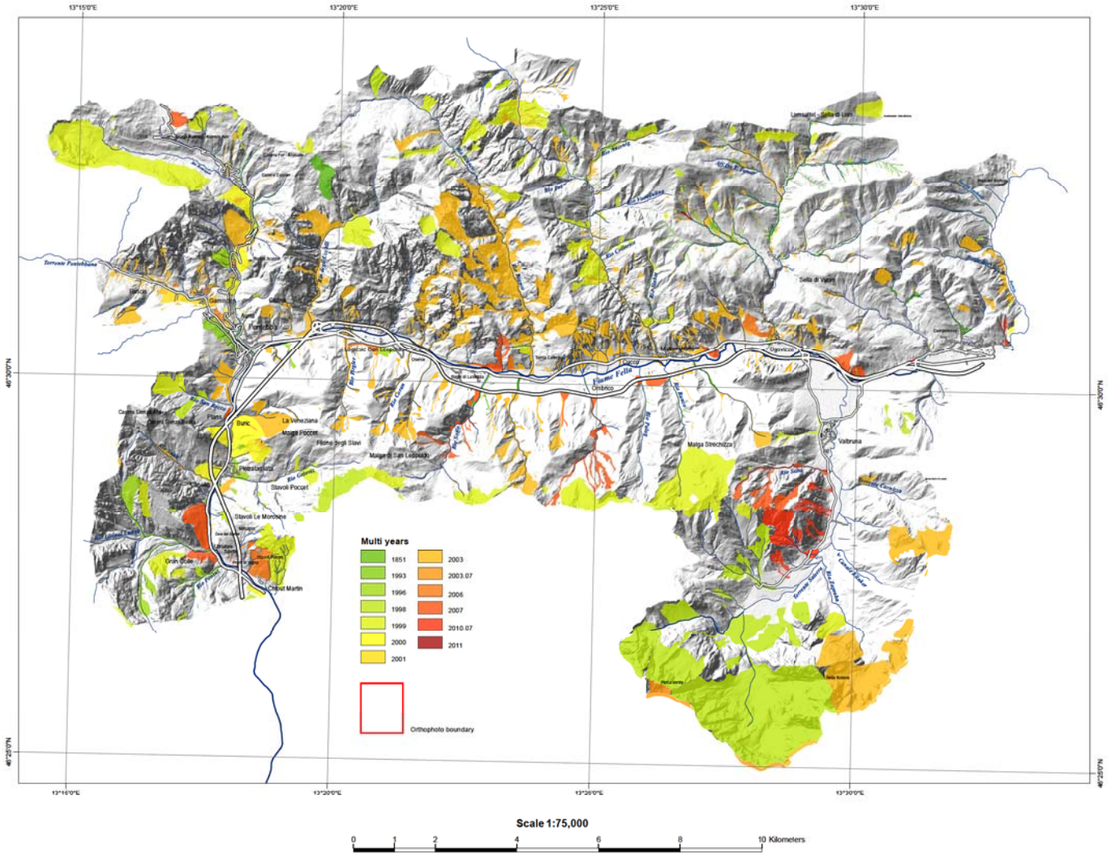
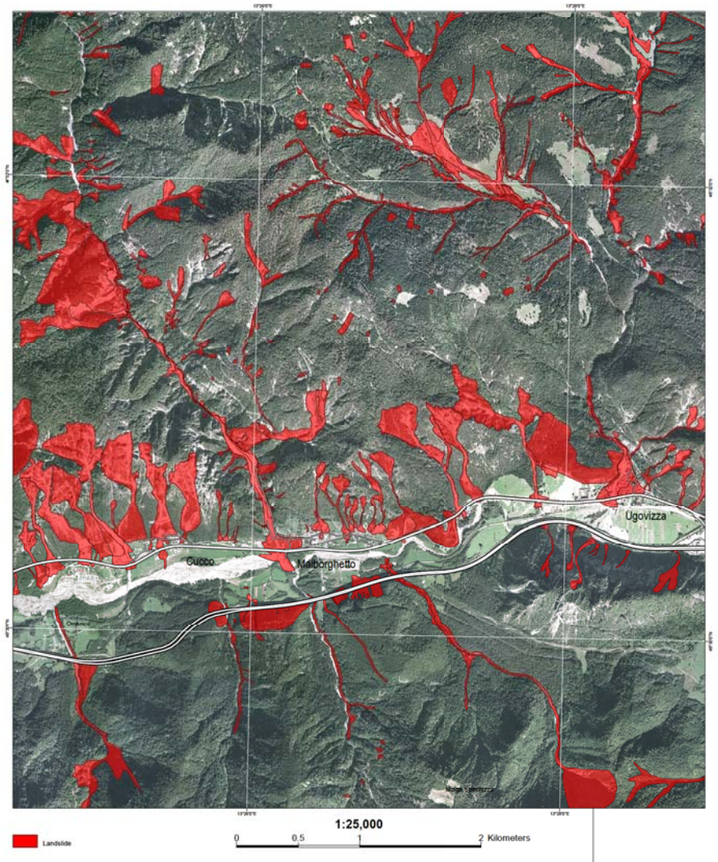
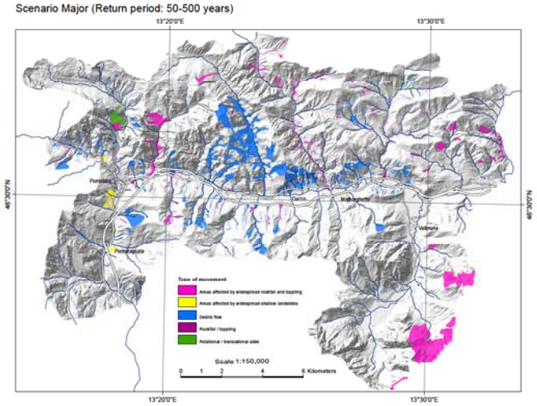
Multi - annual landslide inventory



