

Emerging Agricultural Technologies

Len Hingley

Soil and Water Specialist

Alberta Agriculture and Forestry

January 17, 2018

Gamma Ray Spectrometry (Radiometrics)



Credit: F.M. van Egmond et al., (2010)

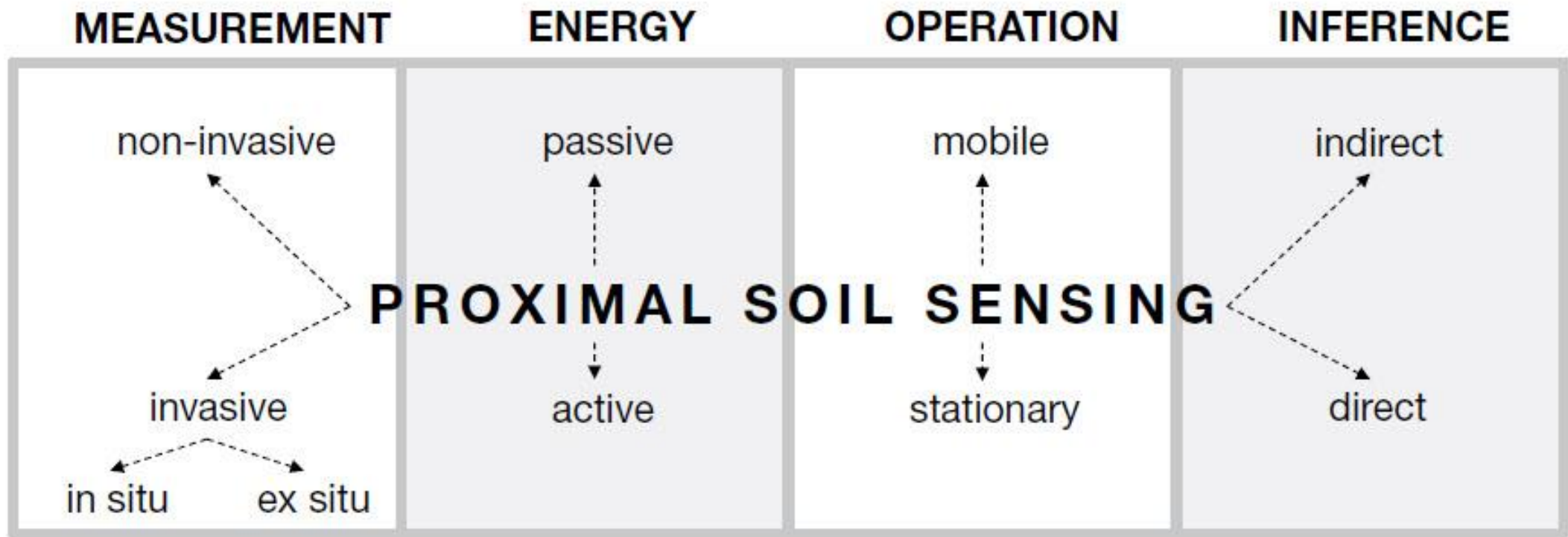
Proximal Soil Sensors (PSS)



Credit: Paolo Storchi et al., (2015)

Proximal Soil Sensing can which is defined as a field based method of measurement that occurs 2 m or less above the soil surface.

(V.I. Adamchuk and R.A. Viscarra Rossel (2011))



Source: Viscarra Rossel *et al.*, 2011.

Gamma Ray Spectrometer

RS-700 Radiation Solutions (Gamma Ray Spectrometer)

- Non-invasive
- Active
- Mobile
- Indirect

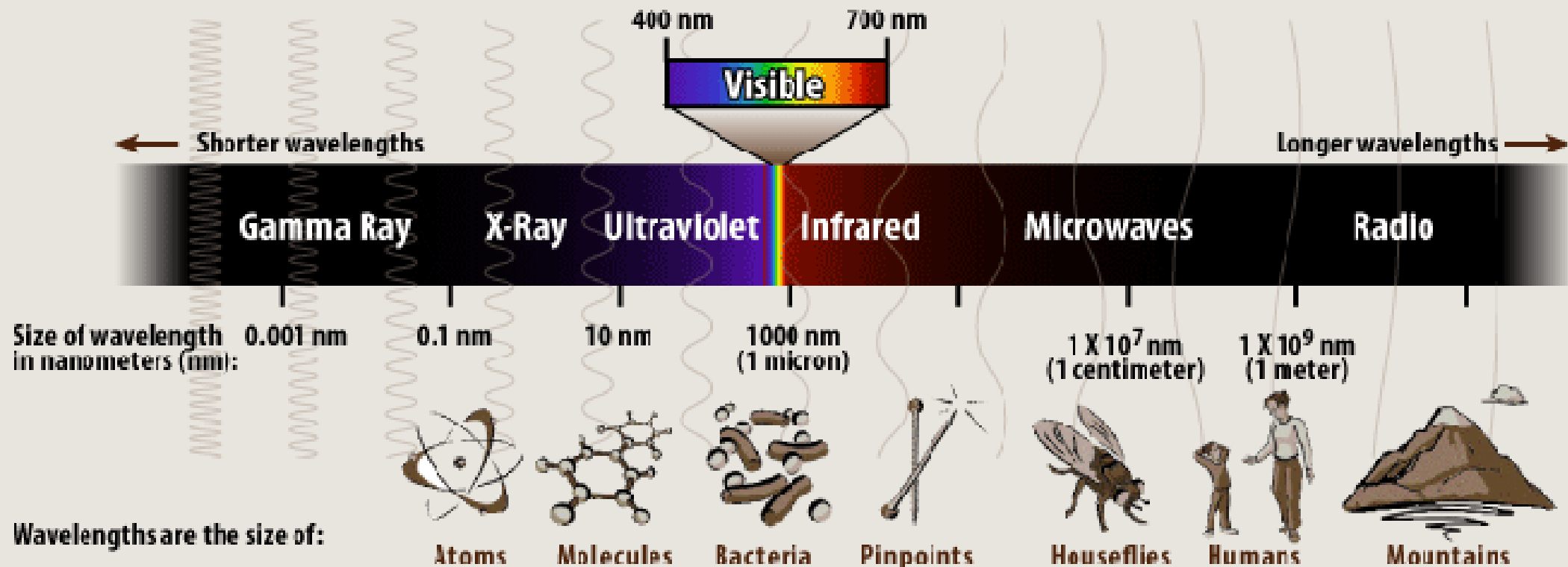


Source: Radiation Solutions Inc.

