Glossary

for the lectures:

- energy balance and snow
- glacier melt and runoff
- glacier mass balance
- permafrost

In general, we refer to:

Cogley, J.G., R. Hock, L.A. Rasmussen, A.A. Arendt, A. Bauder, R.J. Braithwaite, P. Jansson, G. Kaser, M. Möller, L. Nicholson and M. Zemp, 2011, *Glossary of Glacier Mass Balance and Related Terms*, IHP-VII Technical Documents in Hydrology No. 86, IACS Contribution No. 2, UNESCO-IHP, Paris. http://unesdoc.unesco.org/images/0019/001925/192525e.pdf

Expression	Symbol	Unit	Definition
new snow			Snow deposited within an interval of 24 hours
old snow			Deposited snow where the transformation is so far advanced that the original form of the ice crystals can no longer be recognized
firn			1) Snow that has survived at least one *ablation season* but has not been transformed to ice 2) Structurally, the metamorphic stage intermediate between snow and ice, in which the pore space is at least partially interconnected, allowing air and water to circulate
evaporation			The process by which a liquid changes phase into a vapor
condensation			The process by which a vapor changes phase into a liquid
sublimation			The transition of a substance directly from the solid to the vapor phase
deposition			Change of phase from vapor directly into solid. Also called "desublimation", "resublimation" or "sublimation"
accumulation	*for glaciers:* c (point) C (glacier-wide)		1) All processes (snowfall, windborne snow, avalanching, solid precipitation like hoar, freezing rain, and basal accumulation) which add to the mass of a glacier or a snow pack 2) The mass gained by the operation of any of these processes
ablation	*for glaciers:* a (point) A (glacier-wide)		1) All processes (melting, calving, sublimation, loss of windborne snow, avalanching) which reduce the mass of a glacier or a snow pack 2) The mass lost by the operation of any of these processes.

ablation season			A time span extending from a seasonal maximum of glacier mass to a seasonal minimum
snow water equivalent	*SWE*	mm	The liquid water that would be released upon complete melting of the snowpack
snow density	ρ_s	kg m^{-3}	Mass of snow per volume
degree day factor	*DDF*	mm d^{-1} K^{-1}	1) DDF is the coefficient of relation between surface *ablation* and the positive degree-day sum over any period 2) DDF is the coefficient of relation between surface runoff and the positive degree-day sum over any period
albedo	α	(-)	Ratio of the amount of solar radiation reflected by a surface to the amount incident upon it
emissivity	ε	(-)	The ratio of the total radiant energy emitted per unit time per unit area of a surface at a specified wavelength and temperature to that of a black body under the same conditions
ENERGY BALANCE			
energy balance			A relation describing the change in the amount of energy stored within a defined volume owing to flows of energy across the boundary of the volume, the fluxes being W per m^2 and positive when directed towards the surface
global radiation		W m^{-2}	Total *incoming solar radiation* on the entire hemisphere overhead a horizontal surface which consists of: 1) direct incoming solar radiation received in a parallel beam "directly" from the sun 2) diffuse incoming solar radiation, which is the incoming solar radiation which was scattered by molecules or other agents in the atmosphere and surrounding slopes
incoming shortwave radiation flux	S_{in}	W m^{-2}	Radiant energy flux arriving to the earth surface (the surface not necessarily being horizontal) with wave length λ = 0.15 - 2 μm
reflected shortwave radiation flux	S_{out}	W m^{-2}	Amount of the *incoming shortwave radiation* which is reflected by a surface
longwave radiation flux	L_{in}, L_{out}	W m^{-2}	Radiative energy flux in the infrared spectrum with wavelength λ = 2 - 100 μm
net radiation flux	Q_{NR}	W m^{-2}	Sum of all radiation fluxes (+ incoming shortwave radiation - reflected shortwave radiation + incoming longwave radiation - outgoing longwave radiation)

heat flux provided by rain	Q_R	W m^{-2}	Heat energy supplied by rain falling on the snow or ice surface. It can influence the energy budget of snowpacks in two ways: i) sensible heat additions due to the heat added by a volume of relatively warm rain ii) release of the latent heat of fusion if rainfall freezes on a sub-zero snowpack
ground heat flux	Q_G	W m^{-2}	Heat energy that is transferred via conduction within the ground depending on the thermal conductivity and the vertical soil temperature gradient
turbulence			A state of fluid flow in which the instantaneous velocities exhibit irregular and apparently random fluctuations. These fluctuations are capable of transporting atmospheric properties (e.g. heat, water vapour, etc.) at rates far in excess of molecular processes (*diffusion*).
diffusion			The exchange of fluid parcels between regions in space by apparently random motions on a very small (usually molecular) scale
latent heat			Latent heat is the heat released or absorbed per unit mass by a system in a changing phase
latent heat flux	Q_L	W m^{-2}	Vertical transport of latent heat via turbulence and water vapour exchange between the snowpack and the atmosphere. i) Transfer of water from the snowpack to the atmosphere by *sublimation* or *evaporation* constitutes a loss of latent heat ii) Transfer from water from the atmosphere to the snowpack by *deposition* or *condensation* constitutes a gain of energy
sensible heat			Sensible heat is the heat energy able to be sensed (e.g. with a thermometer)
sensible heat flux	Q_S	W m^{-2}	Vertical transport via turbulence of sensible heat, Q_s being positive when the air is warmer than the surface and Q_s being negative when air is colder than the surface
melt energy flux	Q_M	W m^{-2}	The loss of latent heat of fusion when liquid water drains from the snowpack