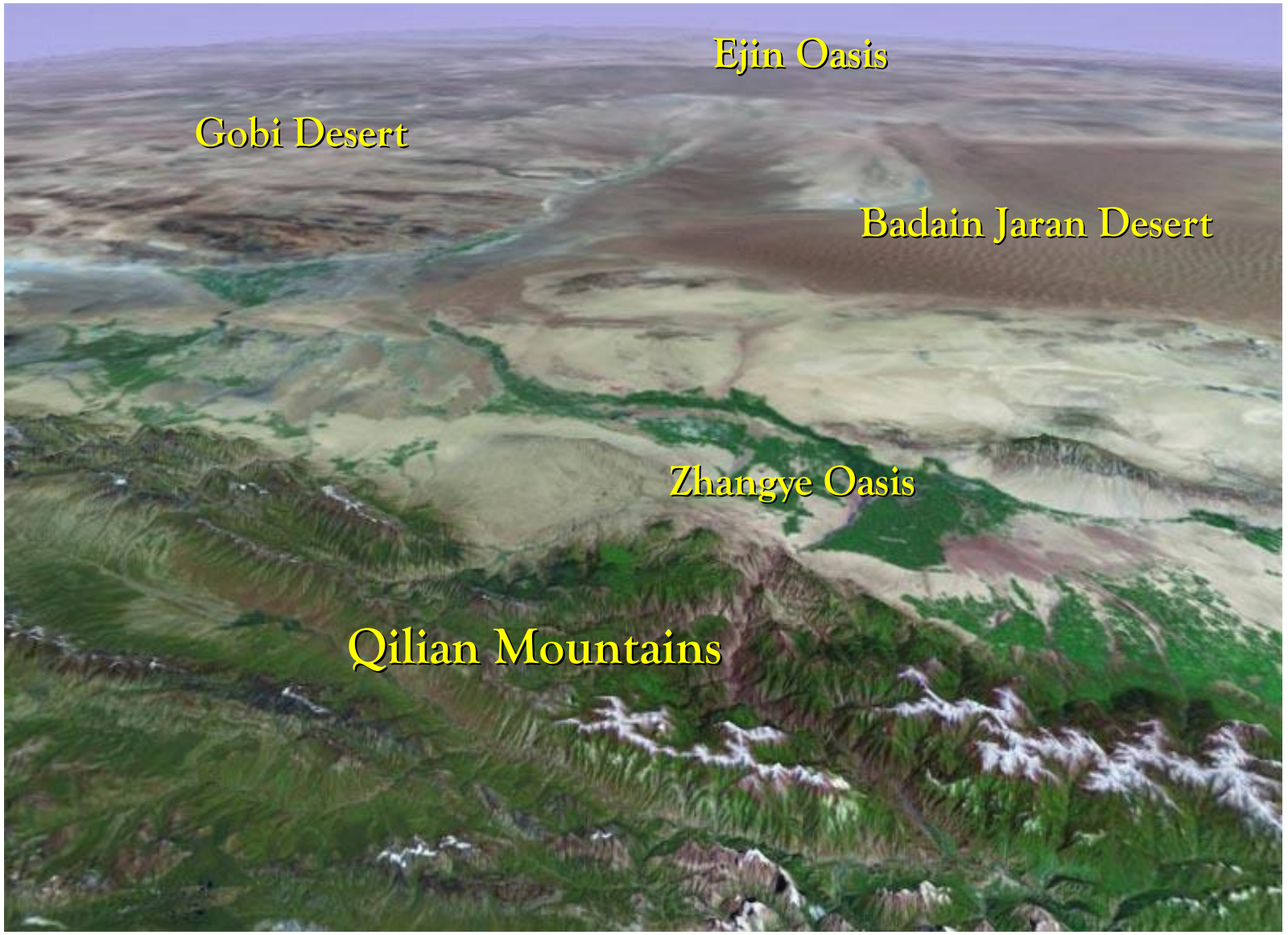
Snow cover and frozen ground observations in Heihe River basin, Qilian mountain

Tao Che
Heihe Remote Sensing Experimental Research Station
Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences

