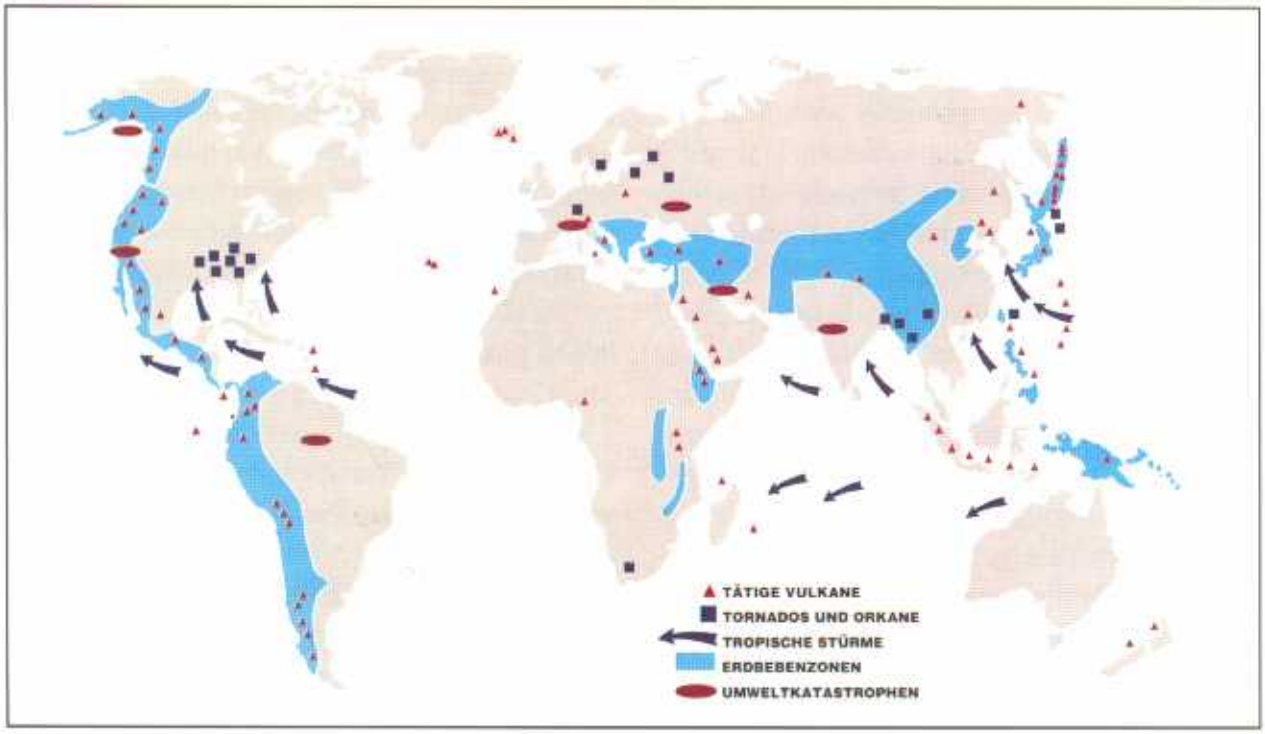
Definition of Natural Disasters

The earth, its atmosphere and the water on and below its surface are in continuous motion. The earth's apparent hard outer crust is made up of rigid plates which float on the magma of the earth's interior at a velocity discernable only in a geological time scale. Along the mid-ocean ridges the crust is continuously breaking open and being closed up again by upwelling rock melt. This newly formed crust pushes the plates apart and they submerge and melt into the earth's interior in other locations, for example along the subduction zones around the Pacific Ocean. The edges of the plates become wedged together, immense tensions build up and are then discharged in sudden dislocations resulting in volcanoes and earthquakes.

Water and air circulate at a velocity varying within short spaces of time. The effects of sun radiation and earth rotation cause the air masses of the atmosphere to orbit around the earth in paths which are effected by mountains and valleys and by thermodynamic processes. Cyclones form, whipping up the seas and flooding coastal lowlands with huge waves and storm surges. The mixing of cold and warm wet air masses causes the water vapour in the air to condense and precipitation with sometimes extreme intensity to fall, leading to floods, erosion and even to landslides. In other places lack of precipitation over a period of many years leads to droughts.

Anthropogene influences are the main cause for the growing disaster potential. Due to poverty or for moneymaking reasons man is disturbing the balance of nature (deforestation, overgrazing, greenhouse effect) which in turn reacts with increased extreme events (eg. floods or desertification). Through settlement in disaster prone regions man is also increasingly exposing himself to the forces of nature (eg. earthquakes, floods). In judging whether an extreme natural event is a natural disaster various criteria are used, according to the particular interests involv-



ed. From the point of view of those directly affected, such an event becomes a disaster if the affected community is unable to cope with the damages and other disruptions. According to this definition the 1989 earthquake in San Francisco, as also the 1989/90 winter gales in Central Europe - both events having caused damages amounting to billions of dollars - were not disasters at all. On the other hand, for example, the cyclones which regularly descend upon the Caribbean and South East Asia are, in the main, to be classified as natural disasters as they rob the inhabitants of their anyway very meagre livelihood basis, even if the total damage is usually much less than after the aforementioned earthquake in San Francisco or the gale storms in Europe.

Disaster relief organizations frequently speak of a disaster in the event of more than 10 dead or more than 100 injured persons. For the insurance industry the amount of damages is the decisive factor. How disaster terms are judged differently from a socio-political view and from the view of the insurance industry can be seen in the surveys in the appendix of this brochure which record the disasters according to cases of deaths on the one hand and according to the damages amount on the other hand.

