Precipitation

All water enters the land phase of the hydrologic cycle as precipitation

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Phases

1. Solid: snow, ice, hail, sleet
2. Liquid: rain, freezing rain
3. Occult: fog and cloud drip

What hydrologists need to know

- Amount
- Rate (intensity)
- Duration
- Quality

Of precipitation, and distributed in

- Space
- Time

Point measurements

rain gauge or precipitation collector

-Volume of ppt / area of opening =

Depth of ppt ($L^3/L^2 = L$)

Factors affecting accuracy

1. Orifice size
2. Plane of orifice
3. Height of gauge
4. Wind screen?
5. Site location
6. Evaporation of collected water

C1 Niwot Ridge, Colorado

Davos, Switzerland

Major Uncertainties

- error in point measurements
- Spatial extrapolation of point measurements

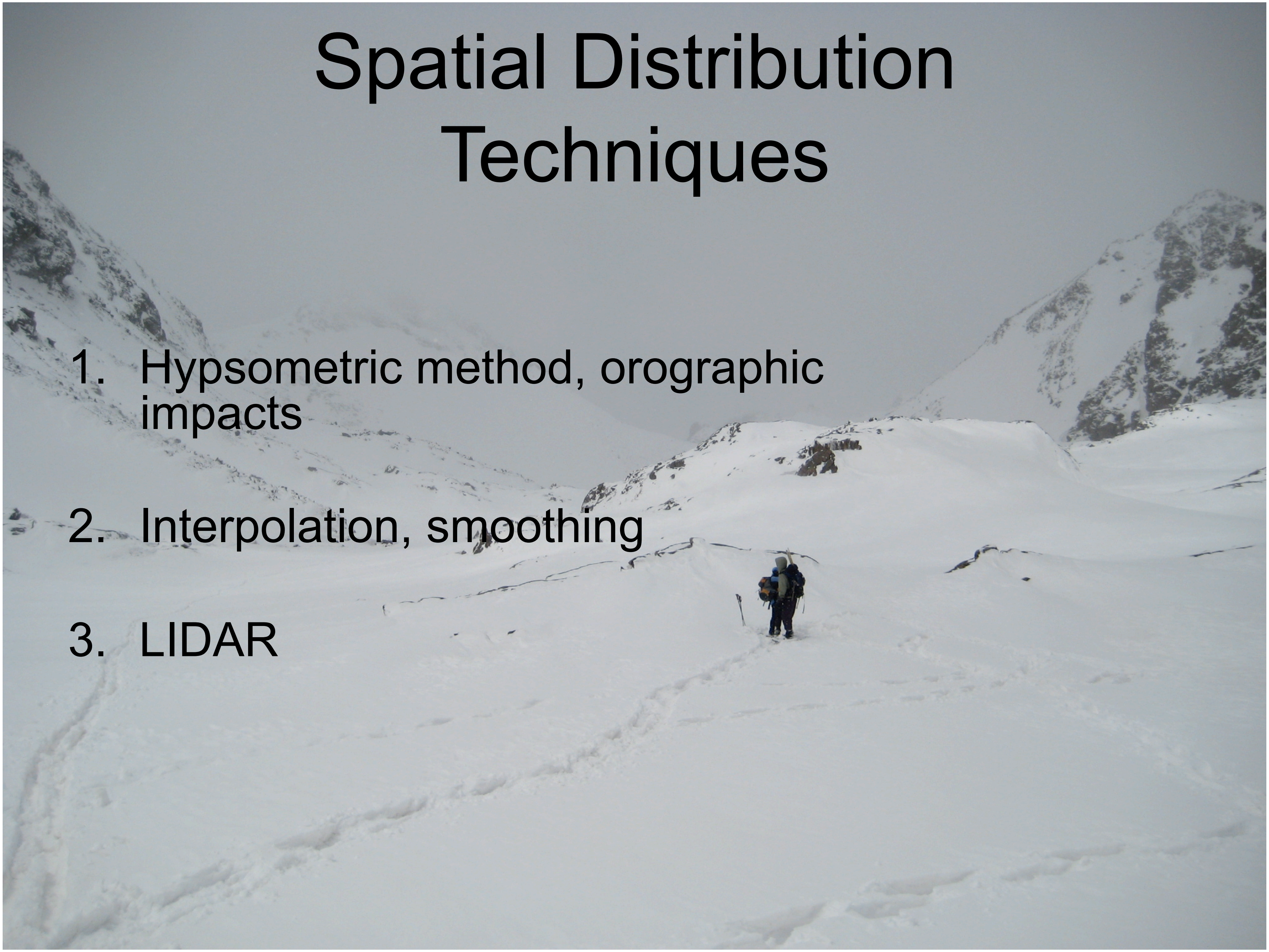
Green Lakes Valley from Niwot Ridge in January

Spatial Distribution Techniques

1. Hypsometric method, orographic impacts

2. Interpolation, smoothing

3. LIDAR



Conditions for Precipitation

1) Creation of saturated conditions in ATM

- RH ≥ 100 %
- Cooling to the dewpoint

2) Condensation / Sublimation

- C/S of water vapor into liquid or solid water
- need cloud condensation nuclei (CCN)
  (i.e. silver iodide and cloud seeding)