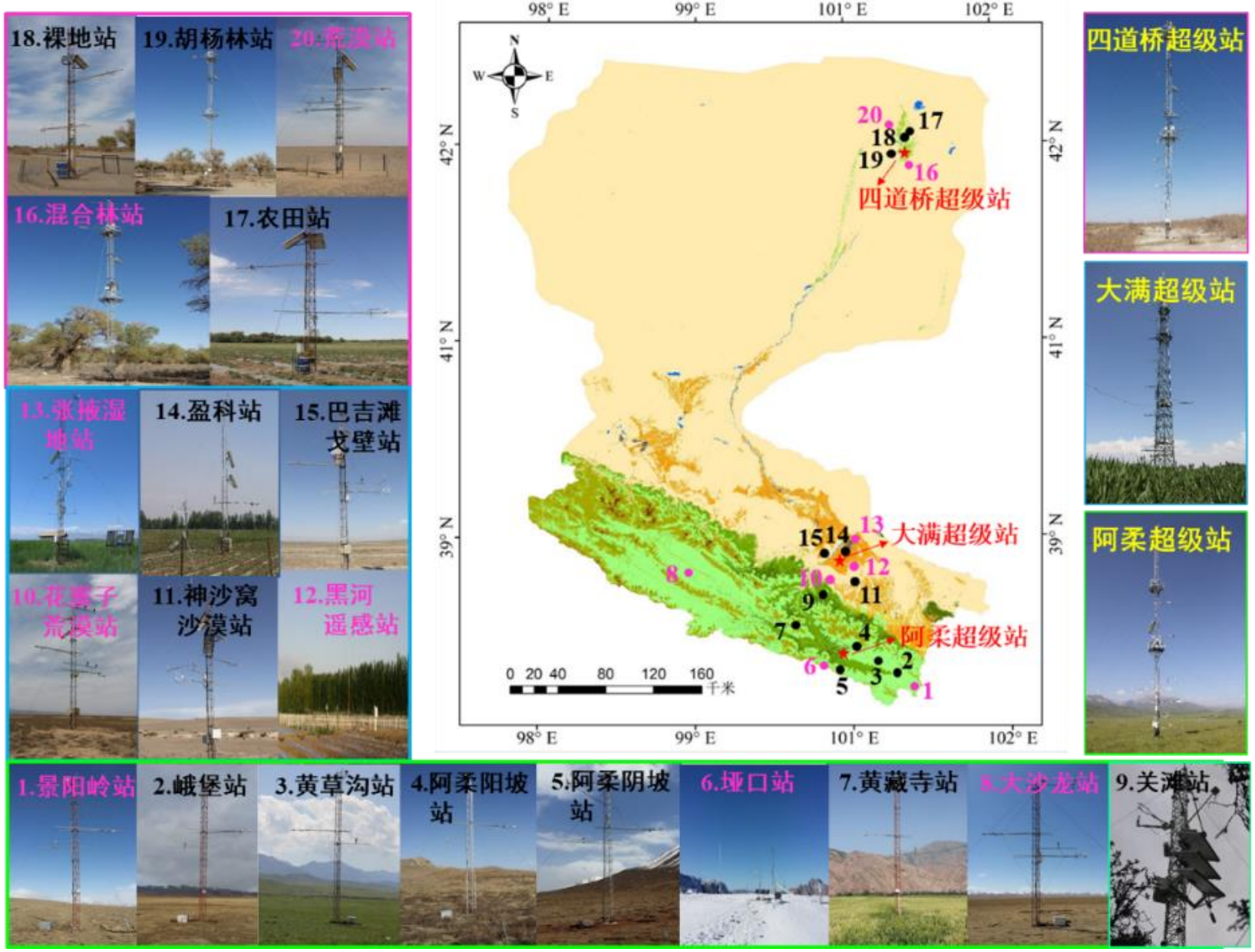
Heihe River Basin

Heihe River Basin

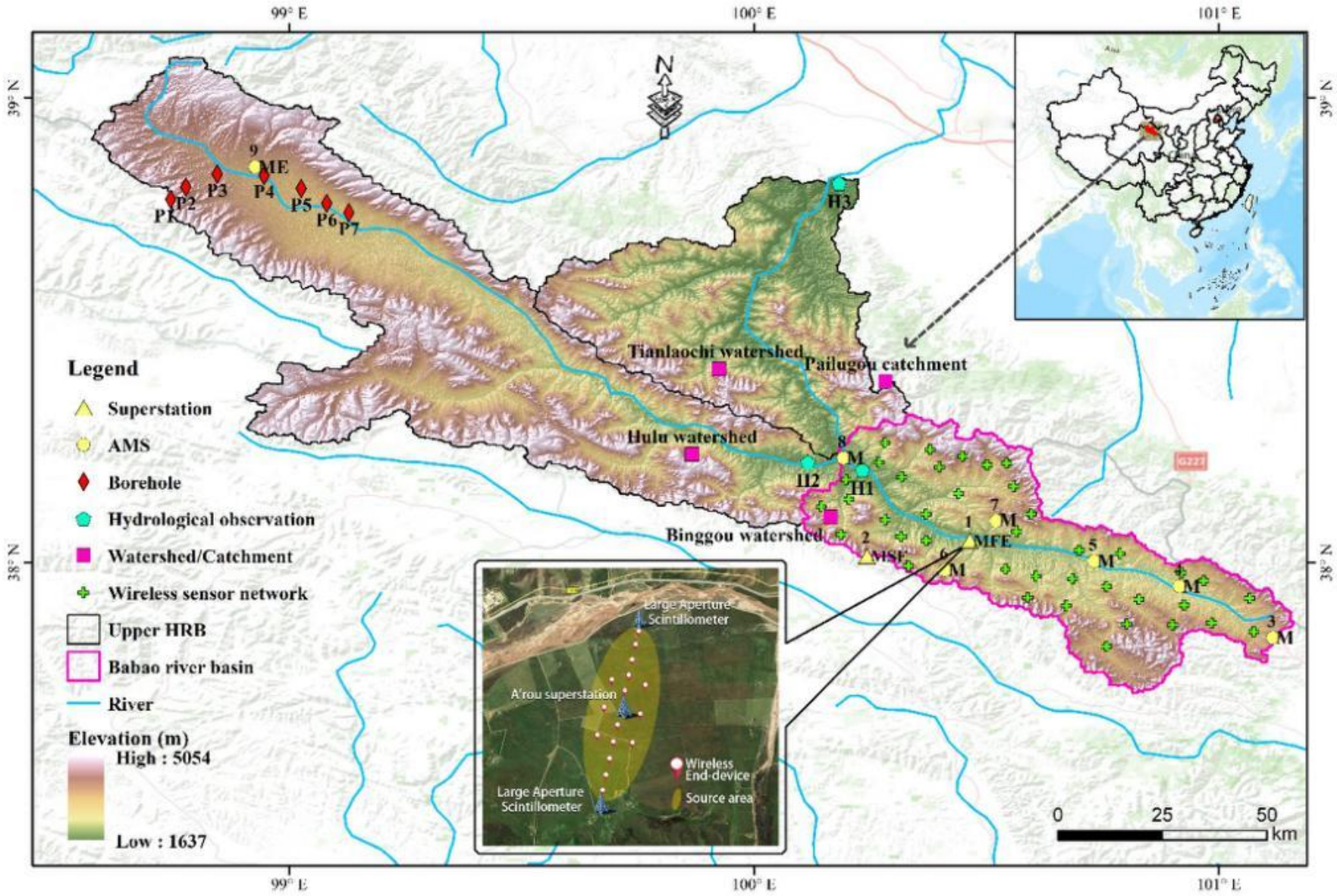


Heihe River Basin

