

DAMOCLES PROJECT

DETAILED REPORT OF ASSISTANT CONTRACTOR FOR THE FIFTH PROGRESS MEETING

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SUMMARY OF MAIN WORK CARRIED OUT DURING THE REPORTING PERIOD, 17/5/02 – 21/11/02

Application of 1-D sub-model (MODDS) of the University of Padova team (WP3) to know the debris flow impact at local scale in the Sahún catchment.

Presentation of a preliminary debris flow probabilistic map for the whole area of Benasque (work done together with the IPE team) in the XI International congress on Industry, Mining & Metallurgy. Zaragoza, June 2002.

Delimitation of rockfall source areas and blocks mapping in the Benasque valley. Application of a 3-D rock-fall simulation program (STONE), made by University of Milano Bicocca and the *Consiglio Nazionale delle Ricerche*, Istituto di Ricerca per la Protezione Idrogeologica, to the Benasque valley. A communication was presented in the 4th EGS Plinius Conference, Mallorca, October 2002.

Estimation of the origin (debris flow, fluvial or mixed) of all the alluvial fans of the Benasque area according to the Melton number and the slope of the fan.

Attendance to the DAMOCLES training course about debris flow modelling at Padova and Milan Universities, September 2002.

3D cartography of the debris flows in the Benasque valley.

SECTION 1: Objectives of the reporting period

The objectives of the reporting period were related with the following matters:

- 1) Field data trying to characterize geologically the occurrence of the debris flows observed and the potential rockfall areas. Consideration of more detail observations of biotic factors (vegetation and land use).
- 2) Applying the regional models for predicting areas of debris flows in the Benasque valley trying to deep into more detailed geological and biological conditions.
- 3) Applying the Milan team regional model (WP2) for predicting areas of rockfalls in the Benasque valley.

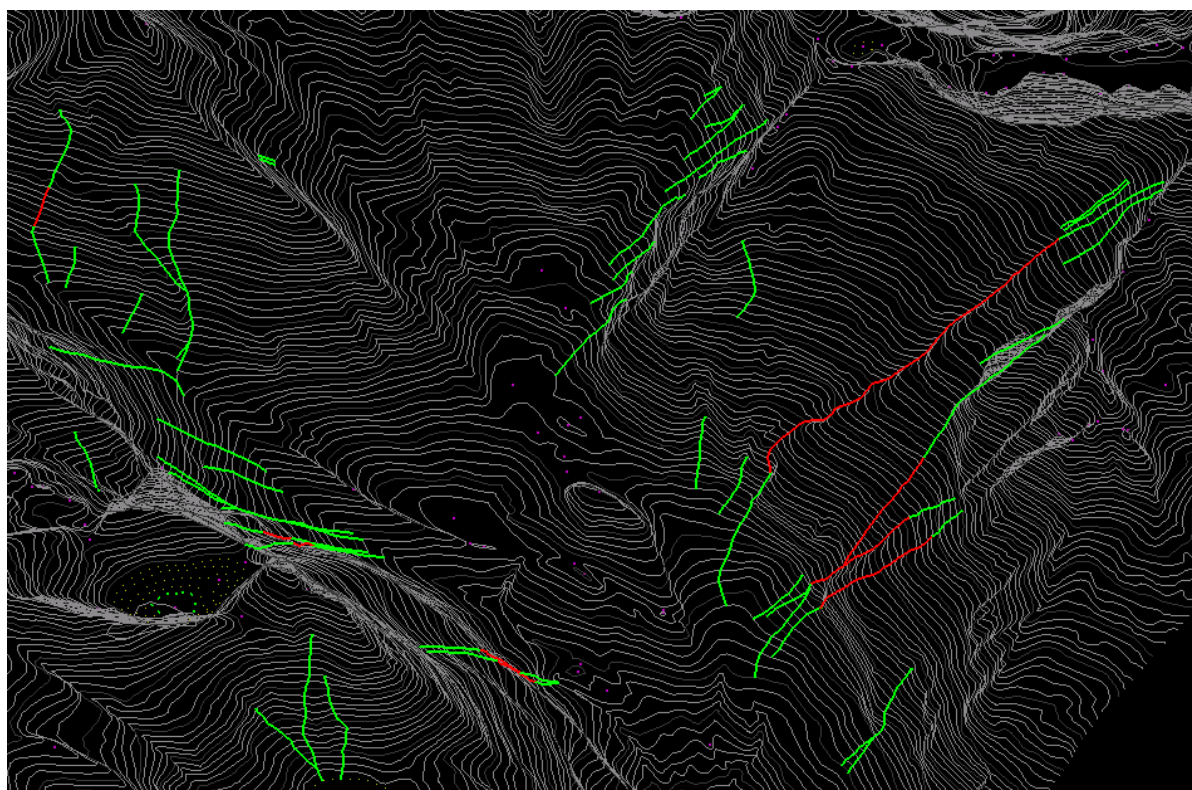
- 4) More detail studies in Sahun Catchment: Improve the thematic maps (geomorphology, lithology, vegetation and land use) at 1:5000 scale. Keep on with the survey to the population of Sahun and close villages and collect information from the town halls about historical events.
- 5) Running the Padova team local model (WP3) on the Sahún fan area.
- 6) For doing 3) and 5) activities, was planned the assistance to the training courses of the Damocles Project to be celebrated in Padova and Milan.

