

Glaciology – GEO04-648SM

Adjunct Professor:

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Programme

1st Module – Meteorology vs Climatology

Introductions and differences; the Earth's energy balance; Absorption spectra and black body; the role of green house gases (CO₂, H₂O, CH₄) and the "green House Effect"; Albedo; Theory of "Climate Change" and evidence (temperature, sea level, glacier melting, sea ice); atmospheric lapse rate (T); introduction to synoptic; Stau-Föhn; energy balance at glacier surface; climatology and meteorology of snow falls in the Alps; seminars on specific topics

2nd Module – Glaciers and glacial environment

Snow metamorphism and density (snow, *firn*, ice), *Sorge's* law, glacier *facies*, the global cryosphere (definitions), Mass Balance (regimes, seasonality, gradients, freezing level), ELA, precipitation-temperature relationships with the ELA, glacier sensitivity to climate change, the *Brikdalsbreen* event, methods for the calculations of the ELA (AAR, MELM, CFA, THAR, Kurowski or MGE, AABR), mass balance methodologies (glaciological, geodetic, geophysical and the use of GPR), thermal structure of a glacier (temperate, polythermal and cold glaciers), pressure melting point, temperature distribution within a glacier), glacier dynamics, ogives or Forbes bands, continuity equation, creep, stress, strain, basal and lateral drag, crevasses, *bergschrund*, Glen's law, Basal motion, Basal sliding, Calving processes (back stress, melt undercutting, buoyancy driven-Greenland, Antarctic ice shelf collapse), Surging processes (Hydrologic switch and thermal switch), glacier hydrology, *bedières*, englacial drainage (cut and closure, fractures), glacial speleology, Zwally effect, debris transport (supraglacial, englacial, subglacial), plucking, debris cover glaciers, the Little Ice Age (LIA) in the Alps, Black Carbon and the end of the LIA, debris deposition and types of moraines (frontal, lateral, ice-cored, fluted, *rogen*, hummocky), glaciokarst, intro to glacier modeling; seminars on specific topics

3rd Module – Permafrost and periglacial environment

Permafrost (definition), frost action, zero-curtain effect, thermal regime in the ground and active layer, permafrost types (latitudinal, altitudinal, montane, alpine, submarine), ground ice, ice wedges and thermal contraction crack polygons, soil constituent and freezing processes, Geometric situation in the soil, ice lenses, transient layer, active layer phenomena (ice needles, bedrock heave, tilting of stones, patterned ground and frost sorting, geli/solifluction features, moss banks), cryoturbation and frost heave (injection ice, elevational potential and pore water expulsion), Pingo (Open system and Closed system), thermokarst, Stefan Solution, Rock glaciers (activity degree, dynamics and climatic/geomorphological classification, glacial and periglacial genesis, avalanche-derived rock glaciers) RILA, BTS (Bottom Temperature of Snow-cover), ERT (Electrical Resistivity Tomography), Protalus and Pronival Ramparts, Ice caves, static ice-caves and dynamic ice caves, ice cave climatology, cryogenic calcite, cryosphere and glacier-like forms on Mars.