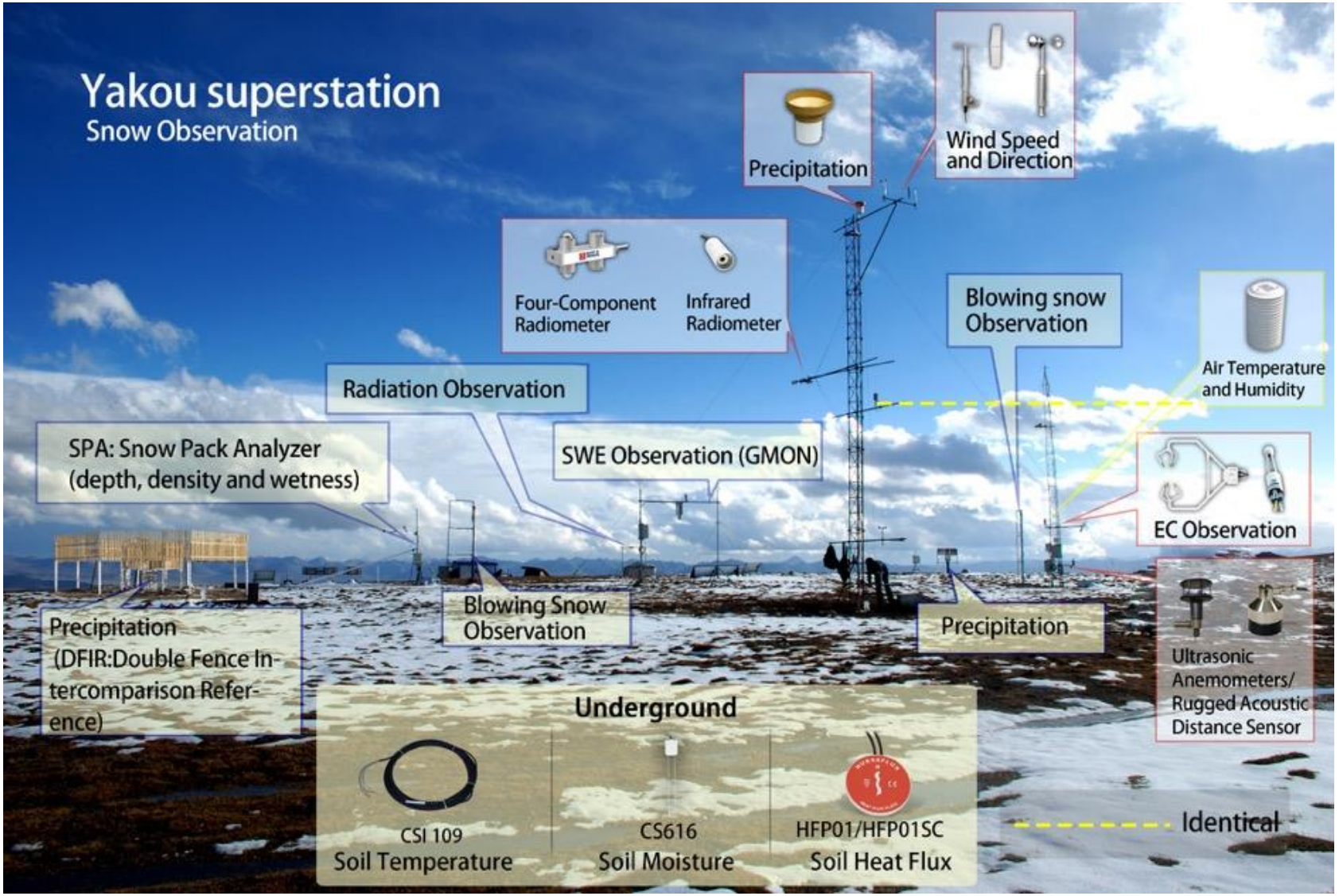
Observation sites (11+2sites)



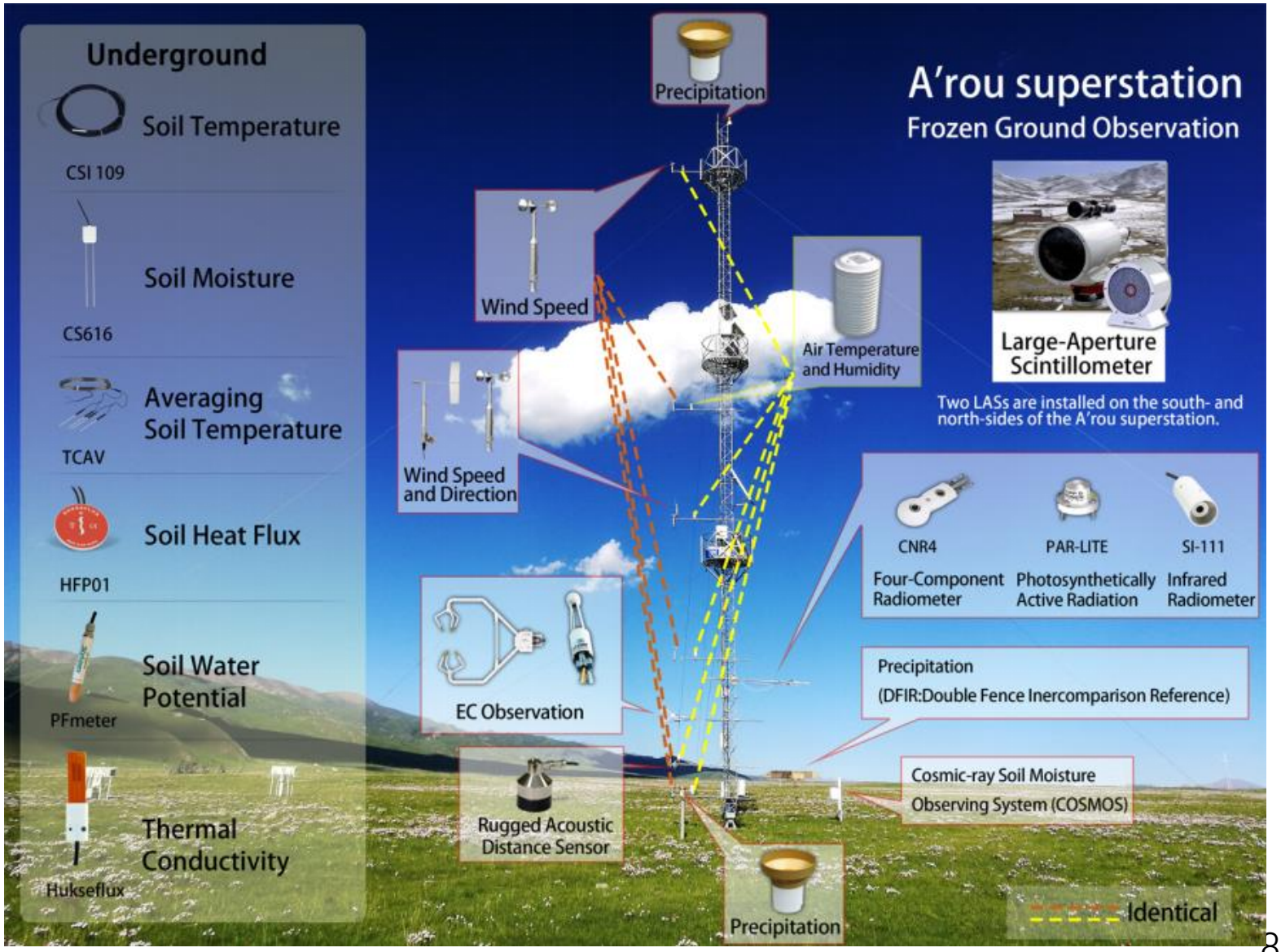
Multi-scale high mountain river basin observing system



