GEO2010 Spring 2017

Exercise 1

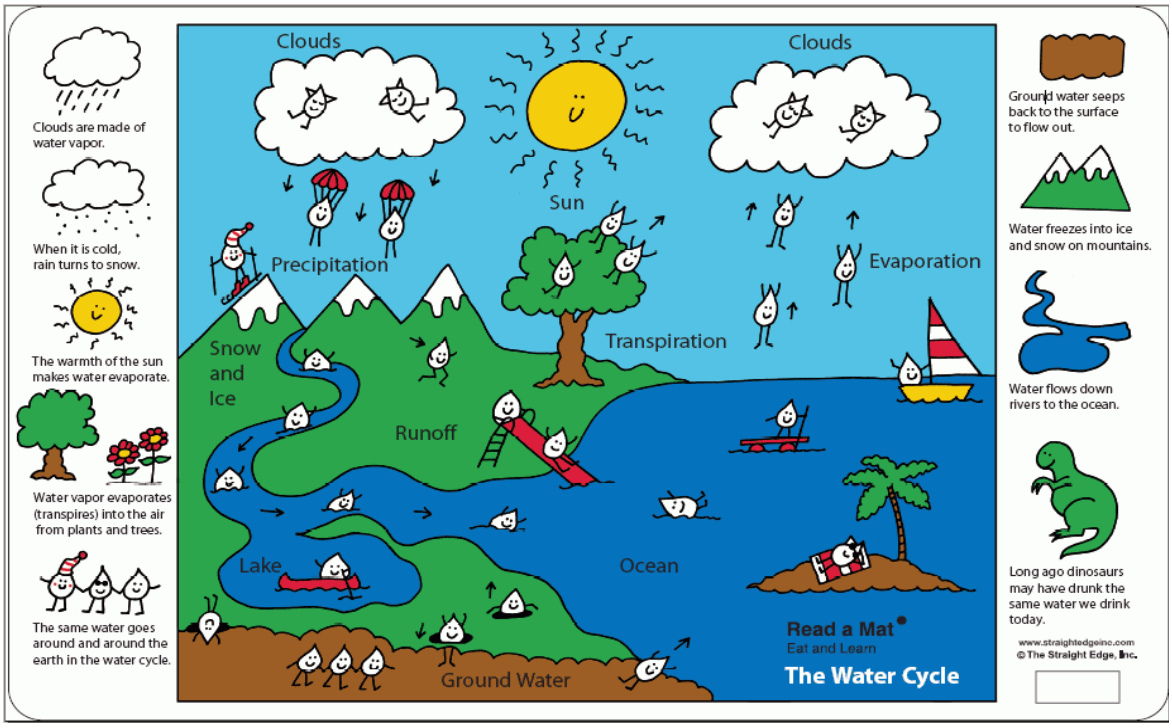
The obligatory exercise is due January 30, 2017. Please save this notebook as .ipynb file and upload it to the folder "GEO2010/Øvelser/Oblig" in the Fronter.

Training exercise 1.1 – Water balance

The figure below shows a simple drawing of the water cycle.

a) Make a similar sketch, but with arrows for the transport of variables (e.g. precipitation, runoff, transpiration, infiltration, percolation), and let the arrow sizes indicate the magnitude of the transport (see figure 1.1, pp 4 in Dingman). Mark phase transitions between ice, liquid water and water vapour where it is relevant.

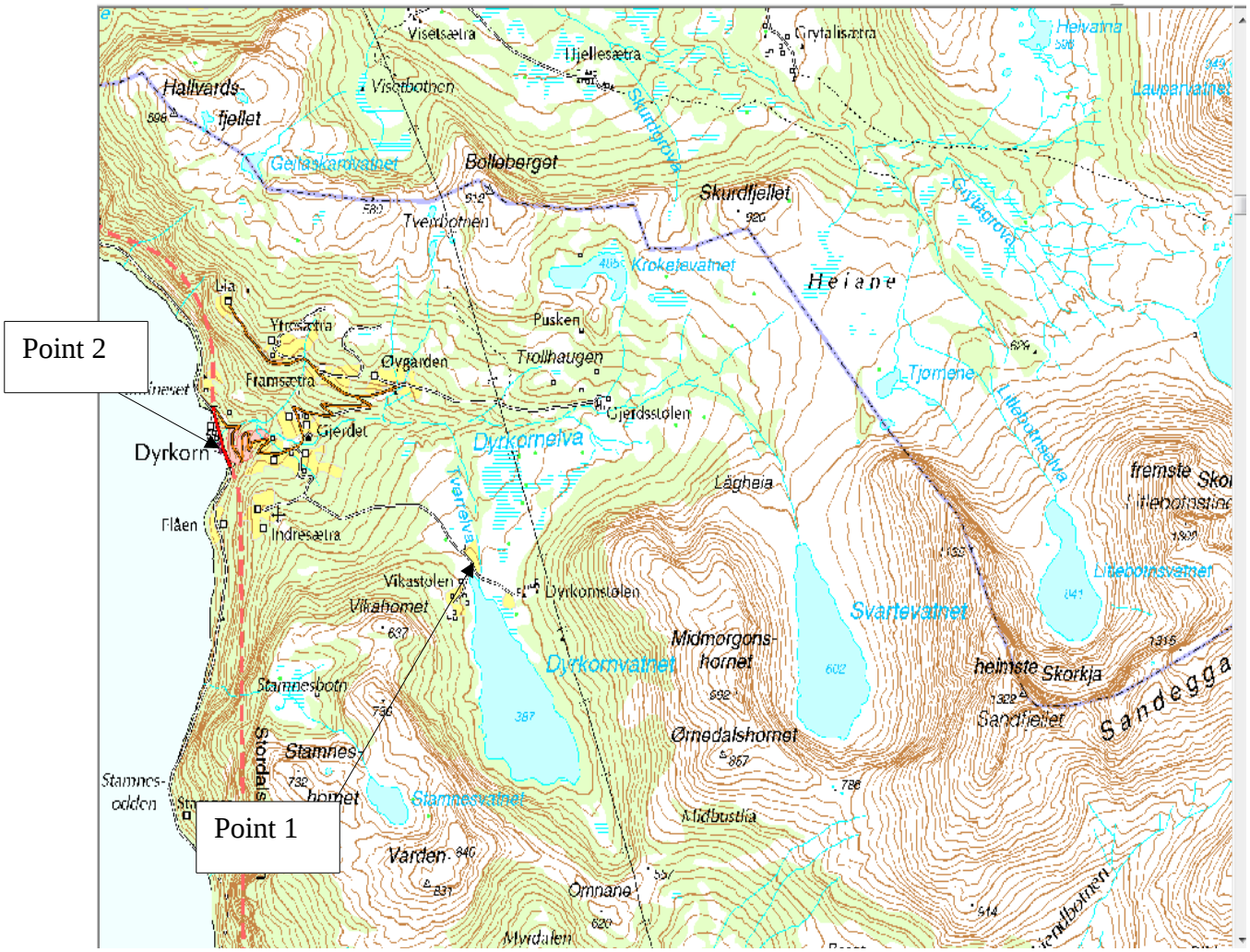
b) Can you guess what the residence times for the storages of ocean, groundwater, glaciers, atmospheric water, intercepted water, lakes and rivers are? State an approximate time, e.g. 1 hour, 1 week, 1 year, 100 years. The residence times are not given in Dingman, but we will calculate them later in this course.