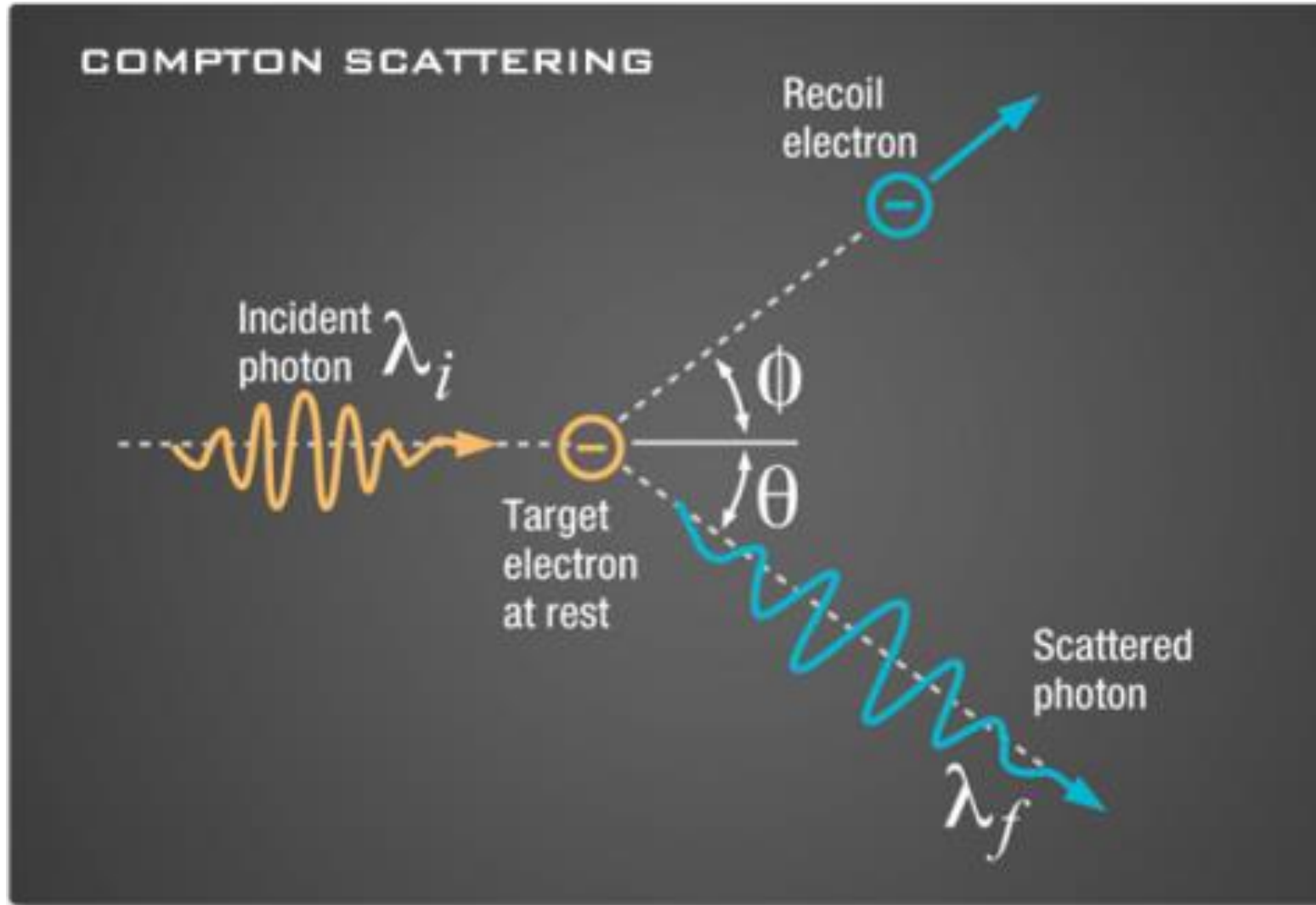
How does it work?