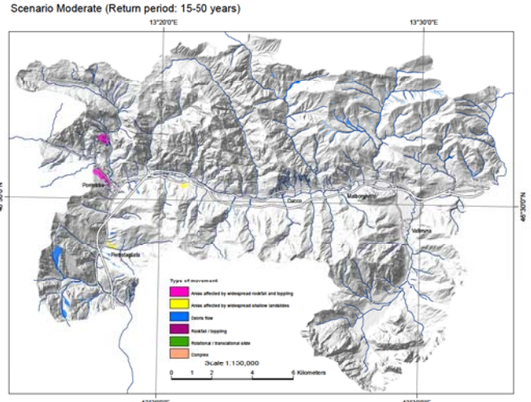
Orthophoto with debrisflows of 2003



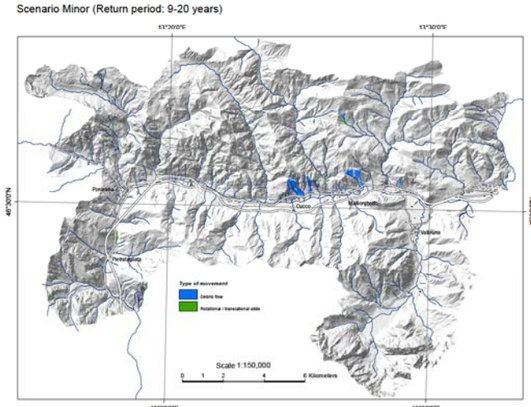
Scenario Major (Return period: 50-500 years)



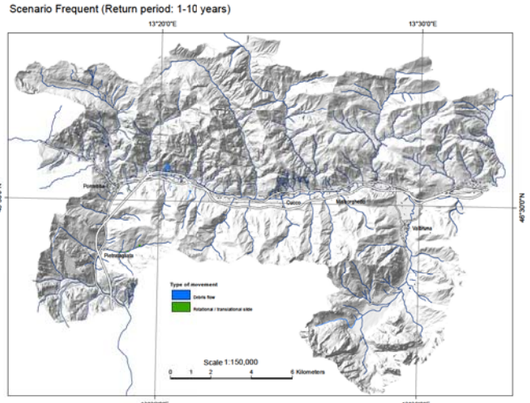
Scenario Moderate (Return period: 15-50 years)

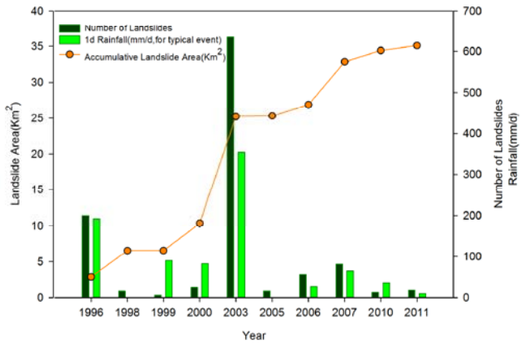


Scenario Minor (Return period: 9-20 years)



Scenario Frequent (Return period: 1-10 years)