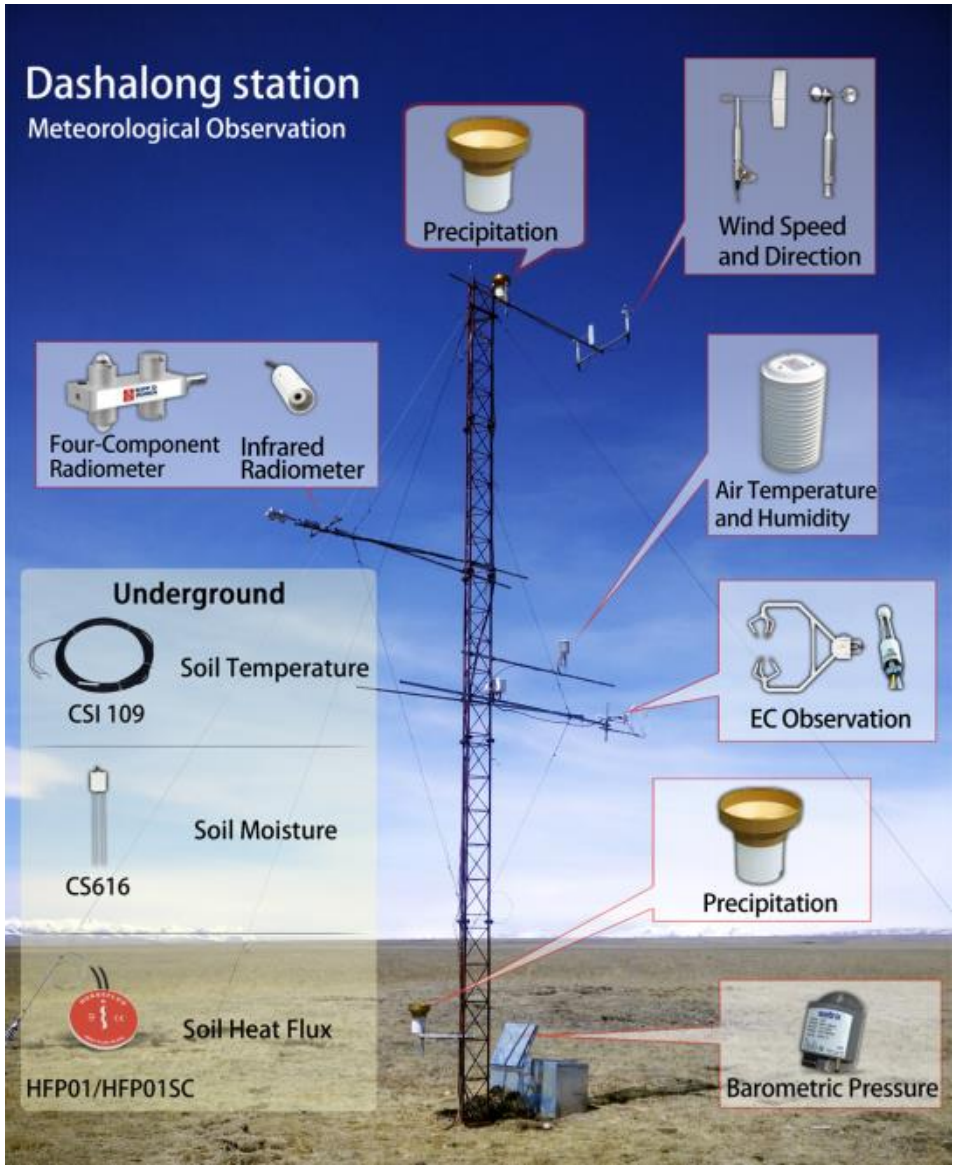
Yakou site


Yakou superstation
Snow Observation
Precipitation
Wind Speed and Direction
Four-Component Radiometer
Infrared Radiometer
Blowing snow Observation
Air Temperature and Humidity
Radiation Observation
SPA: Snow Pack Analyzer (depth, density and wetness)
SWE Observation (GMON)
EC Observation
Blowing Snow Observation
Precipitation
Precipitation (DFIR:Double Fence Intercomparison Reference)
Ultrasonic Anemometers/ Rugged Acoustic Distance Sensor
Underground
CSI 109
Soil Temperature
CS616
Soil Moisture
HFP01/HFP01SC
Soil Heat Flux
Identical