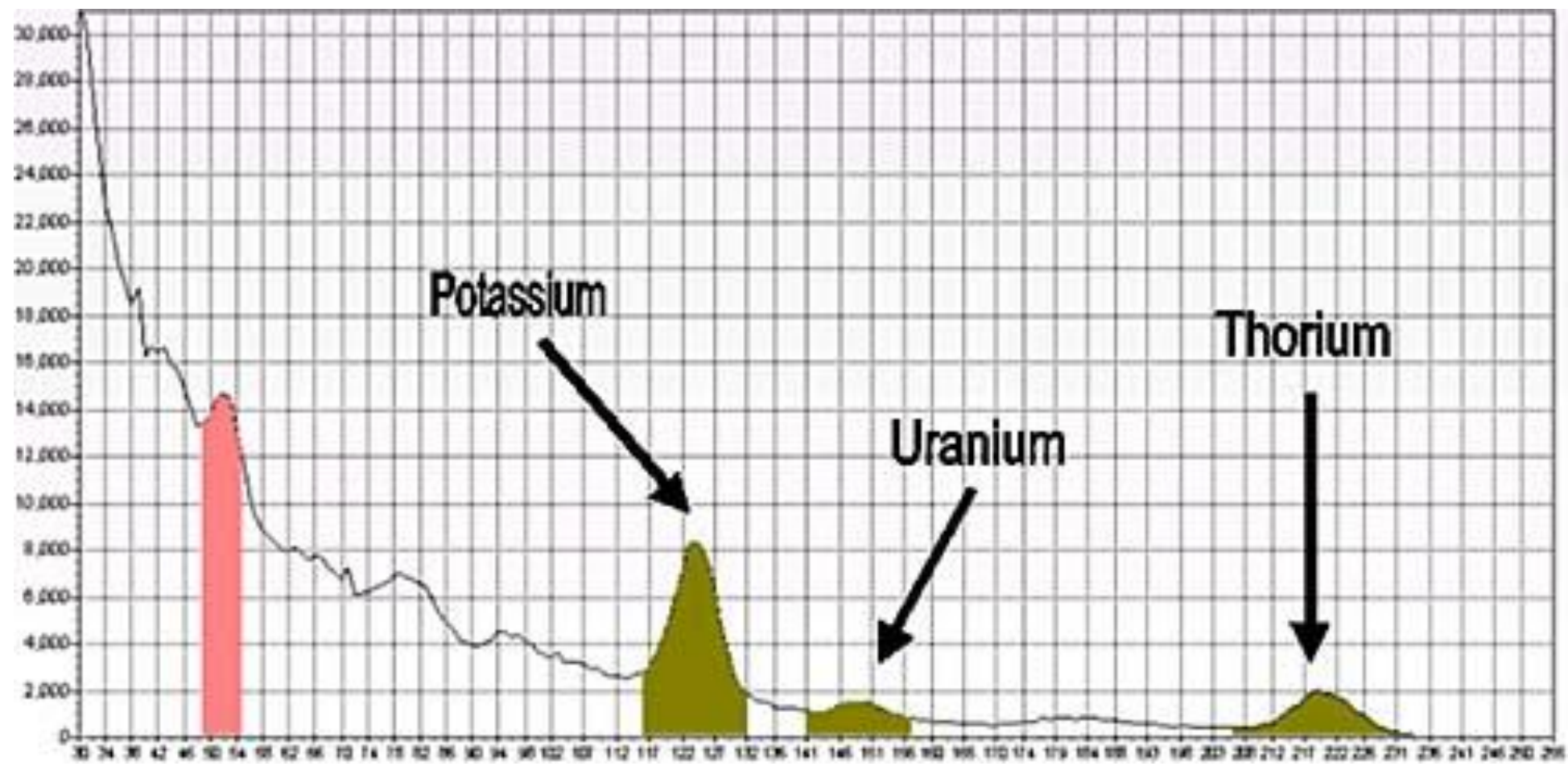
The Electromagnetic Spectrum

The electromagnetic spectrum is made up of light of many different wavelengths. Most wavelengths are invisible to us. In fact, our eyes can only detect the small portion of the spectrum between 400 and 700 nanometers. We call these wavelengths "visible light."




How does it work?



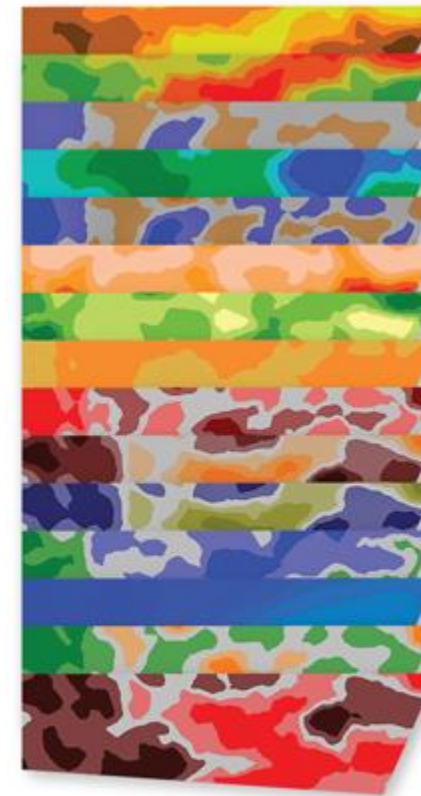
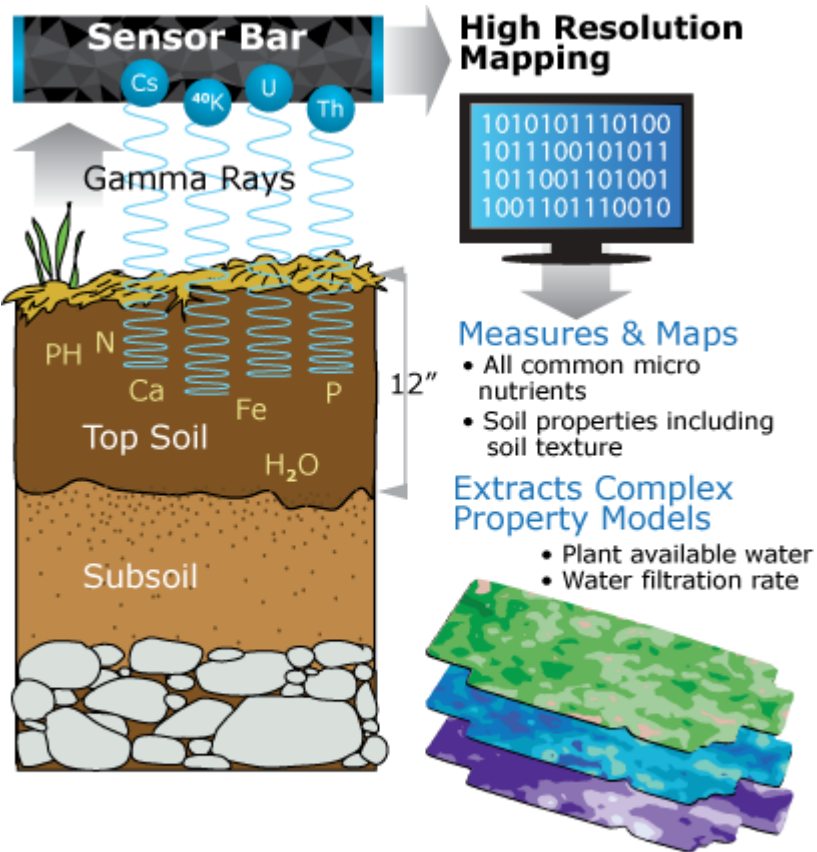


Source: Agriculture Victoria

Soil property	EM SPECTRUM							
		γ-rays	X-ray	DRS	Microwave / Radar	Acoustic / Radio	EMI	Electro- chemical
carbon		GOOD		GOOD			SOME	
nutrients			OK	SOME			SOME	GOOD
elements		GOOD	GOOD	some				
pH				OK				GOOD
CEC				GOOD				
salinity/sodicity							GOOD	OK
water		GOOD		GOOD	GOOD	OK	SOME	
bulk density		GOOD		SOME	SOME	SOME		OK
strength/compaction					SOME	OK		OK
clay, silt, sand		OK		GOOD		SOME	OK	
colour				GOOD				
soil depth					GOOD	SOME		+
mineralogy		OK	GOOD	GOOD				

Viscarra Rossel et al. (2011)

SOILOPTIX® High Definition Top Soil Mapping



Layers developed to date...

