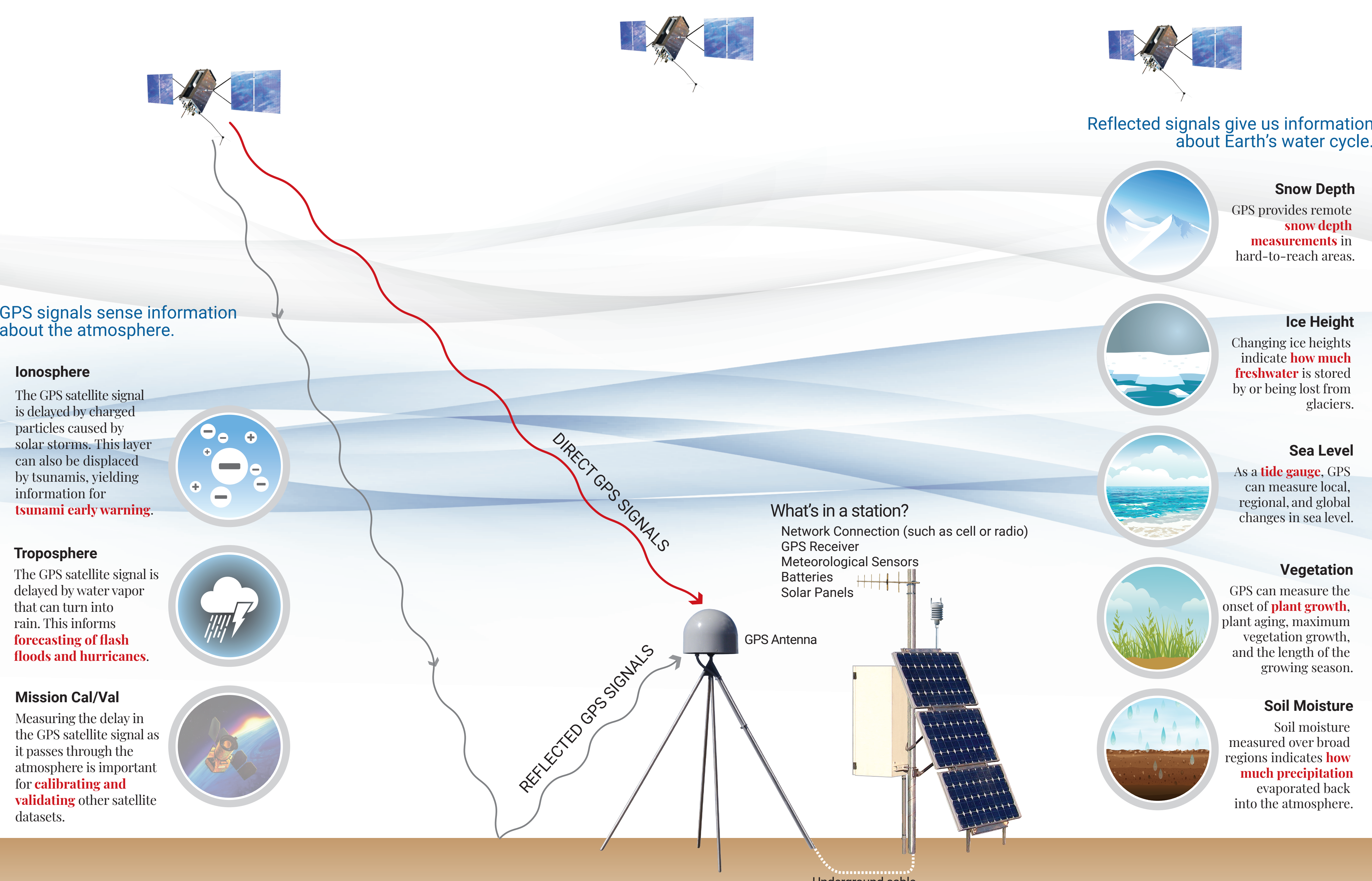


What GPS Can Tell Us About Earth

High-precision GPS stations measure Earth system processes and hazards.



Reflected signals give us information about Earth's water cycle.

Snow Depth

GPS provides remote **snow depth measurements** in hard-to-reach areas.

Ice Height

Changing ice heights indicate **how much freshwater** is stored by or being lost from glaciers.

Sea Level

As a **tide gauge**, GPS can measure local, regional, and global changes in sea level.

Vegetation

GPS can measure the onset of **plant growth**, plant aging, maximum vegetation growth, and the length of the growing season.

Soil Moisture

Soil moisture measured over broad regions indicates **how much precipitation** evaporated back into the atmosphere.

What's in a station?

- Network Connection (such as cell or radio)
- GPS Receiver
- Meteorological Sensors
- Batteries
- Solar Panels

GPS Antenna

Underground cable

GPS signals sense information about the atmosphere.

Ionosphere

The GPS satellite signal is delayed by charged particles caused by solar storms. This layer can also be displaced by tsunamis, yielding information for **tsunami early warning**.

Troposphere

The GPS satellite signal is delayed by water vapor that can turn into rain. This informs **forecasting of flash floods and hurricanes**.

Mission Cal/Val

Measuring the delay in the GPS satellite signal as it passes through the atmosphere is important for **calibrating and validating** other satellite datasets.

GPS positions give us information about Earth's many systems.



Volcanoes

Many volcanoes inflate and deflate like a balloon as **magma pressures** fluctuate. GPS also measures **ash plume height** based on changes in the satellite signals traveling through the ash.



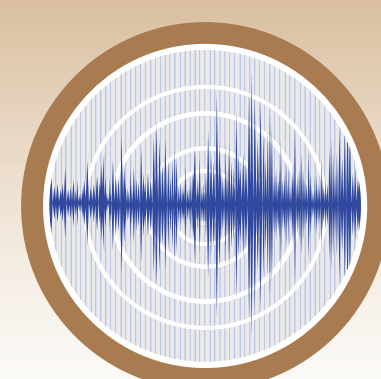
Water Resources

The ground moves up and down slightly in response to changes in lake, snow, and groundwater levels, useful in **monitoring drought and recovery**.



Glaciers

Glaciers weigh down and depress Earth's surface, which rebounds as glaciers melt away. This motion gives information about **Earth structure and changes in ice, snow, and shorelines**.



Earthquakes

GPS measures both the slow build-up to and the rapid movement during an earthquake, crucial for **hazards assessments** and tsunamis and earthquake **early warning systems**.



Tectonics

GPS measures Earth movements as small as millimeters per year; it's sensitive enough to record the **slow motions of plate tectonics**.

GPS is the U.S. component of the global navigation satellite system, known more generally as GNSS.