Disaster Causes and Effects

Natural disasters

An extreme natural phenomenon only becomes a disaster if people and their property and belongings are affected. Irrespective of the strength of an earthquake, provided it only hits an uninhabited region it does not result in a disaster. If people decide – for whatever reason – to settle in an area that is at risk from extreme natural phenomena then, to a certain extent, they are partly responsible for their increased vulnerability. In poor countries, however, citizens often have no choice for their endangered existence; they do not have the financial resources to move into a safer region.

When does an extreme natural phenomenon become a disaster? From the perspective of those who are directly affected an extreme natural phenomenon is a disaster when they are no longer able to deal with the consequences themselves. Using this interpretation the severe winter hurricanes that have blighted Central Europe would not have been considered as a disaster even if they had caused damage that extended into billions. On the contrary cyclones in the Caribbean would be considered as disasters even though the material damage they cause is only very low. Such storms deprive many people of their basic existence, which is extremely meagre in any case, and, as a result, have disastrous consequences. Relief organisations use the term disaster if the number of casualties exceeds 10 and the number of injuries 100. For the insurance industry the level of damage is significant.

direct damage

damage to property (houses, furniture, vehicles etc.)

indirect damage

loss of production capacity

loss of income and jobs

secondary damage

negative consequences for economic growth, investment, the balance of trade and rate of inflation

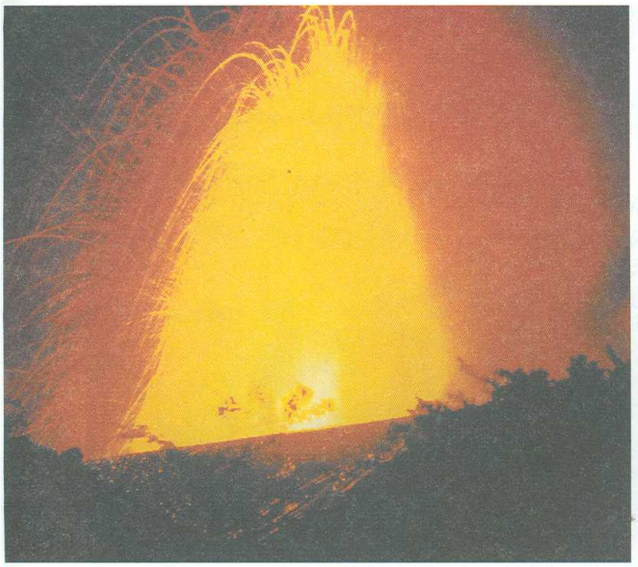
Earthquakes

Earthquakes occur extremely suddenly, surprising the people affected more than other natural disasters. No continent is spared from earthquakes. Most earthquake regions lie at the edges of, or on faults in, the thirteen oceanic and continental plates, making up the earth's crust. In the case of tectonic quakes, which account for some 90 per cent of all earthquakes, the plates move up to thirty centimetres towards or away from each other or scrape past each other. This friction can cause the build-up of energy, which is then released as an earthquake.

Throughout the world some three billion people live in regions that are extremely prone to earthquakes. Germany is hardly at risk from earthquakes. However, in Germany too, powerful tremors can occur. These primarily affect regions in Baden-Württemberg and the Lower-Rhine Basin, which was shaken in April 1992 by a quake of medium severity with its epicentre in Roermond. In quakes of this kind, many people could lose their lives if German buildings were not constructed to be more earthquake-resistant than buildings in other countries.

Science devotes much time and effort to developing possibilities for earthquake prediction. One of the 15 German IDNDR projects is examining possibilities for predicting earthquakes in western Turkey. The study is based on changes to the permanently occurring micro-quakes in this seismically vulnerable region. In connection with this project a "Decade earthquake observatory" is to be established which aims, among other things, to develop a real-time early-warning system that, for example, will enable plant to be switched off at short notice or traffic to be diverted away from bridges which threaten to collapse.

The "sandwich-effect": an entire storey collapses (Kobe 1995) Photo: Brauner



The eruption of the Cerro Nero volcano in Nicaragua, 1995
Photo: Bormann, GFZ

Volcanic eruptions

Some 50 of the 500 or so active volcanoes throughout the world erupt every year. Only few of these eruptions are threatening either because they are highly explosive or close to densely populated areas. Most explosive volcanoes can be found along so-called active continental margins, particularly around the Pacific Rim and on chains of islands such as Japan, the Philippines or the Indonesian islands. Glowing avalanches, i.e. a mixture of hot gases, pumice and hot lava chunks reaching up to 500 degrees which flows down the side of the volcano and the thus ensuing mud flows, are amongst the greatest risks from volcanoes. The waves of hot pressure that rush before the glowing avalanches are likewise extremely dangerous as the example of the complete destruction of the town of St. Pierre on the Caribbean island of Martinique in 1902 with the loss of around 28,000 lives shows. The enormous tidal waves that occurred following the eruption of Krakatoa in 1883 caused a death toll of 36,000 along the nearby coastline.