Texture

Clay	Sand
Loam	Silt

Macro Nutrients

Calcium	pH
Calcium Base Saturation	Phosphorus - Bicarb
Calcium-Magnesium Ratio	Phosphorus - Bray
Cation Exchange Capacity	Potassium
Magnesium	Potassium Base Saturation
Magnesium Base Saturation	Potassium Magnesium Ratio
Organic Matter	

Micro Nutrients

Aluminum	Nitrate as N
Boron	Sodium
Copper	Sulfur
Iron	Zinc
Manganese	

Complex Models

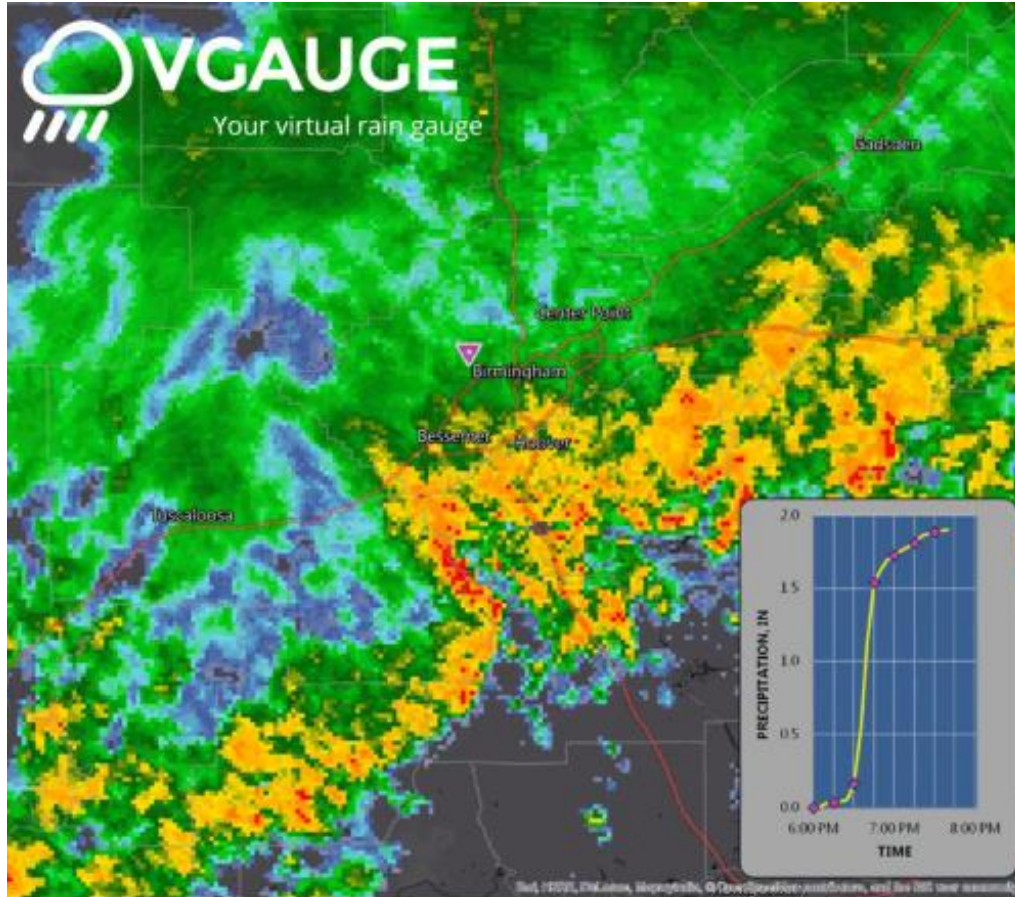
Bulk Density	Plant Available Water
Hydraulic Conductivity	
	Elevation

Maximize Seeding & Input Performance

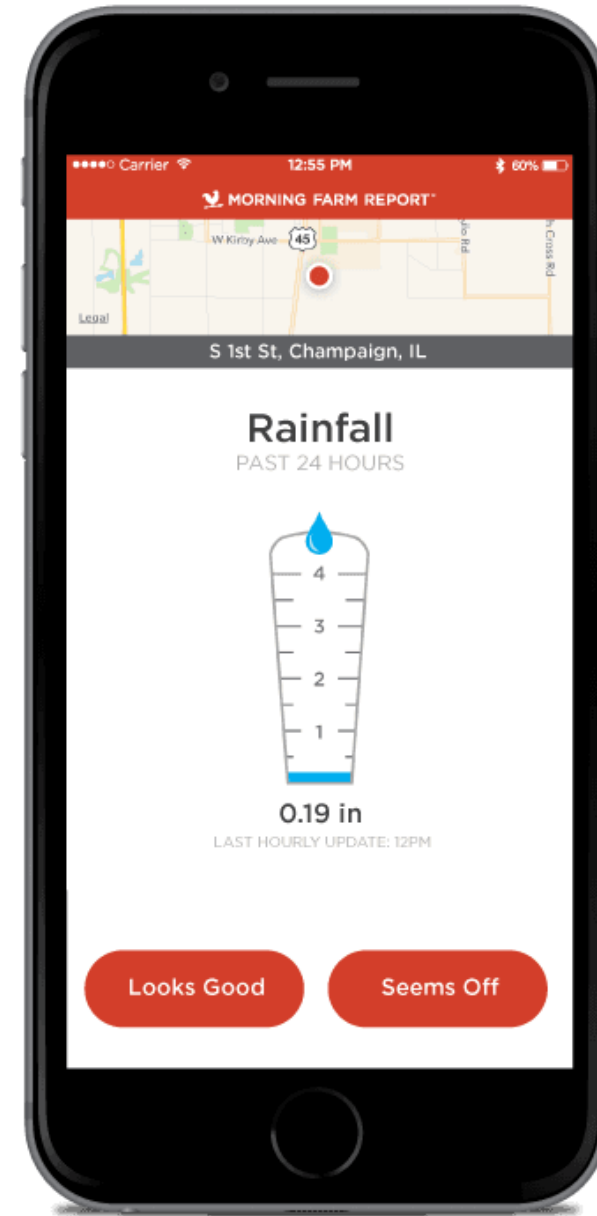
335 pts/acre compared to standard 1-2 pts/acre