Types of Natural Disasters

Effects of earthquakes touch many areas of human societies. They are characterized by extremely sudden onset so that men are much more likely to be caught by surprise than by any other natural event. No continent is spared by earthquakes. We know devastating tremors in California and Japan as well as in Southern Europe, the Middle East, Latin America, and in China. Earthquake induced huge sea waves, tsunamis, may become dangerous for shoreline settlements even at a distance of several hundred kilometers away. Germany is less threatened by earthquakes, but once in a while here also the earth trembles vigorously. Especially the South Western part of the country has experienced damaging tremors as in 1935 when the church in Bad Buchau-Kappel, not far from Lake Constance was destroyed, while the Alb-quake in 1978 became known for heavily damaging the Hohenzollern Castle, formerly seat of the German Emperor's House.

Volcanic eruptions are spectacular events with a great variety of phenomena: thundering explosions of whole mountains (Mt.St.Helens/USA, 1980), fiery fountains of lava (Kilauea/Hawai), mile-high ash clouds (Pinatubo/Philippines, 1991), devastating hot avalanches of gas, ash, and debris (Unzen/Japan, 1991), mud flows (Nevado del Ruiz/Colombia, 1985), completely unhearable and invisible, but equally deadly outbursts of carbon-dioxide (Lake Nyos/Cameroon, 1986) In the environment of a volcano, ash covers houses and fields and pollutes rivers and lakes, but effects may also be dramatic far away from an eruption as gases form aerosols in the atmosphere that may influence the global climate like after the eruption of El Chichón/Mexico, 1982. Equally dangerous is the generation of tsunamis by volcanic eruptions (Krakatau/Indonesia, 1883).

Even in our country volcanic eruptions are not impossible. It may sound exotic, but volcanic activity cannot be considered extinct in the Eifel near Cologne. The last eruption, forming the picturesque volcanic lakes such as the Gmündener Maar, took place some 11,000 years ago - this was just yesterday in a geological time scale!

Mass movements occur either slowly as slope creeping or quickly as landslide or rockslide. Narrowing of valleys due to tectonically induced creep movements may take decades or even centuries. Sudden landslides are often triggered by other natural events such as earthquakes or long lasting, heavy

rain. Complete layers slide downhill under the effect of water, and hardly measurable movements of a few centimeters per year may suddenly become a dramatic avalanche-like earthflow. Although landslides occur all over the world, they are a specifically serious problem in Japan, South America, the countries in the Himalaya, and in the Alpes.

Mass movements threaten men and buildings by direct burying, but even more by secondary effects. Landslides into reservoirs are particularly dangerous as the soil or rock masses may make the water spill over the dam and even lead to its collapse. Such events have caused catastrophic floods downstream of reservoirs (Longarone/Italy, 1963). If a landslide forms a barrier in the course of a river like in the Veltlin/Italy in 1987, the river is dammed up. If the water overflows, the dam breaks and a flood wave rushes down the valley. In spring 1991 a landslide near Randa/Switzerland blocked the access to the

famous resort village Zermatt at the Matterhorn for several days, fortunately a dangerous build-up of the water level could be prevented

Windstorms as causes of disasters have increased most dramatically in recent years. They are leading in the statistics of worst disasters both in number of fatalities and economic damages (p. 6). Very often extreme precipitation goes along with strong winds. Extremely high damages do not only occur in exotic countries: one of the most expensive event for insurance companies was the Munich hailstorm in 1984: it cost them more than one billion German Marks.

Storms destroy large forested areas, bend pylons and antenna masts, and damage roofs. The series of gales in Western and Central Europe in spring 1990 caused economic damages of 25 billion German Marks and exceeded considerably the previously most expensive event, hurricane „Hugo" (Caribbean and USA, 1989, damage: 15 billion Marks). Many places in Germany displayed pictures of destruction such as in the Odenwald near Frankfurt. Even today, almost two years later, damages are still not repaired everywhere, and more than ten million trees must be planted in order to close the gaps torn by the wind.

A tremendous disaster potential exists in the form of tropical cyclones. Hurricanes and typhoons sweep over the countries around the Caribbean Sea and East Asia and leave whole regions devastated. Storm surges induced by tropical cyclones hit the Indian subcontinent over and over again and claim hundreds of thousands of lives (Bangladesh, 1970 and 1991).

Inundations cause the highest damages worldwide. Disasters result from floods or, along coasts, from storm surges and from tsunamis. Storm surges, created by the interaction of strong wind and high tidal waves, have threatened the inhabitants of low-lying coastal flatlands for centuries, and a sea level rise due to climate change will increase the risk of these areas. Extensive construction works and the enlargement of levees along the coast of the European North Sea during the past decades have kept damages resulting from storm surges to a low level although the flood stages were in several cases higher than those during the catastrophic 1962 flood.

Disaster potential in the interior of countries is caused by floods resulting from heavy precipitation or snowmelt. Basically we know how to protect ourselves by construction of dams, retention basins, and river works, but smal and large scale catastrophic floods are still frequent. On June 21, 1984 the streets of the village of Gissigheim near Stuttgart turned into wild torrents of water within a few minutes after extremely heavy rainfall.

In recent years flood disasters have become more serious because of their effects on water quality: pollutants enter drinking water aquifers during floods, and waste water discharges from settlements and industrial plants pollute rivers during low flow periods and eventually endanger even the marine ecosystems.

Droughts are consequences of large scale and long-term natural climate changes. In the beginning they do not cause significant harm, but they develop to more and more perceptible and finally serious catastrophes which may lead to a breakdown of the food system of a whole region. Man-made influences, for example, clearing of tropical rain forests and greenhouse effect, may cause climate changes, which convert regions with enough precipitation into areas with water shortage or even deserts.