With massive volcanic eruptions, the mixture of hot gases, lava particles and sucked-in air can climb higher than 20 kilometres into the atmosphere. On certain flight paths over volcanically active regions such as in Indonesia or between Alaska and Japan, this mixture can constitute an acute risk for air traffic, as the two dozen or so close calls in the last 15 years have demonstrated.

The sulphur dioxide gases that are blasted into the atmosphere and the stratospheric aerosols that result from the mixture of these gases, water and solar energy can reduce the global temperature over several years. This was the case in the wake of the Pinatubo eruption in 1991. The massive eruption of the Tambora volcano in 1815, for example, resulted in failed harvests all over the world.

After the eruption of the Lake Laach volcano in the German Eifel region, which expelled almost as much magma as the Pinatubo eruption, the entire Neuwied basin was buried under a thick layer of pumice several metres deep. This sudden overload caused the Rhine to dam up into a lake of some 15 metres in depth. When the pumice dam burst close to Andernach tidal waves swept downstream until well past Bonn, perhaps the true reason for the German government's decision to move to Berlin.

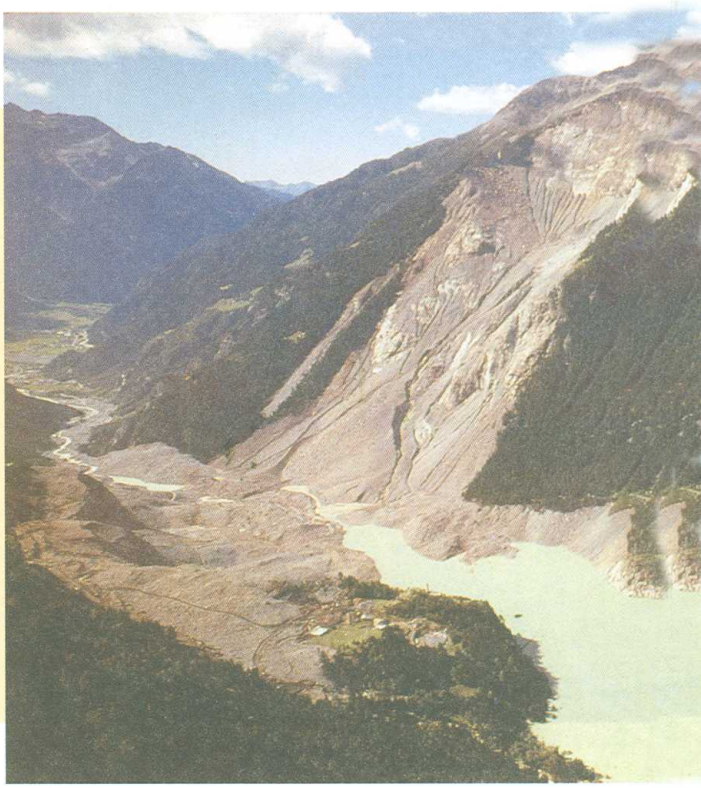
Advance warning of large volcanic eruptions comes several months beforehand as a result of earthquakes, buckling of the earth's crust or strong degassing. Hence, thanks to timely evacuation tens of thousands of people can be saved each year. Under the auspices of the IDNDR, German scientists from several universities and research institutes such as the Geo Research Centre in Potsdam and Geomar in Kiel are researching the activities of the highly active Merapi volcano in Indonesia – infamous for its many destructive glowing avalanches and mud flows. This research will hopefully provide greater understanding of volcanic processes and hence enable forecasting of impending eruptions to be improved.

Mass movements

Solid and loose rock can move extremely quickly as the result of a rock or landslide or very slowly over centuries as in the case of slope creeping. Such rapid slope creeping is often triggered by other natural phenomena such as earthquakes or heavy rainfall. Frequently though, human intervention into natural resources as a result of deforestation and construction, for example, is to blame for landslides.

The threat to buildings and people from mass movements comes from the respective risks of collapse and being buried under rubble. Landslides at the edge of man-made lakes or reservoirs are particularly dangerous. The rock mass falling into the lake or reservoir can cause it to spill over the edge of the dam and may even result in a breach. If the rock mass forms a barrier in the river valley this causes the river to be dammed. If the water build-up is too great and the dam breaks then a tidal wave cascades into the valley sweeping with it everything in its path.

Under the aegis of the IDNDR the "International Council of Scientific Unions" intends to step up investigation into the risk of disaster in mountainous regions prone to such dangers.



Landslide in Veltin, 1987, Photo: VAW/ETH Zürich