Geomorphology – overview and intro
Why is it important?
NGEA01, 2018

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Definitions and system boundaries

"Geomorphology is the science concerned with the form of the land surface and the processes which create it." (Summerfield, 1991)
Geomorphological processes and climate determines soil and hydrology properties and is thus important for landuse and localisation of populations!
Endogene and exogene processes

EXTERNAL PROCESSES
- Weathering
- Mass wasting
- Erosion

INTERNAL PROCESSES
- Folding
- Faulting
- Volcanism

(From Hess, 2013)

Endogene/Internal/Constructive/Ulifting
Exogene/External/Destructive/Down-wearing
Geomorphology around the world

**Endogene processes**
Volcano, Mexico

**Periglacial processes**
Polygon wedge ice (Iskilspolygoner): Svalbard

**Glacial processes**
Esker (rullstensås): Dalarna, Sweden

**Eolian processes**
Dunes: Namibia

**Mass movements, fluvial processes, coastal processes**
Braided (Flätad) channel, New Zealand

From Hess, 2013
Keep the geological time scale in mind!

From Hess, 2013
History of the earth

Modified from Hess, 2013
### Studied features in geomorphology

<table>
<thead>
<tr>
<th>Structure</th>
<th>the nature, arrangement and orientation of the material in the landform? What kind of rock and/or soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Geologic, hydrologic, atmospheric, biotic shaping the landform</td>
</tr>
<tr>
<td>Slope</td>
<td>A key property, related both to structure and processes</td>
</tr>
<tr>
<td>Drainage</td>
<td>Movement of water above or below-ground</td>
</tr>
</tbody>
</table>
Geomorphology around the world

A few examples

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From Hess, 2013

Photo: Jonas Åkerman
Endogene processes - Plate tectonic theory

The lithosphere consists 65-100 km thick plates. Plate boundaries: That’s where we have the action.

*From Hess, 2013*
Endogene processes – continuously on-going

From Hess, 2013
Faulting

From Hess, 2013
Movements (ca 50-100 M years ago) along the Tornquist zone (weakness zone from a collision about 400 M years ago)

From Hess, 2013
Clear NW-SE pattern in soils and land use
The mountain chain – Caledonides (Fjällen)

Photo: Cecilia Akselsson
Remains from a collision between Baltica and Laurentia about 400 million years ago

From Hess, 2013
Endogene processes – why is it important?

Example: “Iceland evacuates out of concern for volcano”
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Erosion and eolian processes
Dunes: Namibia
Glacial landforms – young in earth history

(From Hess, 2013)
Pleistocene glaciation – maximum extent

(From Hess, 2013)
Landforms caused by continental ice sheets

(From Hess, 2013)
Swedish soils and many of the landforms: Formed by the ice ages

Photo: Cecilia Akselsson
Soil types in Sweden – mostly till and glacifluvial

- Torv (Mires)
- Lera (Ccay), finmo (silt)
- Grovmo (silt), sand, (sand) grus (gravel)
- Isälvs sediment (glaciofluvial sediments)
- Leriq morän, (clayey till) moränlera (till clay)
- Morän (till)
- Kalt ber/tunt jordäcke (bare rock/thin soils)
- Glaciär (Glacier)
- Sjö (Lake)

(Photo: Cecilia Akselsson)
Glacial processes – why is it important?

Drinking water supply

Waste management: landfill (deponi)
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*Photo: Jonas Åkerman*
Periglacial environments and processes

- Places where processes related to freezing-thawing cycles shape the landscape
- Almost only in the northern hemisphere
Permafrost areas (permanent frozen subsoil)

From Hess, 2013
Periglacial processes – why is it important?
Example: “5 degrees warmer – Beware if the permafrost melts” (DN, Nov 2007)

KLIMATET

5 grader varmare: Bevare oss om permafrostens smälter

Publicerad 2007-11-29 06:00

Smältvattensjöar är ett tecken på att permafrostens i Sibirien börjar tina. Ur sjöarna frigöra metan som kan påskynda global uppvärmning.

Den sibiriska tundrans permafrost kommer att tina, om inte klimatförändringarna dämpas. Då kommer marken varje år att ge ifrån sig lika mycket växthusgaser som i dag släpps ut från alla världens bilar, båtar och flygplan.
Periglacial processes – why is it important?

Example: “Mire provides answers about the health of the earth” (Sydsvenskan, May 2008)
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From Hess, 2013
Photo: Jonas Åkerman
Mass movements

(Photo: Cecilia Akselsson)
Mass movement/mass wasting (massrörelser): one of the denudation processes

**Weathering**: Mechanical, chemical and biological breaking down of rocks

**Mass wasting**: Short-distance downslope movement of broken rock material

**Erosion**: Removal, transportation and deposition of fragmented rock material over wider areas (wind/water/ice)

(From Hess, 2013)
Four categories of mass wasting: Fall (ras), slide (skred), flow (flytning), creep (krypning)
Mass movements – why is it important?

Example: Landslide outside Gothenburg

Raset stänger halva E6 genom Bohuslän

Published 22 december 2006 11:41 · Updated 22 december 2006 11:41

TEXT: PER ROJER, TT

Sverige. Trafikomläggningen på grund av raset söder om Munkedal berör hela E6:an mellan Strömstad och Uddevalla. Det är nästan hälften av vägens sträckning genom Bohuslän.
Fluvial processes

(Photo: Cecilia Akselsson)
Fluvial processes – contributes more to shaping landforms than all the other external processes together

(From Hess, 2013)
Fluvial processes – why is it important?

*Example: Flooding in central Europe*

Sydsvenskan, June 2013:
“This is why Europe is flooding”
Coastal processes – why is it important?

Example: Coastal erosion in permafrost areas – will increase with climate change

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**From Hess, 2013**

*Photo: Jonas Åkerman*
Eolian processes

From Hess, 2013
Eolian processes – why is it important?

Example: *Pine plantation to prevent coastal erosion and transport of sand to agricultural land*
The landforms, topographical and hydrological patterns and the soil properties are the results of many different processes acting on different time scales.

Example: (Washed till) “Svallad morän”

- Endogene processes explains mineralogical composition
- Glacial processes have broken down and moved the material
- Coastal processes (below highest coastline) have washed the till