Source: SoilOptix

Virtual Rain Gauges

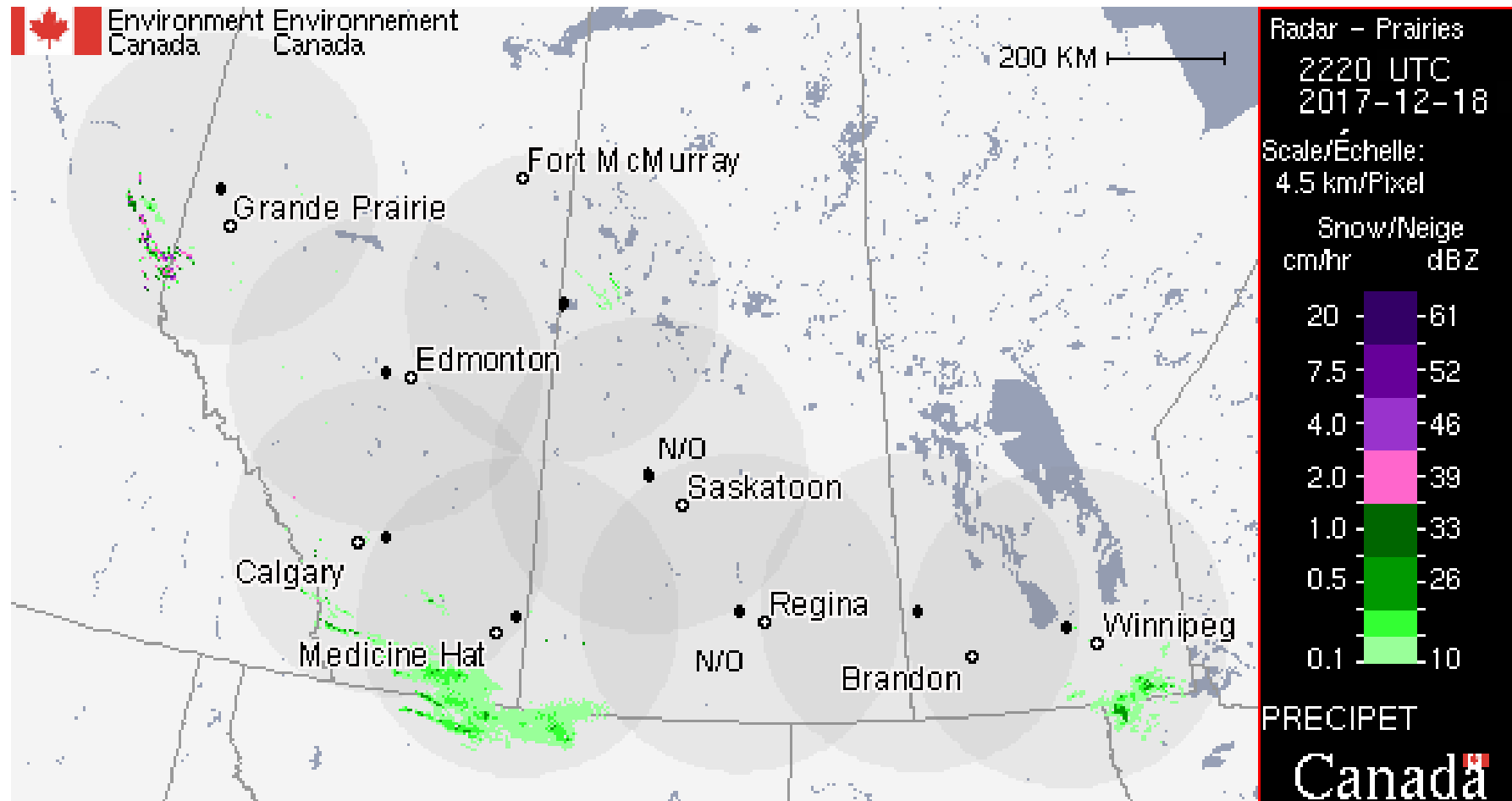


Source: Schoel Consulting Engineers



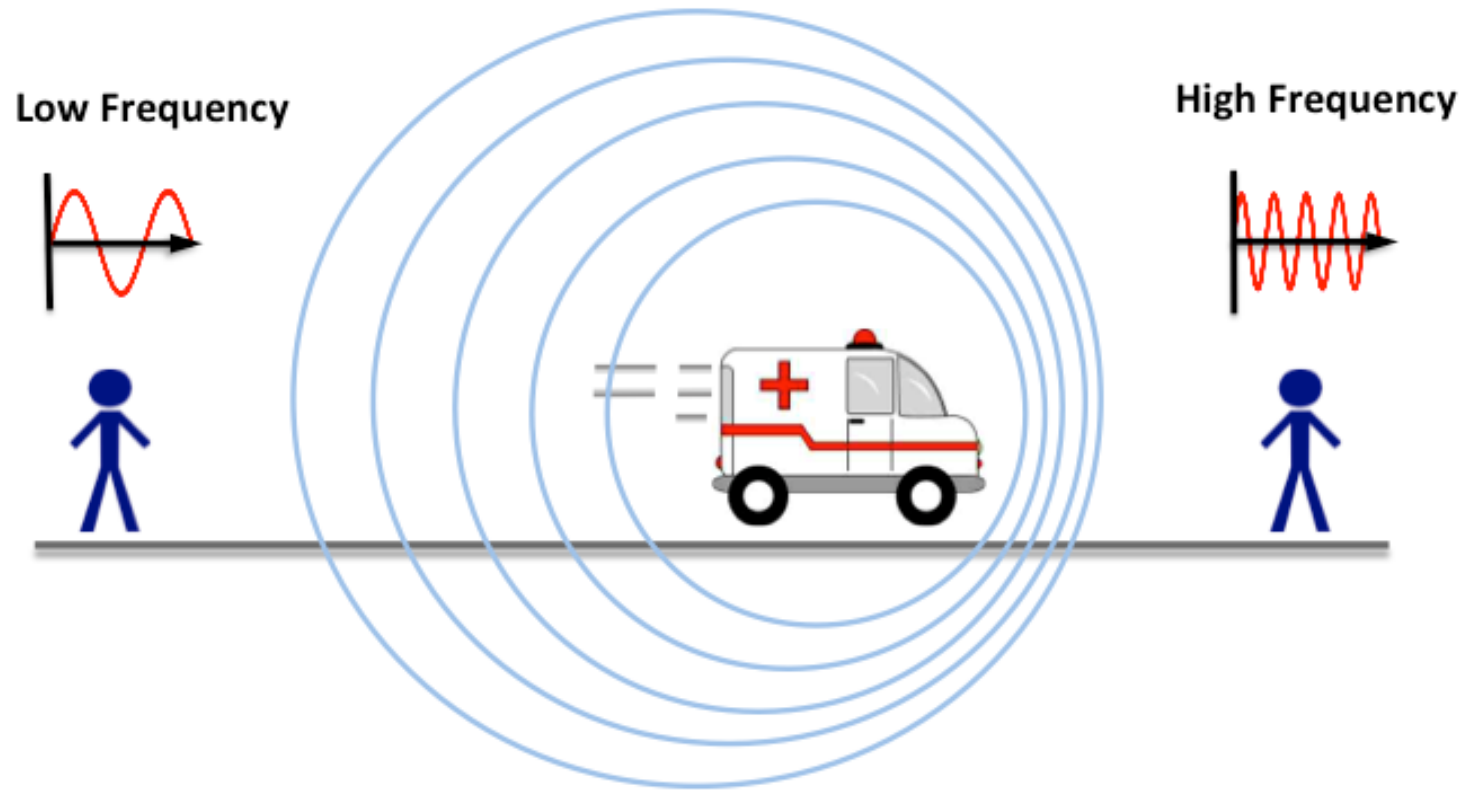
Source: Agribble

Current Doppler Radar Locations in Western Canada

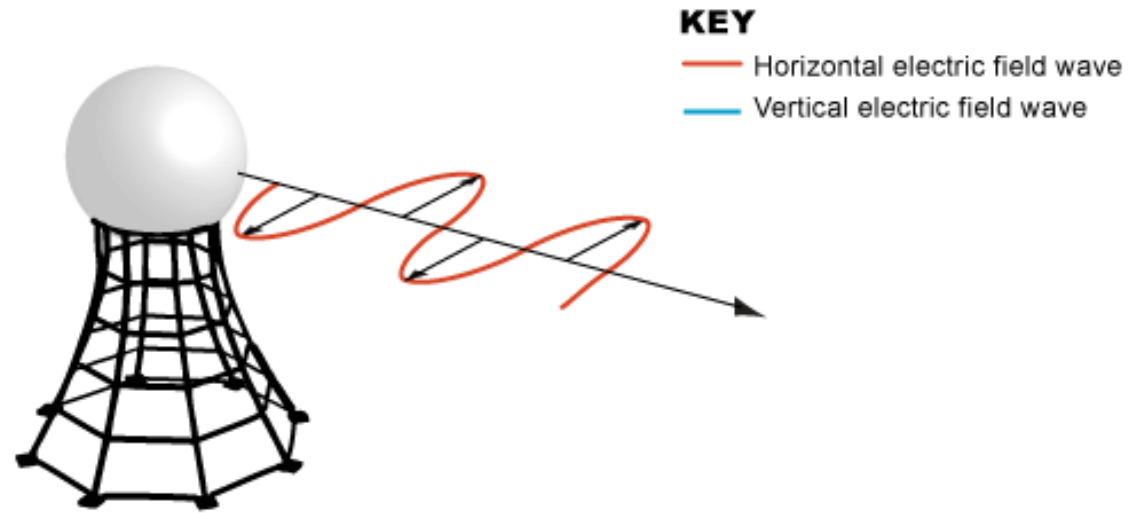


Source: Government of Canada - Weather

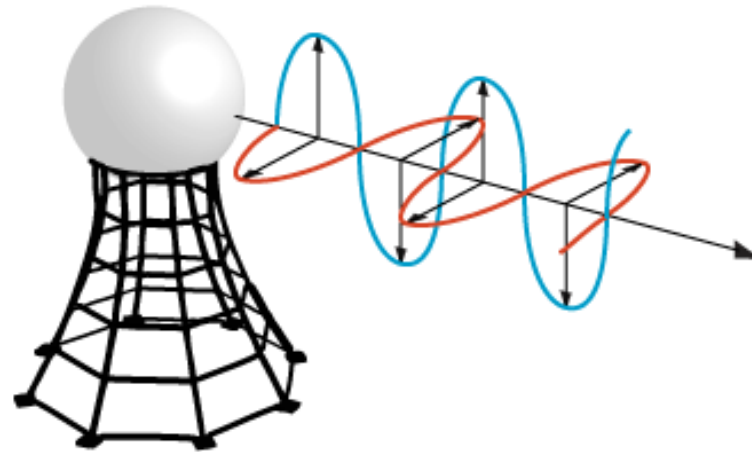
Doppler Effect



Dual Polarization Radar



Current radars (non-polarization)



New dual-pol radars (polarization)