Conditions for Precipitation

3) Droplet Growth

- Liquid water droplets + Ice nuclei
- most snow large enough that gravitational forces can counter-act atmospheric uplift and the droplets can fall to the ground

4) Importation of water vapor

- new water must be imported to maintain saturated conditions to get measureable precipitation amounts

Humidity
(water content of the air)

Specific Humidity:

= mass of water vapor per unit mass of air

= g Kg^{-1}

= convert from vapor pressure to specific humidity using the ideal gas law

Relative Humidity:

= ratio of water vapor in the air compared to the maximum water vapor the air can hold at that temperature, expressed as a percentage %

= VP/SVP = e/e_{sat} x 100%

=Specific humidity / specific humidity at sat(T) x 100%

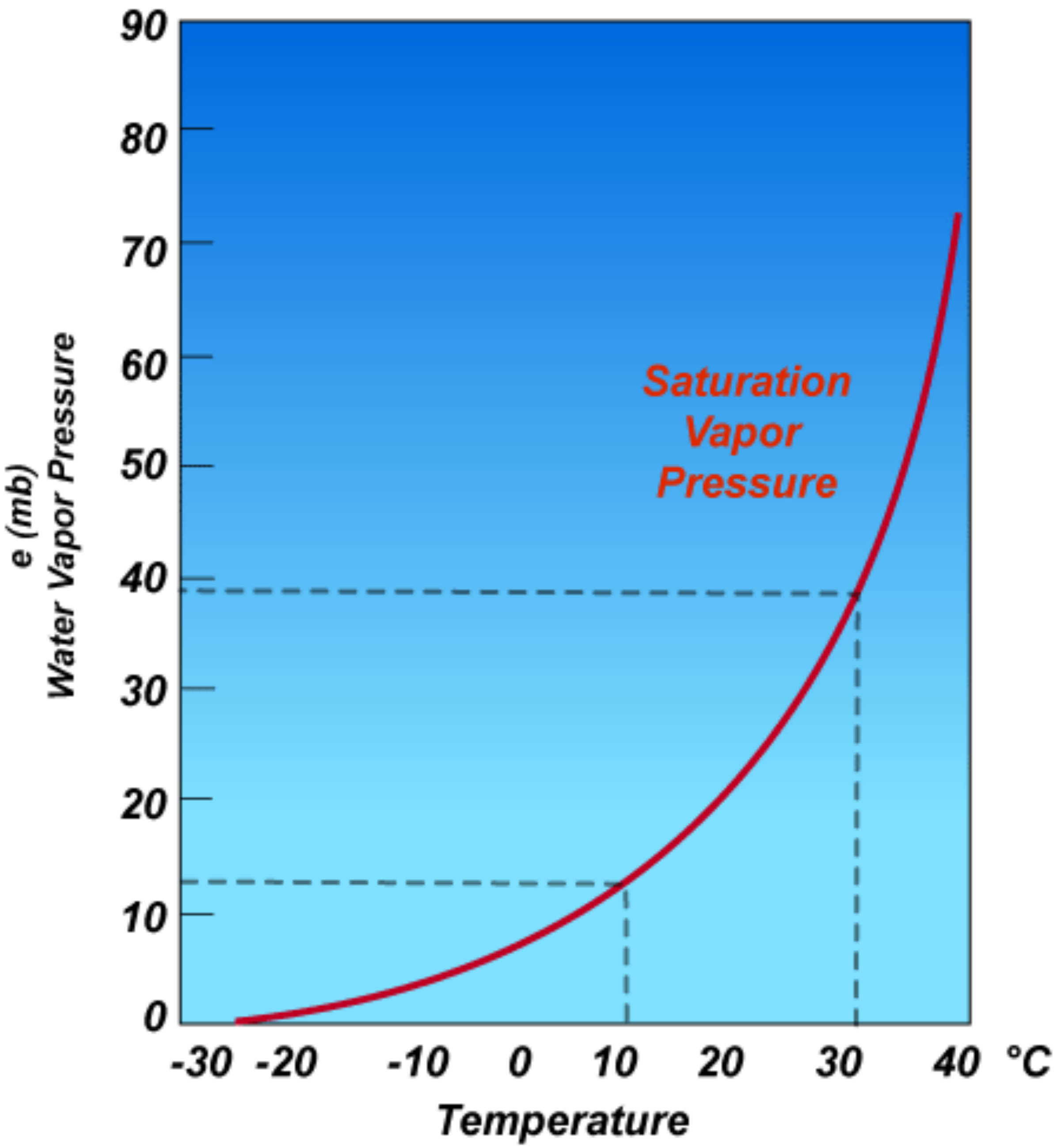
Vapor Pressure (e):

- pressure extended by gasses as a result of their molecular motion and collisions
- Units = mb

Saturation Vapor Pressure (e_{sat}):

- Maximum vapor pressure that the atmosphere can hold under thermodynamically stable conditions
- Function ONLY of temperature of atm (in ^{o}C)
- E_{sat} (T_a) = 6.11^(17.3*Ta / Ta+237.3)

When e_{sat} is reached, adding more water vapor (or lowering T) results in condensation or deposition, the formation of liquid droplets or ice crystals in the air



Super-saturated

Dew point

Under-saturated