Environmental friendly technologies
KEE/ENT

ESF II project of the University of West Bohemia in Pilsen

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Lecture 10

Hydrosphere, components, protection

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Hydrospere - energy

- Chemical energy
  - Dissolving agent – aqueous (27*106 t solid substances)
    - Small concentration

- Thermal energy
  - Thermal gradient
  - Water layers (surface 25°C – deep 4°C)
  - water / air (arctic rivers)

- Mechanical energy
  - Energy of rainfalls (5,11*105 km3)
    - Low concentration
  - Energy of icefields (2,1*107 km3 = 1,8*107 km3 water)
    - dissolvation – increasing see level for 50 m
    - Kinetic energy „icefield flow“

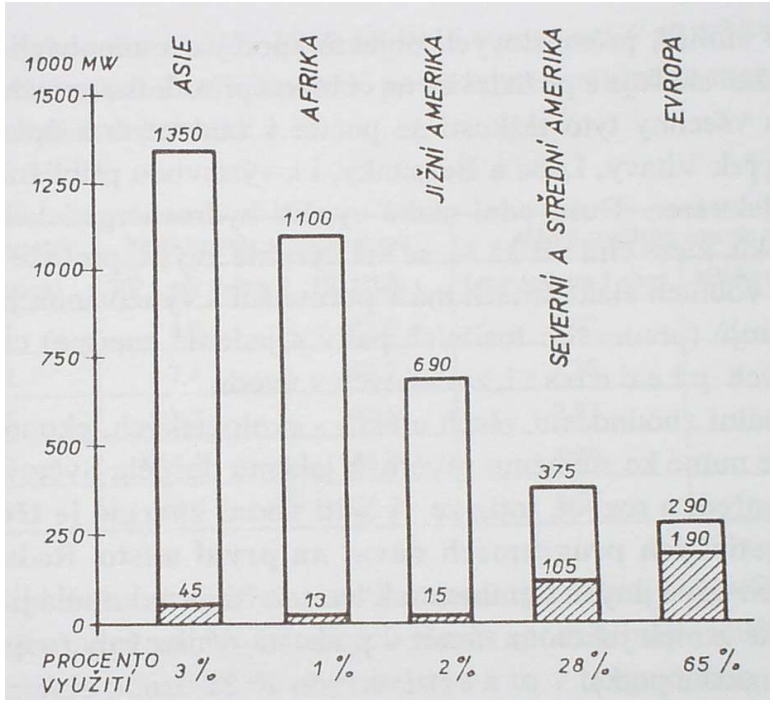
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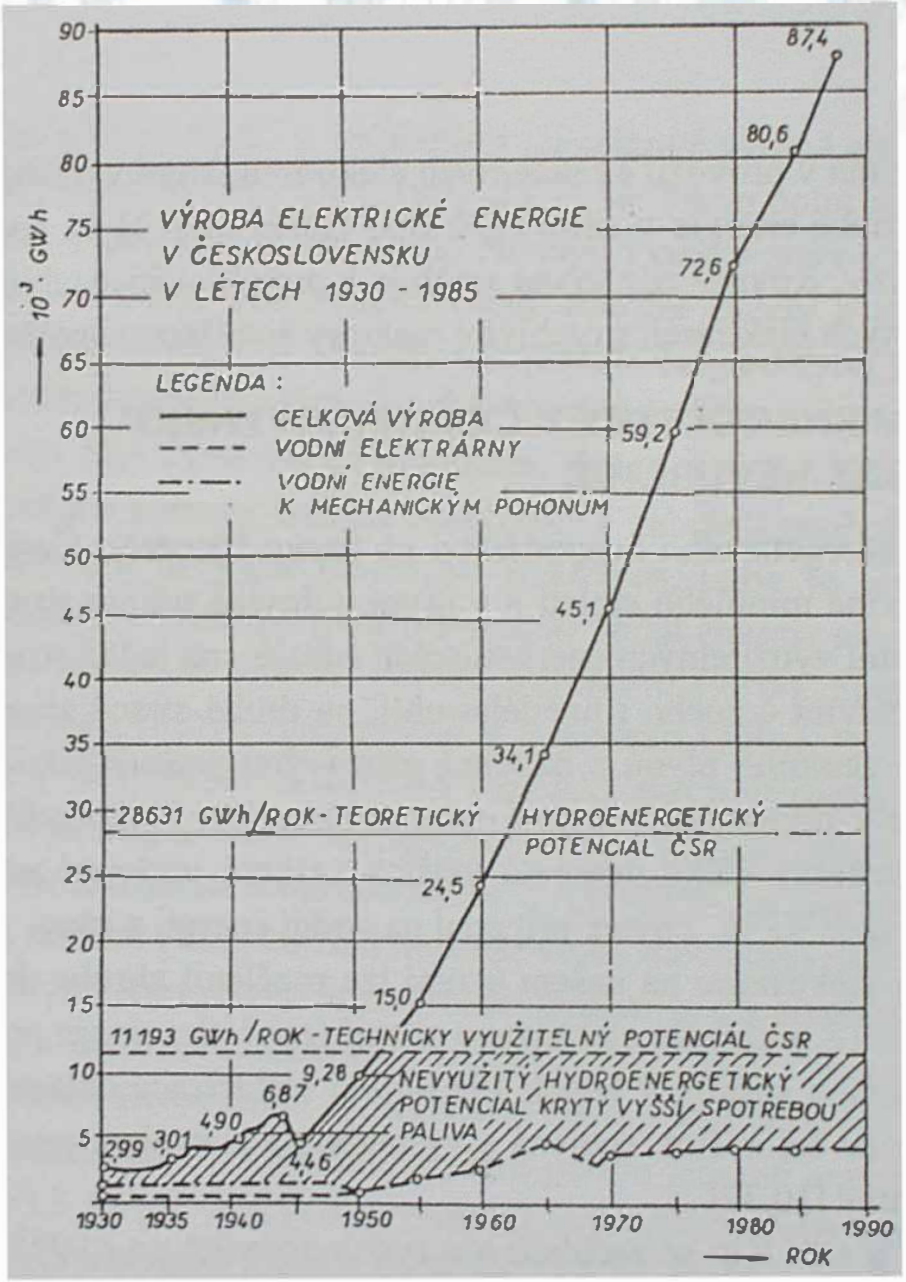
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Energy of water