A'rou site

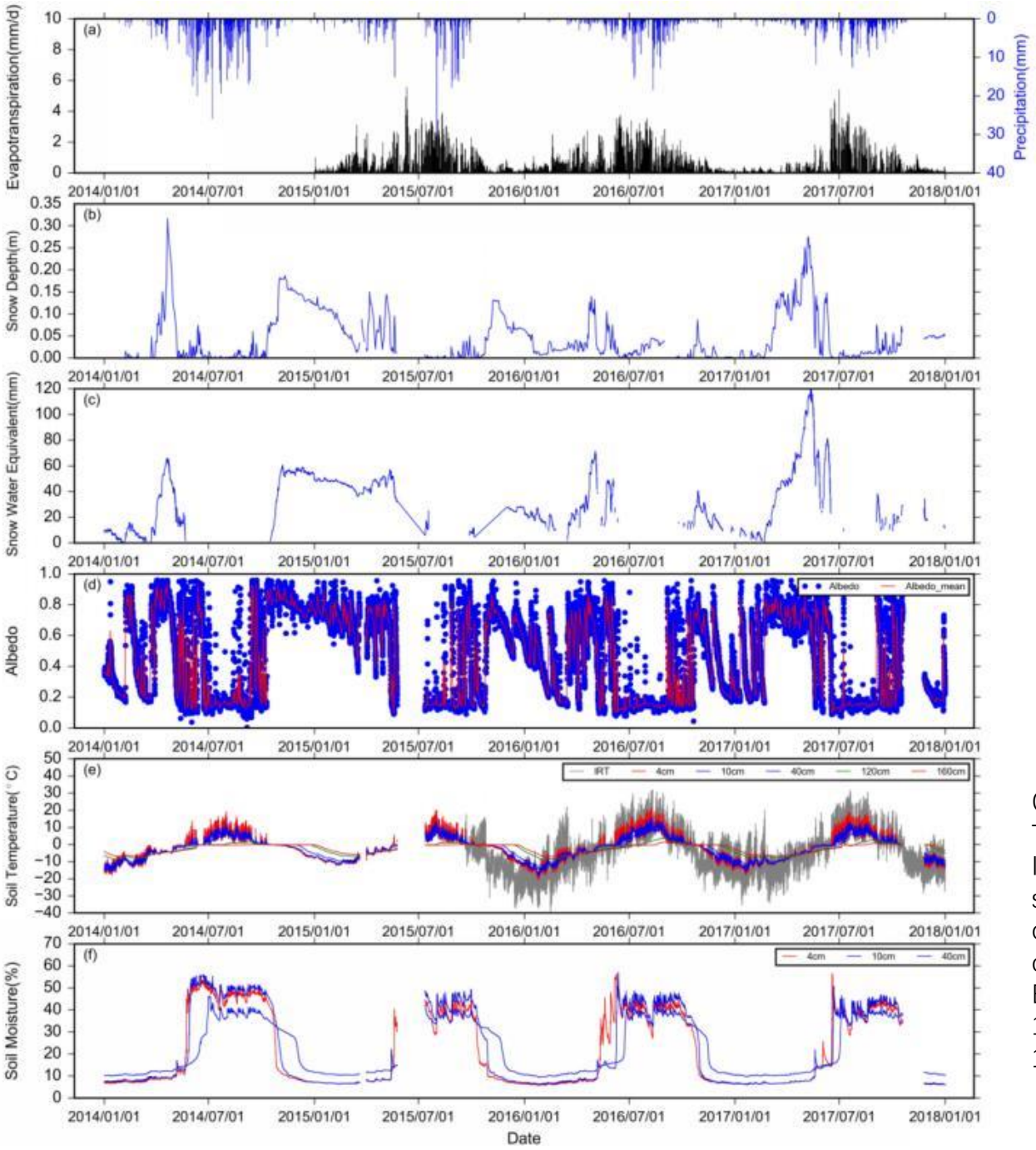

Underground
Soil Temperature
CSI 109
Soil Moisture
CS616
Averaging Soil Temperature
TCAV
Soil Heat Flux
HFP01
Soil Water Potential
PFmeter
Thermal Conductivity
Hukseflux
Precipitation
A'rou superstation
Frozen Ground Observation
Wind Speed
Air Temperature and Humidity
Large-Aperture Scintillometer
Two LASs are installed on the south- and north-sides of the A'rou superstation.
Wind Speed and Direction
CNR4
Four-Component Radiometer
PAR-LITE
Photosynthetically Active Radiation
SI-111
Infrared Radiometer
EC Observation
Precipitation
(DFIR:Double Fence Inercomparison Reference)
Cosmic-ray Soil Moisture Observing System (COSMOS)
Rugged Acoustic Distance Sensor
Precipitation
Identical

Other standard observation sites



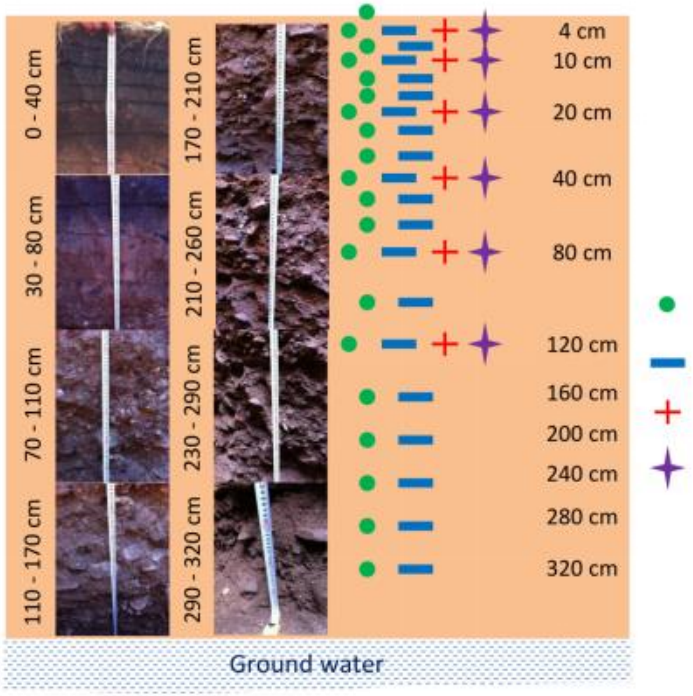

Yakou snow and frozen ground observation
N
Area:10020㎡
GNSS
Precipitation（DFIR）
Precipitation
Meteorological tower
(Eddy correlation)
Four-components
radiometer
COSMOS
SPA:Snow Pack Analyzer
SWE Observation
(SSG-2)
SWE Observation
(CS725)
Antenna station
Laser Weather Sensor
(OTT Parsivel²)
Meteorological tower
(10 m)

