NASA SnowEx Science Plan Capabilities Chart – Group Activity

		Snow Observation			Gap Capabilities							Instruments/Systems		
Type	**Snow sensing Technique**	**Snow Depth**	**SWE**	**Melt Detection**	**High-Res**	**Wet snow**	**Deep Snow**	**Forests**	**Complex Terrain**	**Shallow Snow**	**Clouds**	**Satellite**	**Airborne/ UAS**	**Ground-based**
SWE via snow depth	Lidar	+/- 2-8cm [11]						14,15				GEDI, IceSAT-2	ASO, LVIS, ATM	TLS
	Ka-band InSAR												Glistin-A	JPL (Mammoth)
	Dual band Ku/Ka altimetry													
	SfM/Stereo Photogrammetry									>30 [12]		Worldview 1/2, GeoEye 1, SkySat-C	ASO, UAS	
	Wideband Radiometer	+/- 2 cm over 3 GHz BW [13]					depends on the sampling rate[13]						UWBRad	WiBAR
Volume scattering	Ku-band SAR												SWESARR, UMASS, SnowSAR	UW Scatterometer, Sherbrooke
	Passive Microwave		+/- 40 mm[1]		3-6 km^2	< 1% LWC[3,4]	Algorithm controlled see note 1	< 20-30% ff[5]				AMSR2, SSM/I, GlobSnow	SWESARR, AESMIR, AMPR	Sherbrook, UMich, OhioSt
Signal interferm.	L-Band InSAR											NISAR	UAVSAR	CRREL
	Signals of Opportunity		+/- 7.5 mm[10]									SNOOPI	JPL/Fraser UAS	JPL/Fraser,
Airborne / ground only	FMCW Radar												UofAL	BoiseSt
	Gamma												NOHRSC	

		Snow Characteristic			Gap Capabilities							Models/Platforms
Type	**Snow sensing/ estimation Technique**	**Snow Depth**	**SWE**	**Melt**	**High-Res**	**Wet snow**	**Deep Snow**	**Forests**	**Complex Terrain**	**Shallow Snow**	**Clouds**	
Modeling	Physical Modeling										Affects forcing data	SnowModel, Alpine3D, CROCUS, Noah-MP, NOAH, Jules, CLSMF…
	Radiative Transfer Modeling											DMRT-ML, HUT, MEMLS, SMRT
	Data-driven modeling											

	Snow Characteristic			Gap Capabilities							Instruments/Systems		
Snow sensing/ estimation Technique	**Albedo**	**SCA**	**Melt**	**High-Res**	**Wet snow**	**Deep Snow**	**Forests**	**Complex Terrain**	**Shallow Snow**	**Clouds**	**Satellite**	**Airborne/ UAS**	**Ground-based**
Hyperspectral												AVIRIS-NG	ASD
Multispectral											MODIS, VIIRS		
BRDF												CARR, Malibu	
Thermal IR												UW S. Pestana	

Green – Demonstrated capability. May not work in all areas, but uncertainty is understood. May still benefit from additional research and algorithm development
Yellow – Potential capability identified and validated in multiple studies. Research needed to better quantify uncertainty.
Orange – Potential capability identified, but uncertainty not quantified. High risk.
Red – No Capability

Technique priority (from Science Plan): **Mission Critical,** Crucial, Important, Beneficial

SnowEx2017; SnowEx2020; TVC ASO

Note 1: Traditional algorithms cite 150 mm as the maximum retrievable SWE[5]. Recent results show advanced algorithms can extract information on deeper SWE from passive microwave[6,7,8,9].

What's Missing??

- Fill in references or numbers for research you're aware of
- Add comments if you think a color is incorrect or a technique is missing
- Add dots if you know of field data being collected
- Fill in names of specific instruments or models