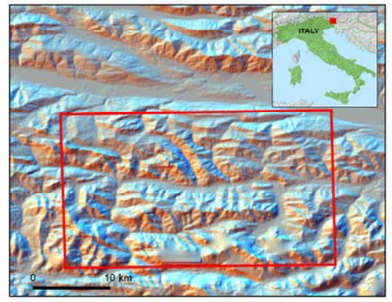
Scenario Class		Major	Moderate	Minor	Frequent
Return Period(years) (with 80% confidence bound)		100-500	25-100	10-25	1-10
Representative event	Date	25/8/2003~1/9/2003	22/06/1996	06/12/2011	1/9/2005
	1d Rainfall(mm)	354,6	192,2	154.4 (19/06/2011*)	/
	Return Period (Years)	133	26	14	/
Historical years		2003	1996	2011	Other years
Recorded landslides	Number	631	200	10	14
	Area(×Km²)	14,551	2,870	0,617	0,093
Debris flows	Number	144	137	7	5
	Area(×Km²)	6,79	2,02	0,58	0,05

Harmonized landslide inventory map

(containing landslide inventories from different triggering events, with associated return periods)

Fella River/ Italy

Overview map



Legend

Population
- Settlement

Hydrology
- River
- Stream

Infrastructure / Transport
- Motorway
- Primary road
- Secondary road
- Residential road

Interpretation

The original data was collected and compiled for the study area at a scale of 1:100,000. The attribute of each landslide includes ID, location (Province, Community and Coordinate of the source area), type of movement, state of activity, area, date of occurrence, etc. In the study area, the inventory map shows 1018 landslides, covering a total area of 39.73 square kilometers, 16.1% of the study area. Landslides ranges in size from 1 to 69410 hectares. And the maps shows: (i) 132 areas affected by widespread rockfall and topple, covering a total area of 19.479 square Km2;(ii) 49 areas affected by widespread shallow landslide, covering a total area of 1.646 square Km2; (iii) 423 debris flows, un distinguished source area and deposit area, covering a total area of 16.43 Km2; (iv) 361 slides, defined as rotational or translational type, covering a total area of 1.686 Km2, (v)18 rock falls or toppling features, covering a total area of 0.332 Km2. Therefore, it is clear that the study area is mostly prone to debris flows, rockfall and toppling, and shallow landslides. These types of movement represent the vast majority of the landslides recognized in Fella. The state of the activity is also considered in this map. The classification is based on Varnes (1996). 76 landslides were very identified as dormant, reactivated and stabilized. But most of them were either recorded as active/reactivated/suspended or with unknown data. The inventory dates range from 1996 – 2013.

About 19 landslide events were identified in this period and four landslide scenarios were defined (see Table 1). Based on the historical landslide hazard inventory data and daily rainfall records from 1976 to 2011, the return period for each class of hazard events was determined with extreme value distribution analysis with daily rainfall and 40 days accumulative precipitation. The major event has a return period from 50 to 500 years with 80% confidence bound, having a representative event case in 2003. For moderate, minor and the frequent events, the return period was 15 ~50 years, 9~20 years and 1~10 years respectively. Landslide distribution for the above four scenarios are shown in this map. Based on this important analysis, the following steps in landslide run out modelling, exposure and risk analysis were conducted for Fella region.

Data Sources

The Digital Elevation Model (DEM) of the Fella River Basin was acquired from airborne laser scanning by the Civil Protection of Friuli-Venezia Giulia (FVG) region in 2003. The 2003 images are from the Spatial planning and Land management department of FVG and acquired by the surveying company CGR (Parma, Italy). The landslide inventory map was in the range from 1996 to 2013, and it was compiled from hazard map, debris flow map and landslide map from the Geological Survey of the FVG autonomous region and the Department of Mathematics and Geosciences, University of Trieste.
Daily precipitation records for landslide scenarios return period calculation were obtained from the Hydraulic Service (HS) in FVG.
Data collection was coordinated by Simone Frigerio and Alessandro Pasuto (CNR-IRPI)

Framework

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement n° 312461 (Increasing Resilience through Earth Observation - IncREO - www.increo-fp7.eu). The IncREO project is coordinated by Airbus Defence & Space (Spot Image S.A.).

Work package partners:

Compilation of the landslide inventory was done by Lixia Chen and Haydar Hussin (UT-ITC).
Landslide initiation modelling was done by Haydar Hussin (UT-ITC), Simone Sterlacchini, Paola Reichenbach (CNR-IRPI), Mihai Micu and Veronica Zumpano (IGAR).
Runout modelling was done by Haydar hussin and Cees van Westen (UT-ITC)
Map produced by: Koert Sijmons (GeoMapa) © 2014