

The Earth – Natural Hazards

Earth's topography and plate tectonics are major factors that influence and cause natural hazards. In particular, the distribution of earthquakes and volcanoes is linked to plate boundaries. Another important factor in causing natural hazards is the climate. The appearance of storms is closely related to global circulation and sea temperature as well as surface topography. Wildfires, if not caused by human influence (slash and burn) are often generated by lightning strikes.

Natural hazards, topography and cities are presented here:

- to provide an overview of their distribution;
- to show the relationship between hazards and relief structures;
- to allow an assessment of threats to the population arising from natural hazards.

Map Descriptions

Map 1: Global map of natural hazards

Source: Munich Re (adapted)
Acquisition Date: 1998 (adaptations 2005)
Band Combination: -
Map Information: natural hazards; cities; main rivers

Description: This overview of the distribution of earthquakes, volcanoes and storms gives an insight into their relation to mankind (major cities; cf. also global population distribution, Atlas p. 42/43). Earthquakes and volcanoes occur mostly along tectonic plate boundaries (cf. tectonic map on Atlas p. 31). These activities occur particularly frequently along the Ring of Fire bordering the Pacific Ocean. Tropical storms have their sources to the north and south of the equator over warm ocean water in the trade winds zone. Their destructive power is relevant only when they cross inhabited land.

Map 2: Forest Fires. Samos, Greece

Satellite/Sensor: Landsat ETM
Acquisition Date: 09.07.2000
Band Combination: near natural colours
Map Information: forest fires

Description: Forest fires can have two causes: First, they can be of natural origin (spontaneous combustion, lightning); second, they can be generated by human activity (slash and burn). Particularly in the tropical regions slash and burn is used for the clearing of new agricultural land. The map shows the extent of the forest fires which destroyed a large area of the Greek island of Samos. In the Landsat image the burnt areas are displayed in a red-brown colour and the smoke of the fires shows up in blue.

Map 3: Volcanic eruption. Etna, Italy

Satellite/Sensor: Landsat ETM
Acquisition Date: 29.07.2001
Band Combination: near natural colours, including infrared bands
Map Information: volcanoes

Description: The map shows the eruption of the volcano Etna in the eastern part of Sicily, Italy. It is Europe's biggest active volcano. The recent lava flow shows up in pink, while older lava flows are displayed in shades of grey. In the lower part of the volcano the lava flows are flanked by intensively cultivated land, exploiting the fertile ground (see also Atlas p. 188).

Map 4: Earthquakes. Bam, Iran

Satellite/Sensor: ERS-SAR
Acquisition Date: 30.12.2003
Band Combination: SAR interferogram
Map Information: Interferogram of Bam

Description: In December 2003 the city of Bam in the southern part of Iran was hit by a severe earthquake of magnitude 6.6. Large parts of the city were destroyed and more than 41,000 people were killed. The deformation and movement of the ground have been measured with the help of radar interferometry. Analysis of interferogram and other data suggests that the earthquake originated in a complex north-south fault system to the south-east of the town (see also Atlas p. 189). The denser the colour fringes the larger the displacement of the earth surface caused by the earthquake. The central black part is the city area. No interferometric data is available due to vegetation cover, but also due to destruction, both of which disturb the phase correlation required for an interferometric analysis.

Map 5: Floods, Elbe and Vltava, Czech Republic

Satellite/Sensor: ERS-SAR
Acquisition Date: 16.08.2002
Band Combination: multi-temporal radar
Map Information: floods

Description: Persistent rainfall in August 2002 resulted in severe flooding of central and northern Europe. The map shows the Elbe and Vltava rivers whose floodwaters caused the inundation of agricultural land and cities. Near Mělník, where the Vltava discharges into the Elbe, the area resembles a lake. Since radar systems can penetrate clouds, they are ideal for quick assessment of the extent of floods and are thereby an important auxiliary tool for planning disaster relief operations.

Map 6: Sandstorms. Sirocco, N. Africa-Italy

Satellite/Sensor: Aqua MODIS
Acquisition Date: 16.07.2003
Band Combination: near natural colours
Map Information: sandstorms

Description: Sandstorms are common in arid and semi-arid regions. Southerly winds like the Sirocco may trigger such sandstorms, which can also affect Europe. They originate in low pressure areas moving eastwards across the Mediterranean Sea. The air flows northwards, producing hot, dry and dusty conditions over the northern African coast. The uplifted sand and dust, which can reach central Europe, results in poor visibility and damage to instruments and equipment. The Sirocco leads to stormy conditions in the Mediterranean Sea and to cold, wet weather in Europe.

Map 7: Hurricanes. Hurricane Elena

Satellite/Sensor: hand-held camera on space shuttle STS
Acquisition Date: 03.09.1985
Band Combination: -
Map Information: hurricane

Description: Hurricane Elena was a category 3 storm (on a 1-5 hurricane scale) and caused severe damage along the Florida, Mississippi and Alabama coasts. The damage was caused by floods from the sea, heavy rainfall, and direct consequences of the high wind speeds. Elena, like most hurricanes, was located in the northern hemisphere – here the air circles in a counter-clockwise direction due to

the Coriolis effect. The image shows the extent of the storm system as well as the eye of the hurricane.