(Photo courtesy of Environment and Climate Change Canada)

DOPPLER RADAR

120 km coverage range

Horizontal pulse of energy creates one-dimensional images

Unable to distinguish between different types of precipitation

Can detect rotation in the atmosphere to better help infer when tornadoes may be forming

SELEX ES RADAR

240 km coverage range

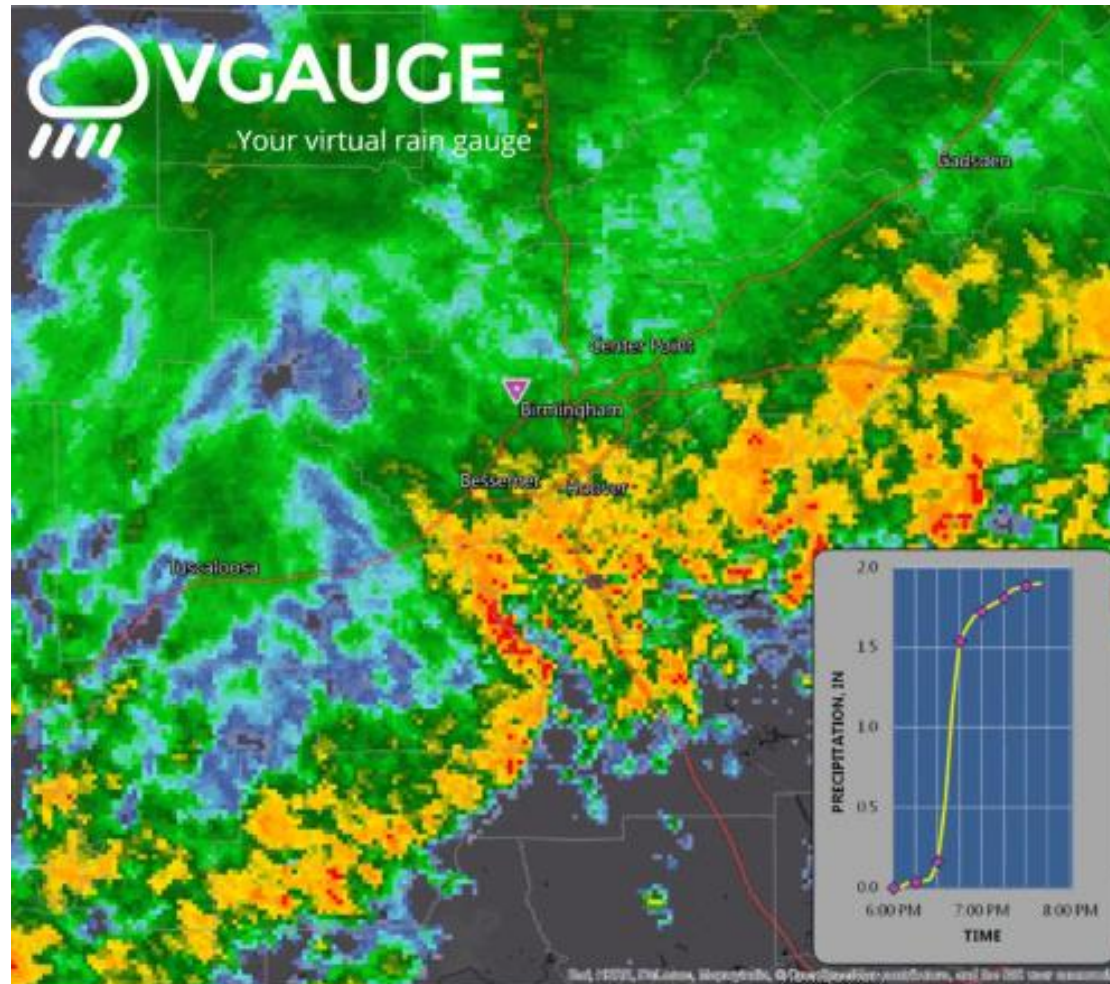
Two-fold energy pulse sends and receives horizontal and vertical pulses of energy which create two-dimensional images