SECTION 2: Scientific/technical progress made in different work packages according to the planned time schedule

2.1.- WP1 Development of functional relationships for rapid slope failures:

Some field works have been carry out to improve our knowledge about the areas were the debris-flows occurred and to try to characterize the magnitudes of this flows. Some precision about the moment were this events began to take place have been made trying to date some recent faults in relationships with the last postglacial period. Some samples of carbon have been pick up in some trenches made near sackungen faults and have been sent to a Laboratory.

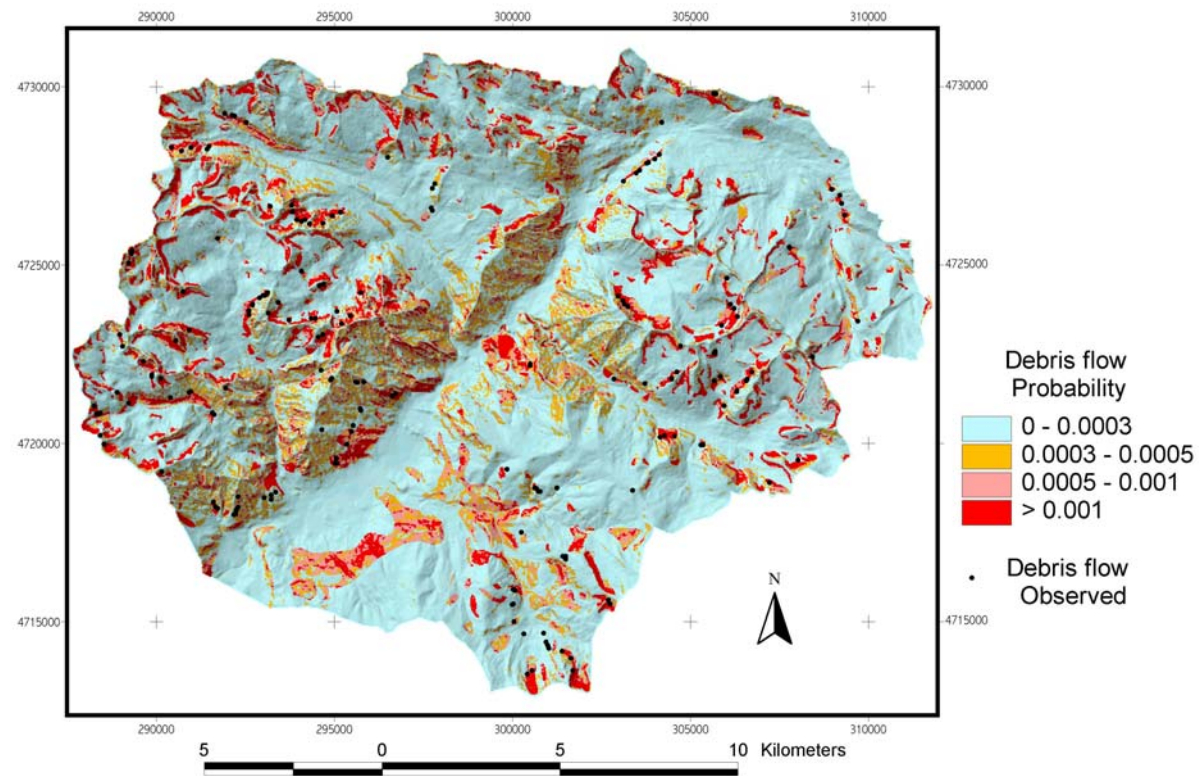
A new 3D debris flow cartography has been done (see example).



