

SOLID PRECIPITATION

Solid Precip. = Snowfall, ice pellets (graupel), hail, hoar frost, rime, glaze.

Globally, $\approx 5\%$ annual precipitation falls as snow

Alpine and Arctic areas $\approx 70\%$ falls as snow

Maximum amounts ≈ 5 m snow annually on Mt Rainier (~ 2.5 m water equivalent).

Empirical relation (Monthly):

$$\text{Snow (\% of precip)} = 50 - 5 T_A \text{ (near MSL) [Lauscher]}$$

In Alps, ~ 700 m: Snow % = $61 - 5 T$ [Sevruk, 1985].

MEASUREMENT PROBLEMS

**Gauge catch: depends on wind speed, turbulence
local terrain, gauge exposure
gauge height, shielding, design of gauge esp. rim
wetting of gauge walls, evaporation of catch**

**Gauges need: Shield (Nipher, Alter, Tretyakov)
In windy environments – shield + snow fence(s)**

**Catch of unshielded gauge/snow on ground $\sim 0.3-0.4$
Alter shielded gauge $\sim 0.5-0.8$
Nipher-shielded gauge $\sim 0.9-1.05$**

SNOW DEPTH:

**Ruled stick N, America; 3 fixed stakes – Russia
Sonic detector of surface height (AWS)**

SNOW WATER EQUIVALENT:

Canada: formerly used depth on ground $\times 0.1$ to estimate precip from snowfall;

But, density factor 0.07-0.11 annual range ;

For individual storms, SNOW DENSITY from 50-300 kg/m³.

MEASUREMENT OF WATER EQUIVALENT

SNOW BOARD – on surface (if no wind); cleaned after each fall.

SNOW COURSE – sample depths at regular intervals; overall density (10 days in Russia; 1-2 /month in N America).

**PRESSURE PILLOW – weight of pack gives w.e (at SNOTEL Sites);
Pillow surface $\geq 3.66 \text{ m}^2$**

NUCLEAR PROFILING - Radio-isotope (Co-60, Cs-137) attenuation

**Airborne – natural gamma radiation spectrometer surveys,
Before / after snowfall (effects of soil moisture, radon gas).**

NETWORK DENSITY

WMO recommended: 1 station /6500 km² in plains, 1/500 km² in mountains.

Canada: average ~ 7 stations/25,000 km² and $< 2/25,000 \text{ km}^2$ over half of country.

U.S. network density $\sim \times 6$ that of Canada.