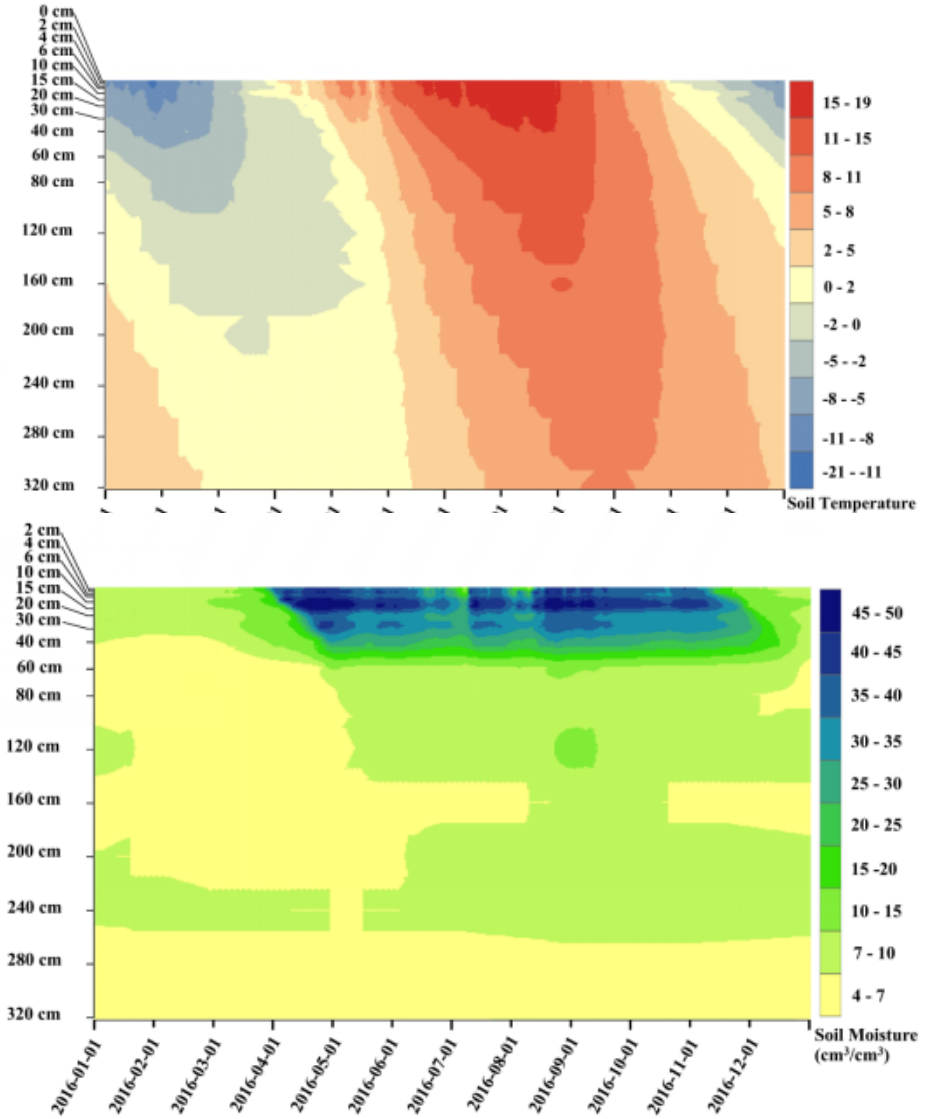
Data at Yakou



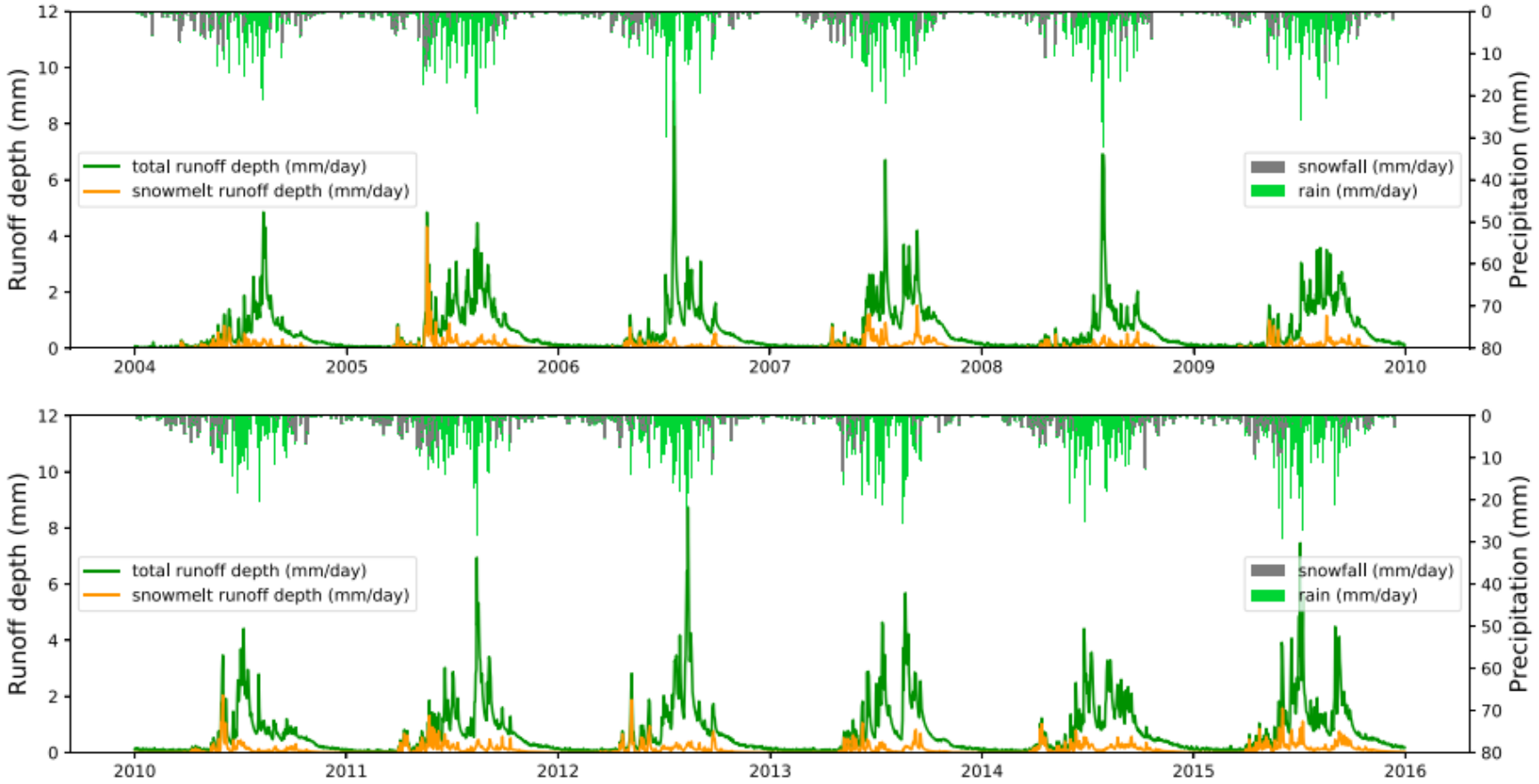
Che, T., Li, X., Liu, S., Li, H., Xu, Z., Tan, J., . . . Yang, X. (2019). Integrated hydrometeorological, snow and frozen-ground observations in the alpine region of the heihe river basin, china. Earth System Science Data, 11(3), 1483-1499. doi:10.5194/essd-11-1483-2019

Soil temperature and moisture data at A'rou



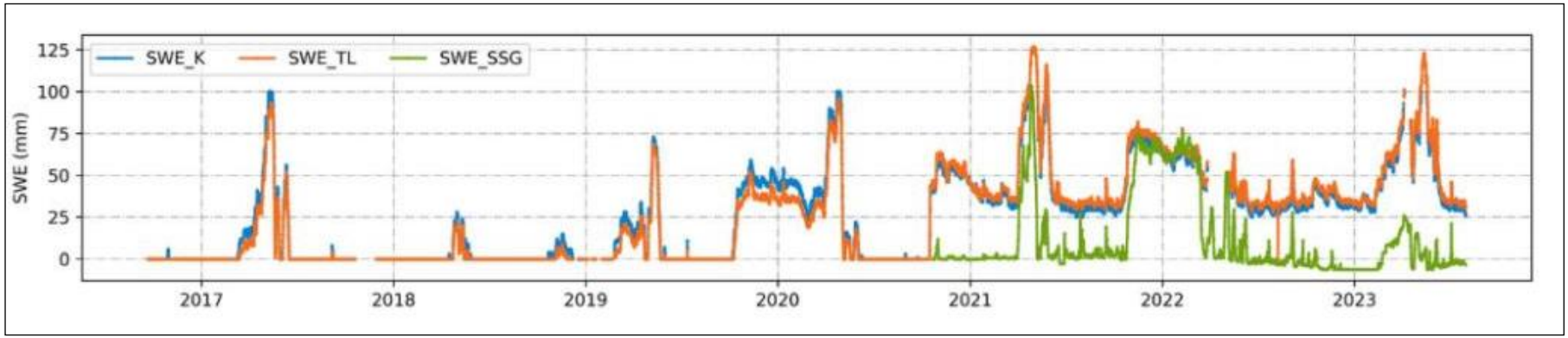


Snowmelt modelling (15. 8%)



Li, H., Li, X., Yang, D., Wang, J.,Gao, B., Pan, X., et al. (2019).Tracing snowmelt paths in an integrated hydrological model for understanding seasonal snowmelt contribution at basin scale. Journal of Geophysical Research: Atmospheres, 124, 8874–8895. https://doi.org/10.1029/2019JD030760