Close up of the 3D debris flow cartography

For the regional (WP2) and local (WP3) analysis some georeferenced thematic maps (lithology, vegetation, land use, geomorphology and maps derived from the DTM such as slope and aspect) have been collected and used.

Together with the IPE team, a debris flow probabilistic map for the whole area of Benasque was obtained. The terrain was divided in 25 x 25 m cells and a binary logistic regression was applied. The 70% of the observed debris flows were predicted by the model. The variables or factors explaining the spatial distribution of hillslope debris flows were lithology (in particular, quaternary deposits and the regolith developed over the limestone and slate), slope and curvature of the slopes.

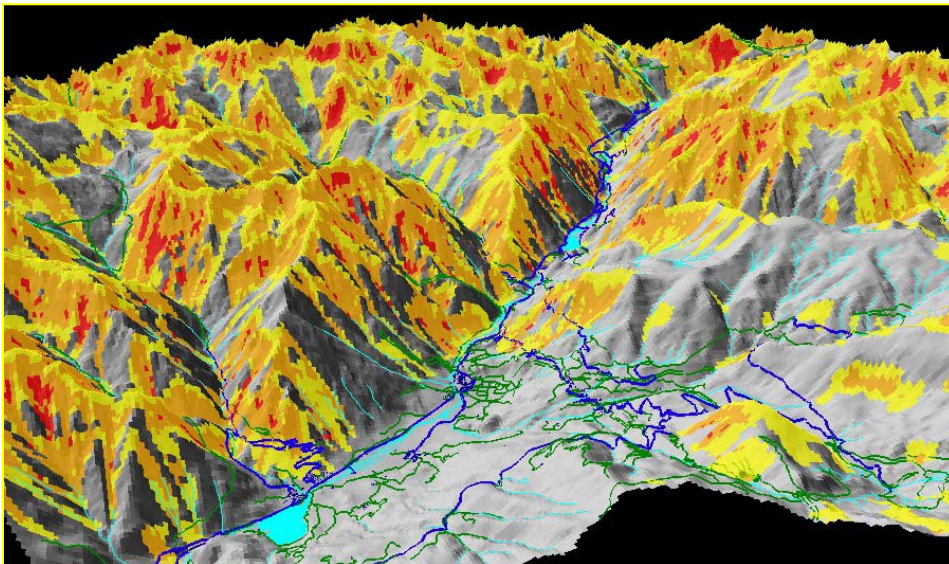


Debris flow probabilistic map of the Benasque valley

We consider this map a first attempt to know the spatial probability of occurrence of some of the debris flows linked with some specific lithology. In our mind is to apply an other analysis taking into account other areas where debris flows can occur and to use a non regular compartmentation of the territory to be analysed (subcatchments instead of pixels)

Together with the University of Milan-Bicocca team, a preliminary evaluation of the rockfall hazard has been carried out in the Benasque valley by using a 3D numerical model named STONE that simulates rockfall motion. STONE has been developed by the aforementioned university together with the CNR of Perugia, in particular with Dr. F. Guzzetti.