ga.water.usgs.gov/edu/watercyclematsmallpage.html

Training exercise 1.2 – Catchment area

Catchment area (or: drainage basin, watershed) is an important concept in hydrology. Draw the drainage basin at the two points marked on the map over Dyrkorn. You can take reference from he satellite image given below:




Hallvardsætra
248
296
Hallvardsvatnet
Visetsætra
Hjellesætra
Visetbotnen
Hallvards-
fjellet
598
Geitaskardvatnet
580
Bolleberget
612
Tverrbotnen
Skurdgrova
Grytalia
741
Grytalisætra
Heivatna
Midtvatnet
Lauparvatnet
1253
Sunnmørs-
lauparlægda
Skurdfjellet
620
Grytagrova
Trongbotnen
1217
Svartvas
Kroketevatnet
Heiane
Grytavatnet
Lia
Ytresætra
Pusken
Trollhaugen
Øygarden
629
Framsætra
Tjørnene
Litlebotnselva
Gjerdsstølen
Lågheia
Gjerdet
Dyrkornelva
Trollbotnen
1070
Dyrkorn
Tverrelva
Fremste Skorka
Litlebotnstinden
1302
Tverrbotnsegga
Flåen
Indresætra
1135
Litlebotnsvatnet
Isbotnen
1370
Vikastølen
Dyrkornstølen
1364
Storbotnshornet
Vikahornet
637
Svartevatnet
1315
Midtmorgons
hornet
962
Dyrkornvatnet
Heimste Skorka
1322
Sandegga
Stavnesbotn
736
Sandfjellet
Ørnedalshornet
887
786
Stavnes
732
hornet
Stavnesvatnet
Storskreda
Benkene
1185
840
Midtbustlia
557
Varden
831
Omnane
620
914
Rikjendbotnen
Myrdalen
Midtbustsætra
Reset
Rikjendskaret
873
Litlelihaugen
595
Turrnausa
Hovsnakken

Training exercise 1.3

Draw the catchment area of Sæternbekken (the attached map, or in the file Nedborfelt_Saet_15000.pdf). The scale is 1:15000. Sæternbekken flows into Øverlandselva, north of Haug gård (south of the text "Ankerveien").

Training exercise 1.4 – Energy balance

Without the sun, there wouldn't be enough energy to keep the water in a cycle. In this exercise we will calculate a very simplified global energy balance.

Given that the solar radiation to the earth is given by
$SW = K (1-\alpha) \pi r^2$,
K = solar constant (global incoming shortwave radiation), 13.5×10^2 [W/m^2]
α = global albedo, 0.3 [-]
r = Earth radius, 6500 [km]

and the emitted longwave radiation from the earth is given by
$LW = \varepsilon \sigma T^4 4 \pi r^2$,
ε = emissivity of the earth, ≈ 1 [-]
σ = Stephan-Boltzmann constant, 5.67×10^{-8} [$W\ m^{-2}\ K^{-4}$]

what is the equilibrium temperature of the earth? (SW=LW and solve for T). What is the unit of the answer?

Obligatory exercise 1

a) Explain with your own words how a catchment area of a river or a lake is defined, and how it can be determined on a map. Why is it important to know the catchment?

b) Draw the catchment area of Sisseldøla and Stuvsbekken on the map in the file Nedborfelt_Sisseldola.pdf. Mark the catchment area of Sisseldøla upstream of the dam near the left arrow, and mark the catchment of Stuvsbekken upstream of the right arrow.