SWE updated



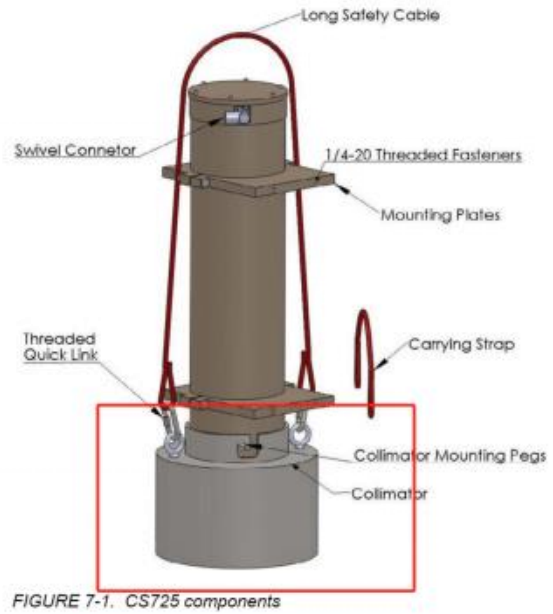
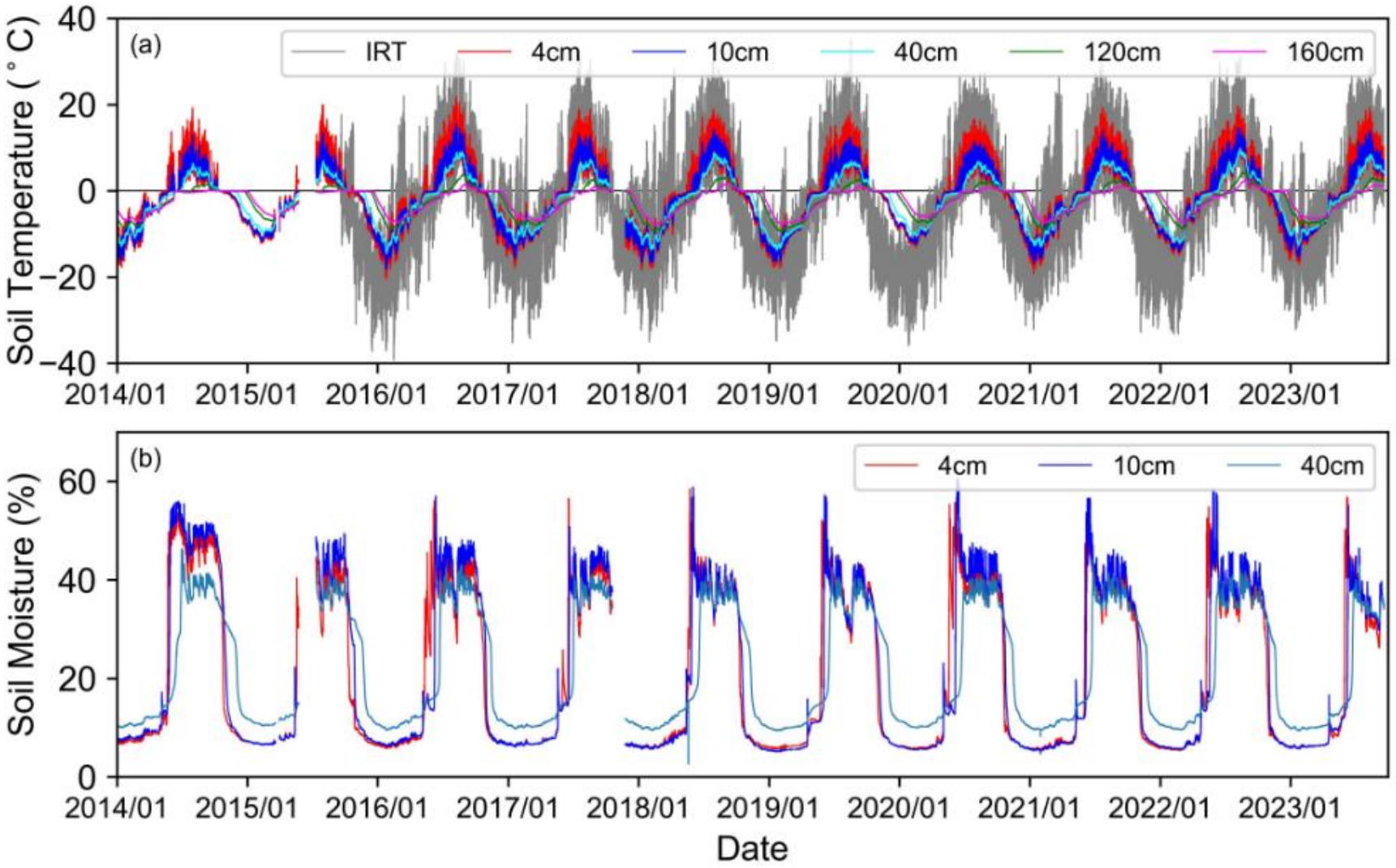
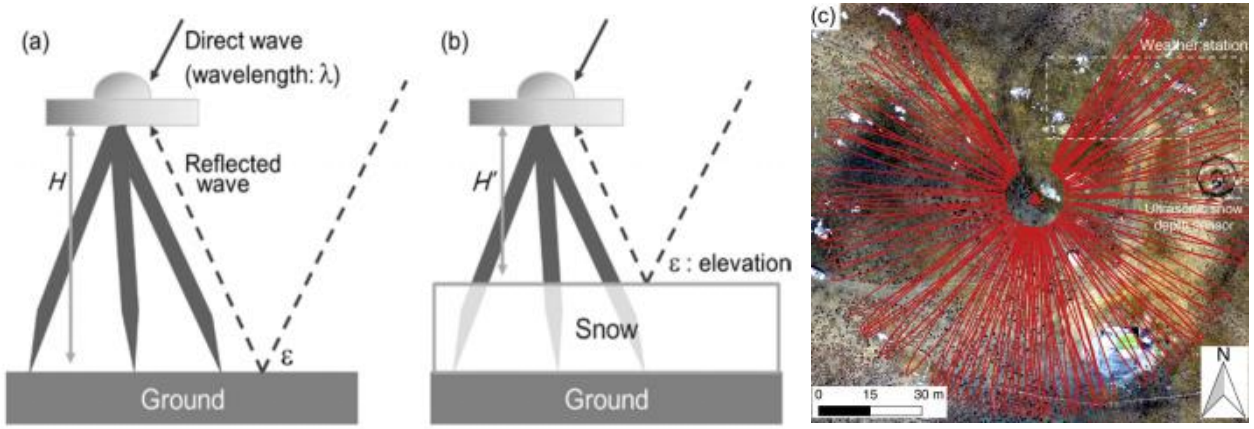