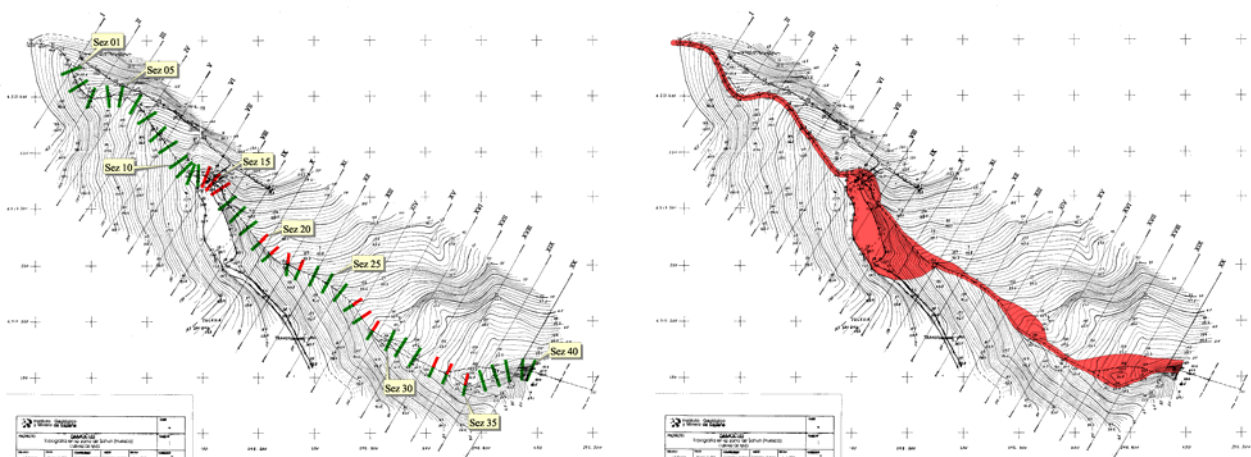
Lithology, geomorphology, land use, vegetation, outcropping areas, rockfall source areas, rockfall blocks, Q-deposits, water, snow and ice covered areas and a DEM with a ground resolution of 25 m were provided for running STONE.



Rockfall hazard assessment in the Benasque valley

Together with the University of Padova team (WP3), a debris flow impact model (MODDS software created by this team) were applied with the data of the Sahún catchment and alluvial fan.

The land use, vegetation, lithology and geomorphology of the catchment were described, the cross sections along the channel through the fan were surveyed, the geological index was calculated and the water flow peak at the exit of the basin was obtained through the hidro-meteorological method to estimate the magnitude of a debris flow great event and to estimate the impact of the debris flow in terms of sediment deposition on the alluvial fan.



Cross sections along the channel through the Sahun fan (left) and affected areas predicted by the model (right)

2.2.- WP5 Dissemination of project deliverables:

As end-users, we have applied to our study area, three models that have been referred above.

We have updated, with the description of our study area and with reports, the Damocles Web site.

GANTT CHART UPDATE

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Works	march 02	april	may	june	july	august	sept	october	nov	dec	jan 02	feb03
1	Planned											
	Real*											
2	Planned											
	Real											
3	Planned											
	Real											
4	Planned											
	Real											
5	Planned											
	Real											
6	Planned											
	Real											

* (Real dedication until Milan meeting 22 Nov 02)

Works:

- 1) Field data trying to characterize geologically the occurrence of the debris flows observed and the potential rockfall areas. Consideration of more detail observations of biotic factors (vegetation and land use).
- 2) Applying the regional models for predicting areas of debris flows in the Benasque valley trying to deep into more detailed geological and biological conditions.
- 3) Applying the Milan team regional model (WP2) for predicting areas of rockfalls in the Benasque valley.
- 4) More detail studies in Sahun Catchment: Improve the thematic maps (geomorphology, lithology, vegetation and land use) at 1:5000 scale. Keep on with the survey to the population of Sahun and close villages and collect information from the town halls about historical events.
- 5) Running the Padova team local model (WP3) on the Sahún fan area.
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TABLE COMPARING PLANNED AND ACTUAL USES

		Planned Dedication	Real Dedication
MANPOWER			
Year 1 Mainly WP1 1-3-01 a 28-2-01	Santiago Ríos	1,25 months	3,05 months
	Antonio Barnolas	0,75 months	0,30 months
	Enrique Acosta	Not considered in the Project	8 months
Year 2 Mainly WP1 1-3-01 a 28-2-02	Santiago Ríos	0,78 months	1,26 months
	Antonio Barnolas	0,47 months	0,35 months
	Enrique Acosta	Not considered in the Project	8 months
Year 3 Mainly WP5 (real dedication until Milan meeting 22 nov 02)	Santiago Ríos	1,09 months	0,90 months
	Antonio Barnolas	0,66 months	0,2 months
	Enrique Acosta	Not considered in the Project	7 months
FINANCIAL RESOURCES in €			
Year 1	Personnel	8.291	11.522,6
	Travel and subsistence	5.602	1.573,7
	Subtotal	13.893	13.096,3
	Overheads	11.442	15.903
	Total y1	25.335	28.999,3
Year 2	Personel	5.182	6.551
	Travel and subsistence	5.600	5.537
	Subtotal	10.782	12.088
	Overheads	7.151	9.040
	Total y2	17.933	21.128
Year 3 (real dedication until Milan meeting 22-nov-02)	Personel	7.255	4.672
	Travel and subsistence	2.802	1.028
	Subtotal	10.057	5.700
	Overheads	10.011	6.447
	Total y3	20.068	12.147

SECTION 3: Milestones and deliverables obtained

We have participated in the milestone D10 attending the End-user training of Padova and Milan

SECTION 4: Deviations from the work plan and/or time schedule and their impact on the project

They are not significant deviations from the work plan of our last second year report.

SECTION 5: Coordination of information between partners and communication activities

The work about debris flow probability in the Benasque Valley, carried out together with the IPE team, was presented in the XI International congress on Industry, Mining & Metallurgy. Zaragoza, Spain. June 2002.

Debris flow propagation in the Sahún alluvial fan, carried out together with the University of Padova team, was presented during the DAMOCLES training course at Padova, Italy. September 2002.

Analysis of rockfall in the Benasque Valley, carried out together with the University of Milan-Bicocca team, was presented in the 4th EGS Plinius Conference. Mallorca, Spain. October 2002.

SECTION 6: Difficulties encountered at management and coordination level and proposed/applied solutions

No difficulties have been found

SECTION 7: Plan and objectives for the next period

We will try to analyse the spatial probability of debris flows in our territory taking into account the areas that can be affected by the flows or by the sedimentation of their materials. In particular, an attempt of analysis based in subcatchments or natural partition of the territory to be analysed.

SECTION 8: Publications

Lorente A, Acosta E and Rios S. (2002) – Application of a regional model for the prediction of debrisflows hazard areas in the Ésera upper basin (Central Spanish Pyrenees). Proceedings of the XI International congress on Industry, Mining & Metallurgy. Zaragoza, Spain, June 4th to 6th 2002.

Agliardi F, Crosta GB, Acosta E and Rios S. (2002) – Regional rockfall hazard assessment in the Benasque Valley (Central Spanish Pyrenees) using a 3D numerical approach. Proceedings of the 4th EGS Plinius Conference. Mallorca, Spain, October 2002.