Extended range will help monitor neighbouring areas in case the case of outages

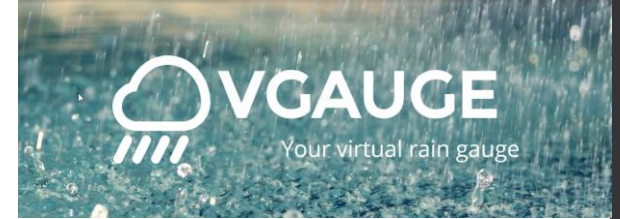
Better track incoming extreme weather in advance



[Photo courtesy of Leonardo S.p.A]



FEATURES



- **Maintenance**

Maintenance free – it's all on your phone.

- **Alerts**

Custom notifications – set alerts to be sent to your phone if a predetermined rainfall exceeds desired amount.

- **Radar Based Rainfall**

Radar (Dual-pol) based information.

- **Forecast**

VGauge can be your on-site weatherman, providing alerts if the forecast rainfall triggers a custom notification

- **Reporting**

Precipitation reports are provided following a rainfall event. Monthly reports are also provided that include the daily precipitation totals for the month.



VGauge

Your virtual rain gauge

SERVICE SETUP AND PAYMENT

Please complete the information in the fields below to setup your VGauge service. If you would like to sign-up multiple sites, please email vgauge@schoel.com.

AMOUNT

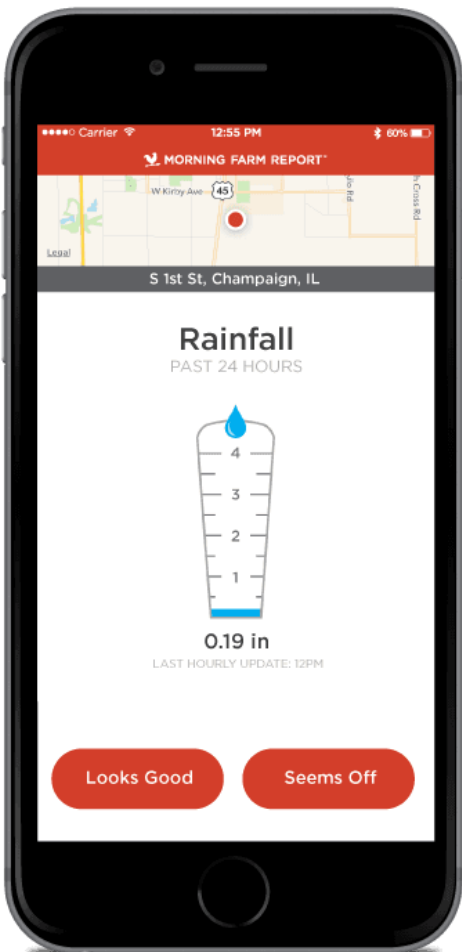
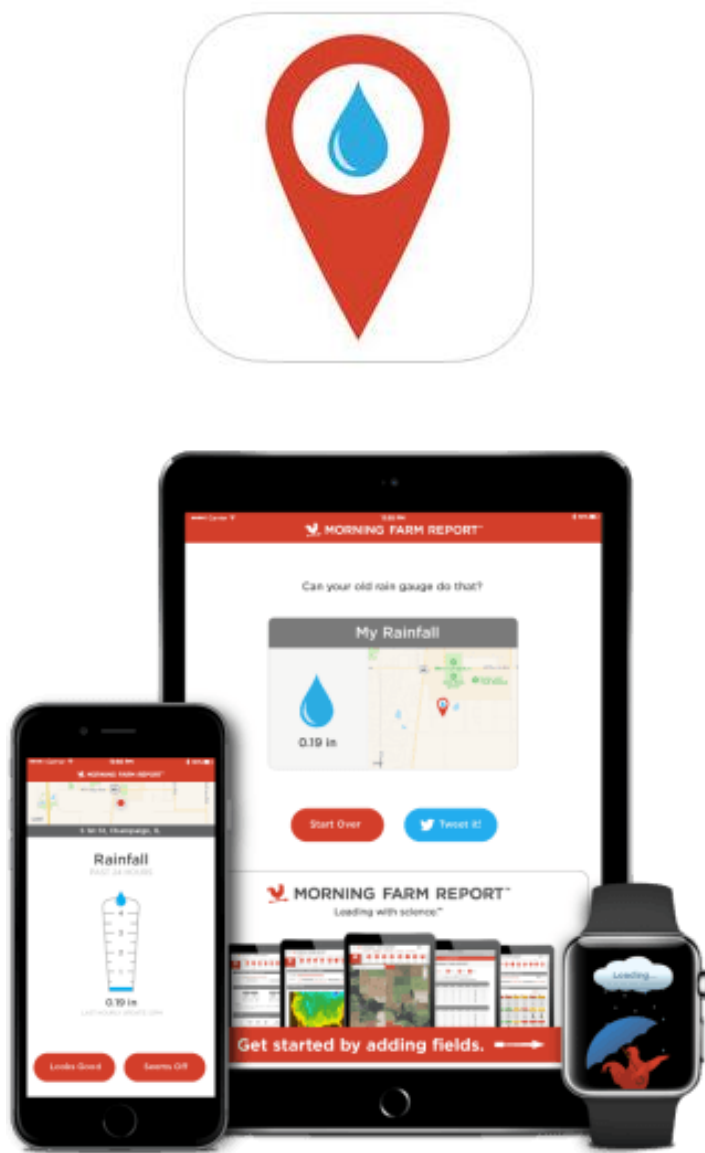
\$35.00