- Water streams energy – white coal
  - 5600 GW – used cca 10%
- Sea and ocean energy
- Energy of wawing – violet coal
- Energy of tide – blue coal

Energy of water





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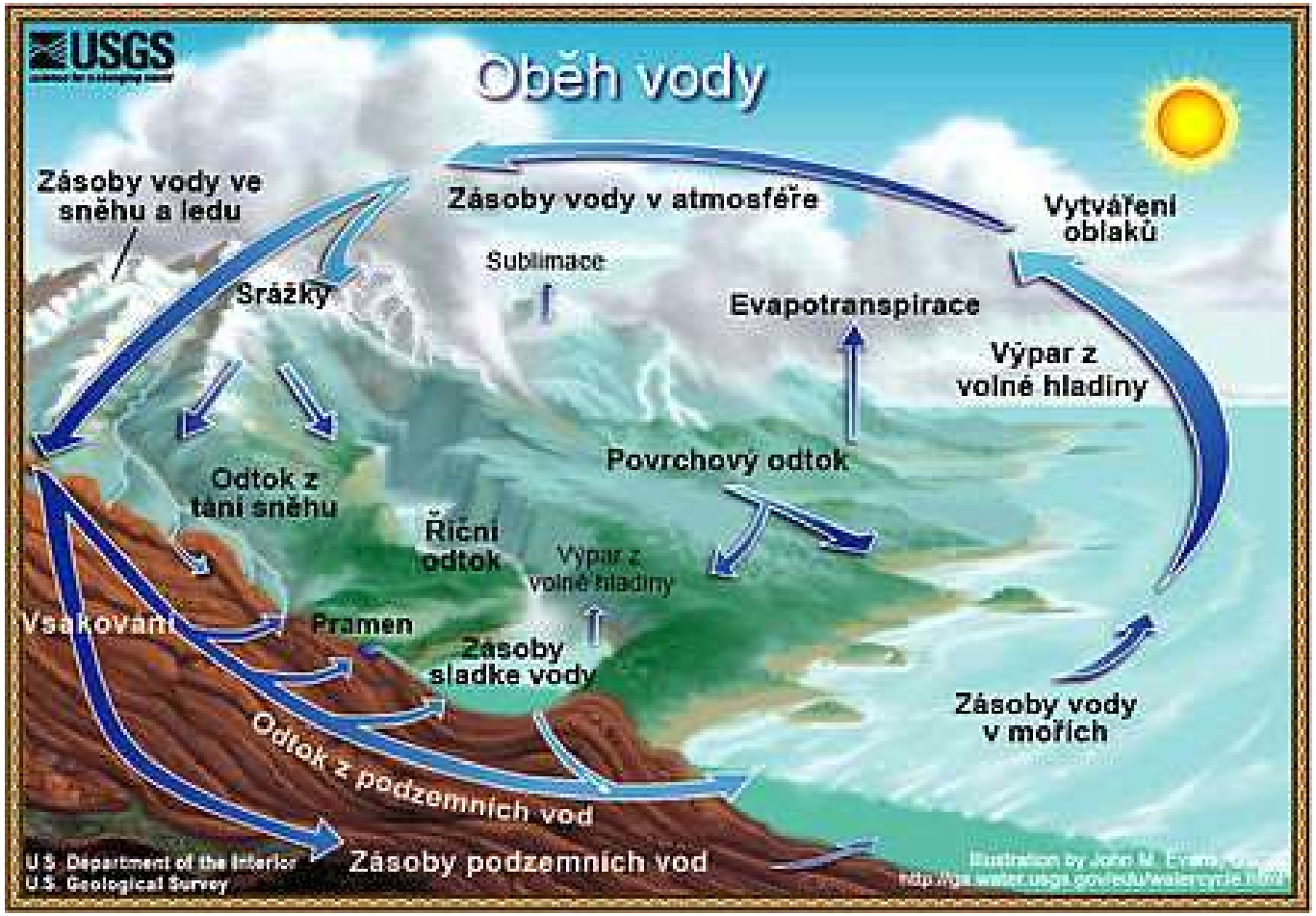
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Water circulation

- 1,386*109 km3 water on Earth
  - 1,338*109 km3 salt water in seas and oceans (96,5%)
  - 2,41*107 km3 frozen water - ice, snow (1,67%)
  - 2,34*107 km3 underground water (1,66%)
  - 1,867*105 km3 water in swamps and lakes (0,13%)
  - 1,23*104 km3 water in atmosphere – rainfall, clouds (0,01%)
  - 2,12*103 km3 water in streams (0,005%)