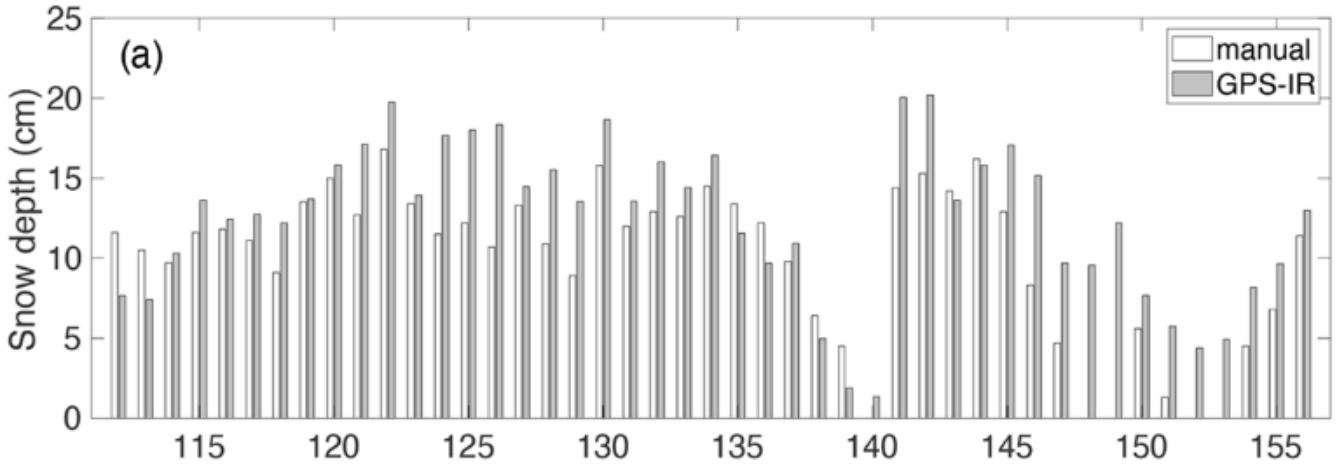
FIGURE 7-1. CS725 components

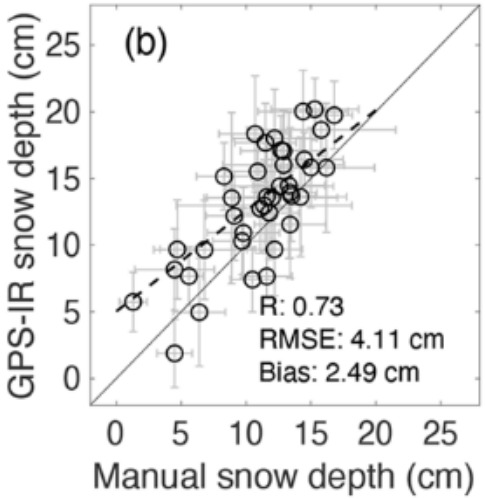
Soil temperature updated



Snow depth from GPS-Reflectometry







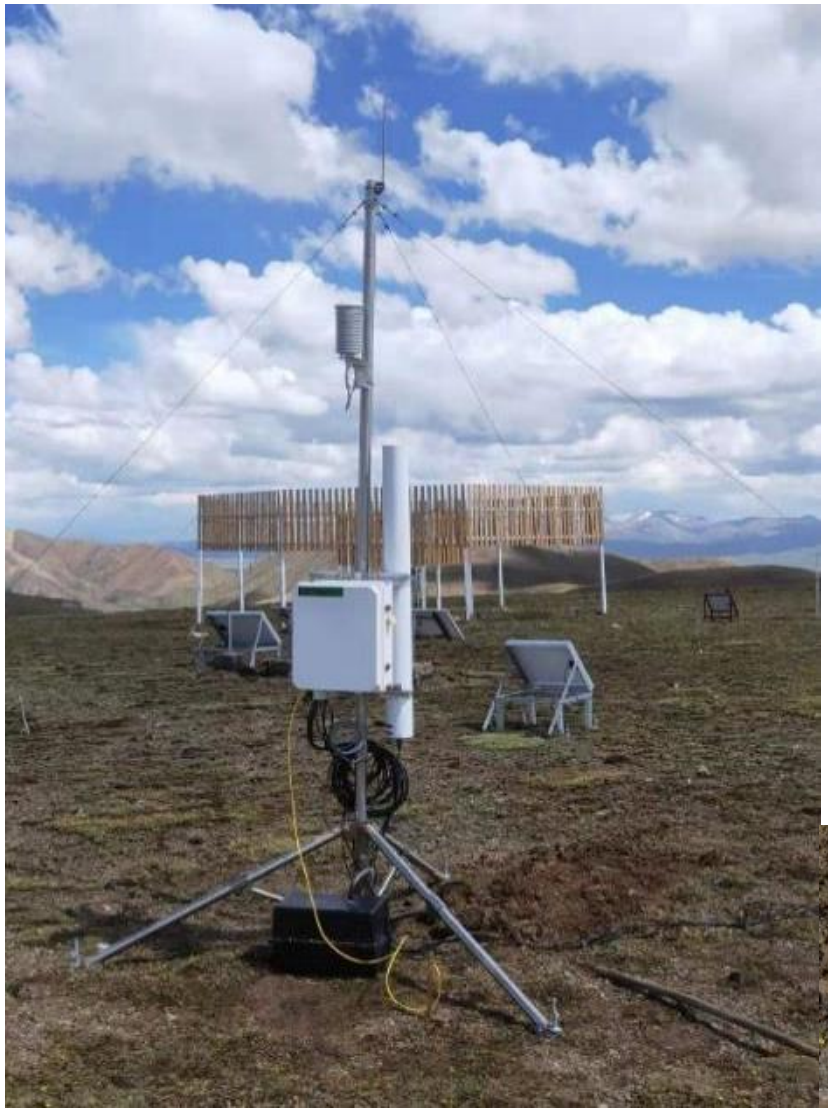
Zhang, J., Liu, L., SU, L., & Che, T. (2021). Three-in-one: GPS-IR measurements of ground surface elevation changes, soil moisture and snow depth at a permafrost site in the northeastern Qinghai-Tibet Plateau. *The Cryosphere*

Laser Weather Sensor Parsivel²

The OTT Parsivel² is a modern laser disdro meter for comprehensive measurement of all precipitation types. The Parsivel² captures both the size and speed of falling particles, classifying them into one of 32 separate size and velocity classes.

The raw data are used to calculate the type, amount, intensity and kinetic energy of the precipitation, the visibility in the precipitatio n, and the equivalent radar reflectivity

Cosmic-Ray Soil Moisture/Snow SensingSystem



The CRS-1000/B use the cosmic-ray me thod to passively and non-invasively mo nitor water content in the top 50 cm of s oil or the water-equivalent depth of sno w up to 20 cm. With the cosmic-ray met hod, one obtains a spatial average over a lateral radius of approximately 300 m at sea level, providing an unprecedented sc ale of observation.

Summary

- We have established a good snow and frozen soil observation site, and pulished the data.
- Recent new equipments need appropriate methods to obtain the snow data.
- Only one person uses one model.


Welcome to Heihe River Basin!