Monthly Monitoring Fee

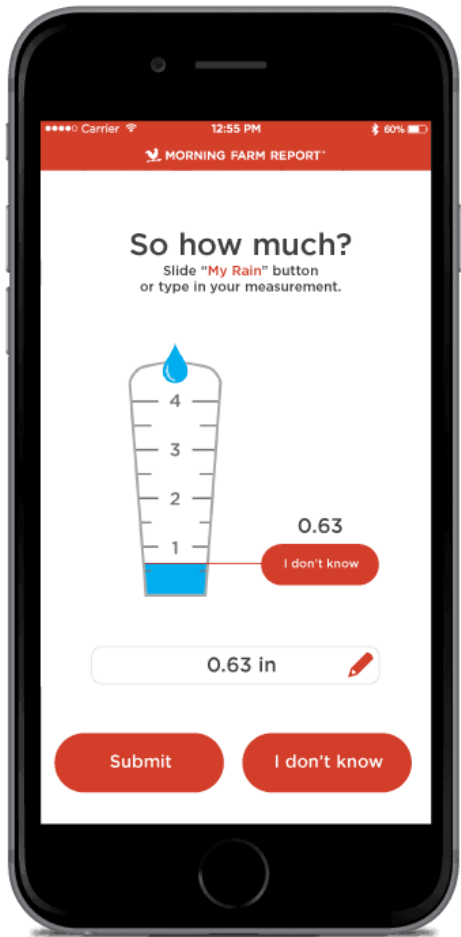
+ \$300.00 at checkout — One-time Setup Fee

🔄 Recurs monthly starting in 7 days

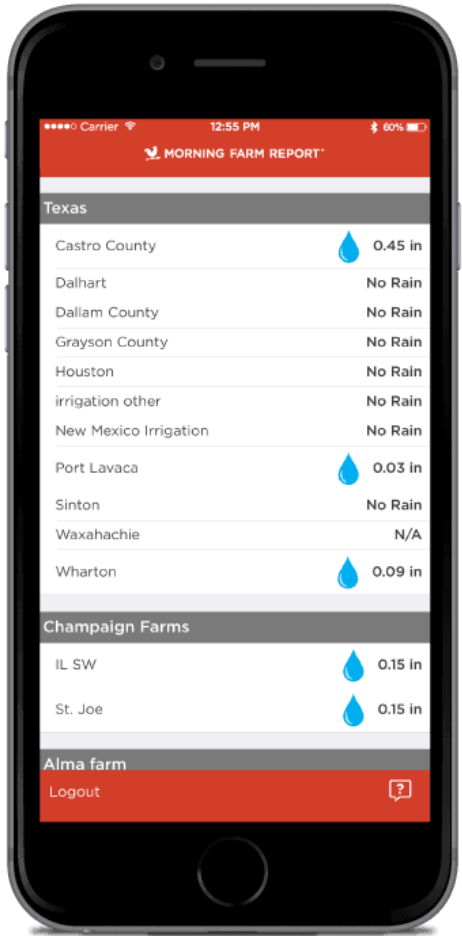
Pocket Rain Gauge



Instant Rainfall
Find out how much it rained at your location in the last 24 hours. Data are updated every hour and represent the previous 24 hours.

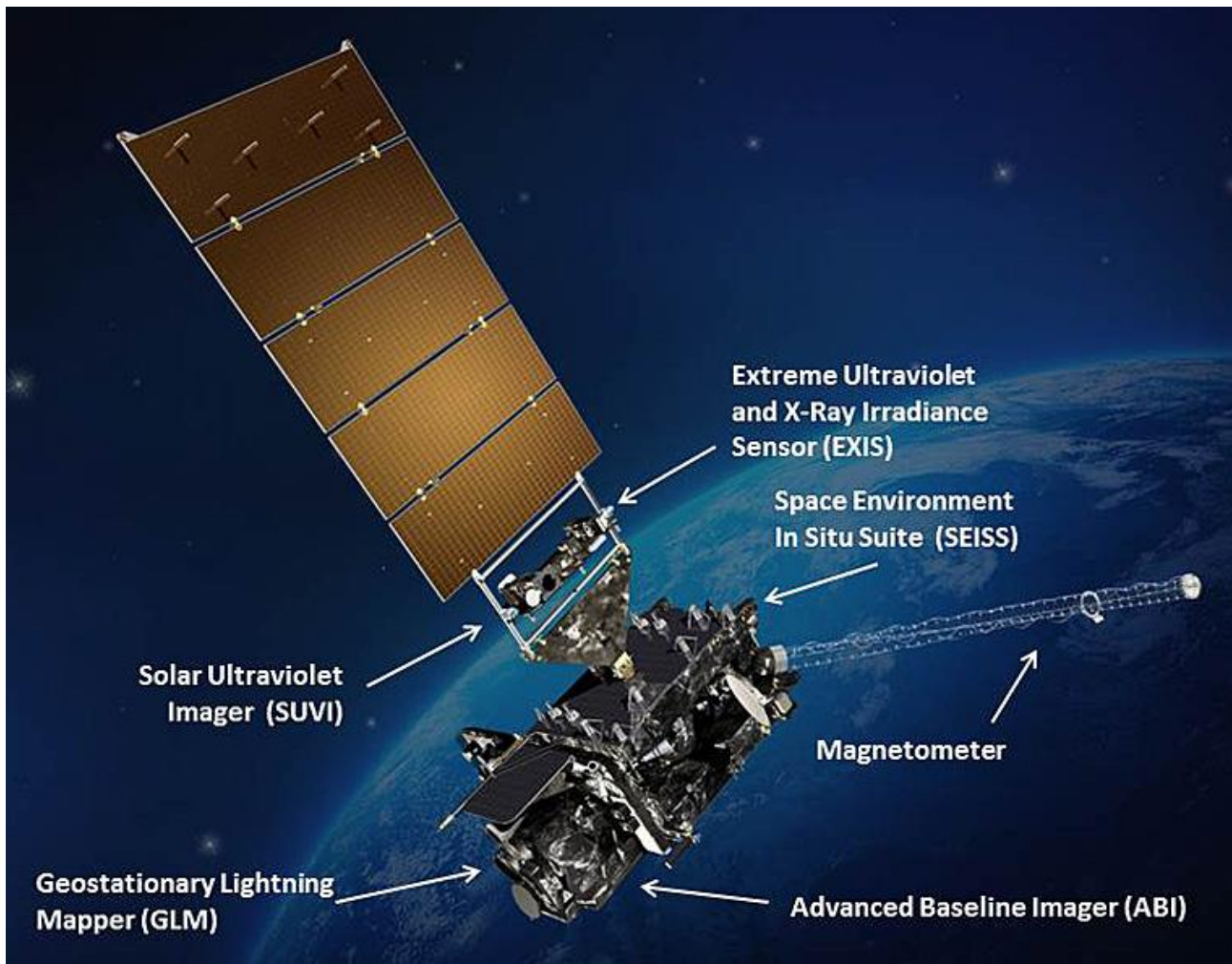


User Feedback
Let us know if we're right, or submit your own measurement if we're off. Feedback helps us improve our results.



Multiple Locations
Check rainfall on every field and anywhere rainfall matters to you. Link **Pocket Rain Gauge™** to your **Morning Farm Report®** account and get started





Source: Both images NOAA

Thank-You