- 1,36*103 Wm-2 solar energy

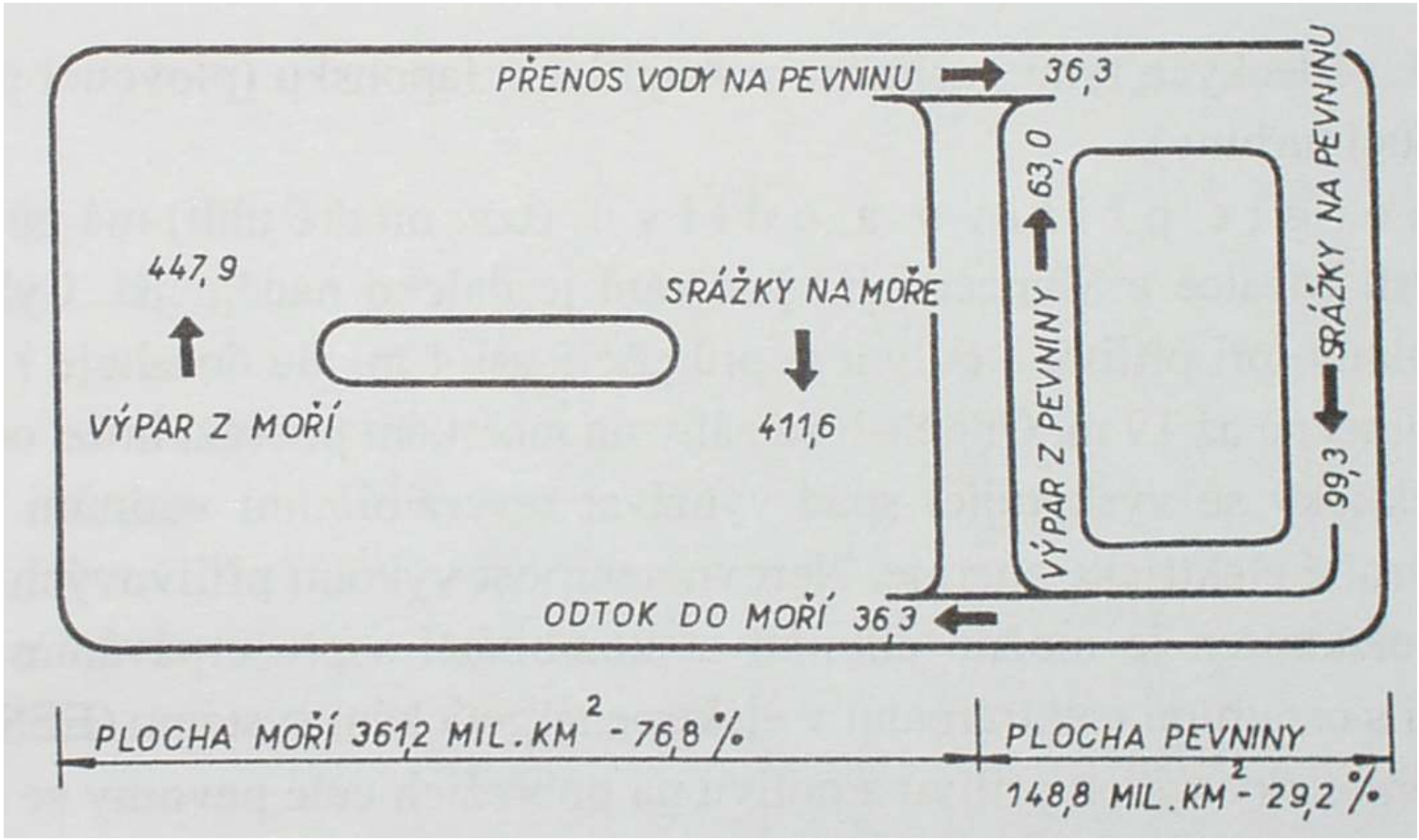
Water circulation



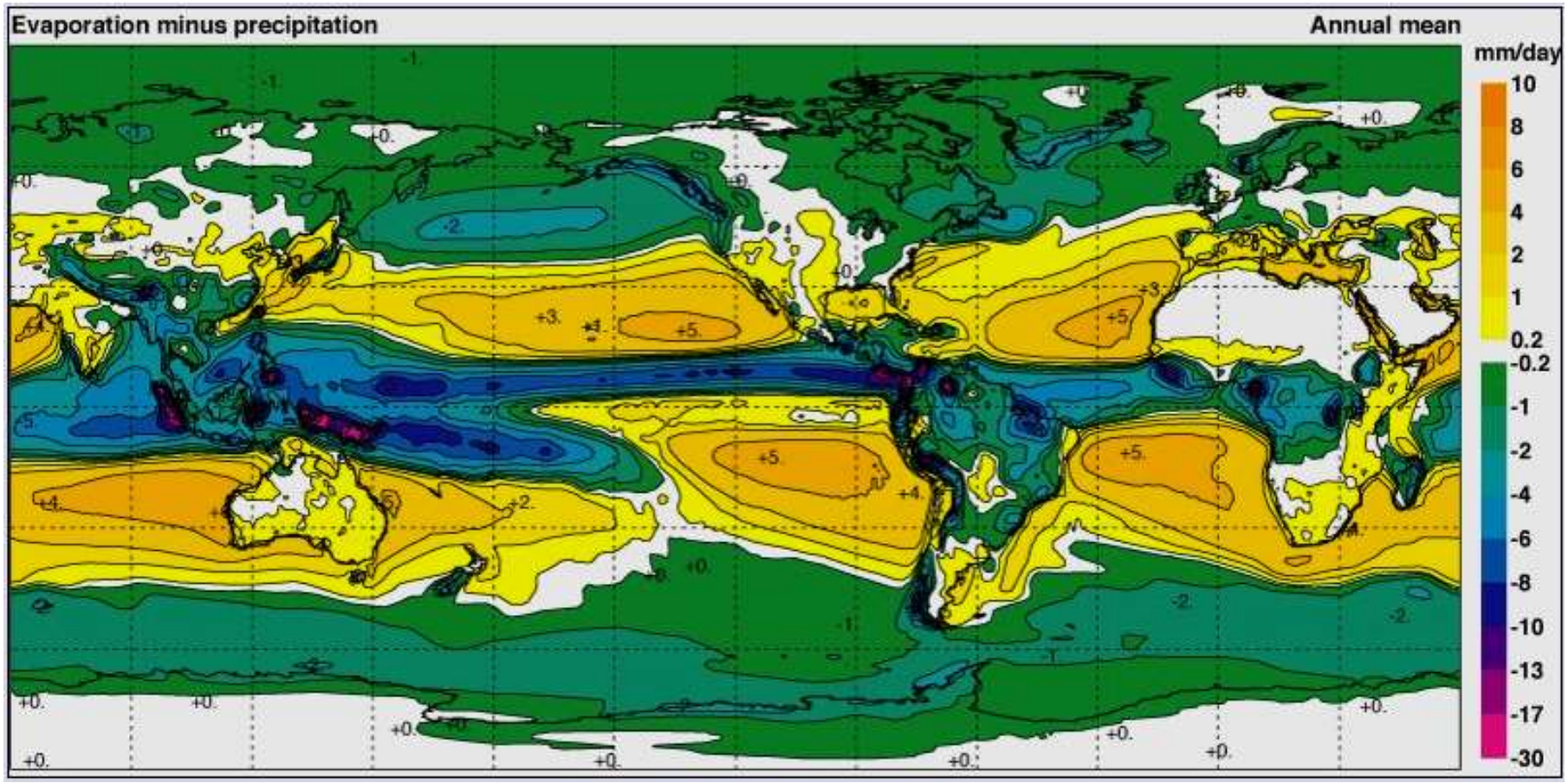
Water circulation

- 5,11*105 km3 annual rainfall
  - 41 full annual cycles
  - in real less – weaker cloudness
  - 50% in tropical areas
  - 74% rainfalls

Water circulation



Water circulation



Energy usage of water

- Thermal gradient (water layers – Zurichersee – termodynamical heating)
- Energy of seas and oceans
    - energy of vertical waves (wind effect) – waves, surf
    - Energy of advancing waves (earthquake)
        - Total energy 3,43*1011 MJ (50 – 80 kW/m on shoreline)
    - slap energy of Sun and Moodn – tide
        - 7,1 – 11,8*1012 MJ
    - Outflow of streams in mouth
    - Energy of sea streams
    - Golf stream near NC – 25*103 MW
- Energy of water streams

Energy of seas and oceans

- Wave energy – waves
- Pontons anchored on the shelf
- Floats oscilating along axes (Ploeg, PowerBuoy - Šp)
- Oscilating floats „fungus“, „dragons“ (Wave Hub – Cornwall, SAAB - Korea)
- Gas pressurization in chambers
- Tanker boats (Kalimai – JAP)
- breakwaters (water column = piston => water turbine)
- Liquid pressurization – sea waters (CETO – Australia, 2014)
- floating turbines (Oyster – Orkneje)
- buoys with microturbines (Hawaii)
- Artifitil atoll with reservoir (Dam Atol)
- Tidal energy
- underwater generators (Bretaň, JAP)

Thank you for your attention...

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