2001	WP2	Granular flow modelling report (Deliverable 5)	Report to Coordinator
18	August 2001	WP3	Preliminary impact model	Attached report by University of Padova
18	August 2001	WP4	Preliminary simulation data	Attached report by University of Newcastle

The project was also on target to provide Deliverable 1, the final WP1 debris flow relationships, during November 2001.

1.4 DEVIATIONS FROM THE WORK PLAN AND/OR TIME SCHEDULE

Work has generally unfolded as planned. However, two partners recently encountered problems which will delay their work. The University of Newcastle's project research associate, Dr Ahmed El-Hames, left in November 2001 for a permanent position at the King Abdulazziz University in Saudi Arabia. He will not be replaced until March 2002. The University of Padova's end-user and subcontractor ARPAV (Arabba Avalanche Centre, Veneto Region) has not signed its contract. A substitute contract has therefore been negotiated with the Associazone Italiana di Idronomia to enable the required work to be carried out. There has also been a three-month delay in appointing two of the Padova team's research assistants. The two partners will provide revised work programmes to ensure that their deliverables are successfully provided by the end of the project.

1.5 COORDINATION BETWEEN PARTNERS AND COMMUNICATION ACTIVITIES

Progress meetings were held at Padova during 9-11 May 2001 and Newcastle during 1-2 November 2001. Copies of the minutes have been submitted to the EC.

Between the progress meetings partners circulate short "bullet-point" reviews of progress at two-month intervals, as a way of keeping each other informed of what is being achieved.

There has been excellent collaboration between the partners over data collection, model application and dissemination of project results. In particular:

- the University of Newcastle, University of Milan-Bicocca and Pyreneen Institute of Ecology have collaborated over data collection to support SHETRAN applications;

- the University of Padova and the Geological and Mining Institute of Spain have collaborated over the application of the debris flow impact model in the Spanish Pyrenees;

- the Pyreneen Institute of Ecology and CNR-CSITE Bologna are jointly investigating methodologies for deriving debris flow susceptibility maps;

- the Pyreneen Institute of Ecology, the University of Padova and the University of Milan-Bicocca are collaborating on the report on debris flow relationships;

- the Universities of Padova and Milan-Bicocca have prepared a joint programme for a training course on their respective models.

Several partners have been or will be involved in conferences and other meetings as described in the attached reports.

1.6 DIFFICULTIES IN MANAGEMENT AND COORDINATION

There are no difficulties to report.

APPENDICES

Progress reports by:

- University of Newcastle upon Tyne, UK
- University of Milan-Bicocca, Italy
- CNR-IRPI, Italy
- University of Padova, Italy
- Pyreneen Institute of Ecology, Spain
- Geological and Mining Institute of Spain