

## Related information for chapter 3

### Further reading

- AsiaFlux Steering Committee (ed.) (2007) Practice of flux observations in terrestrial ecosystems. (<http://www.asiaflux.net/members/material.html> ; available exclusively for AsiaFlux members. It is the English translated edition of AsiaFlux Steering Committee (ed.), 2003, 陸域生態系における二酸化炭素等のフラックス観測の実際.)
- Forest environmental survey editorial committee (ed.) (1999) Handbook of forest environmental survey - environmental measurement in forest-, 284pp, Hakuyusha [in Japanese]
- Hokkaido branch of Japanese Society of Snow and Ice (ed.) (1991) Procedures for measurement of snow and ice cover, 244pp, Hokkaido University Press. [in Japanese]
- Japanese Industrial Standards JIS Z 8806 (2001) Humidity - Measurement methods, Japanese Standards Association
- Kondo J. (ed.) (1994) Meteorology in water regime – water and energy balance on land surface-, 348pp, Asakura shoten. [in Japanese]
- Kanto Branch of the Society of Agricultural Meteorology of Japan (ed.) (1988) Instruments and measurement techniques in agricultural meteorology, 322pp, Association of advancement of agricultural science [in Japanese]
- Kanto Branch of the Society of Agricultural Meteorology of Japan (ed.) (1997) New edition: Instruments and measurement techniques in agricultural meteorology, 356pp, Association of advancement of agricultural science. [in Japanese]
- The society for the study of species biology (ed.) (2003) Introduction to plant physiological ecology, 319pp, Bun-ichi Sogo Shyuppan, Tokyo. [in Japanese]
- Suzuki N. (ed.) (1996) Meteorological Research Note No.185, Meteorological Instruments: Surface Observation, 155pp, The Meteorological Society of Japan. [in Japanese]
- Tsukamoto O. and Monji N. (ed.) (2001) Meteorological Research Note No.199, Methodology of flux measurement on the ground, 242pp, The Meteorological Society of Japan. [in Japanese]
- Watanabe I. (ed.) (1987) Experimental method in agricultural environment -Agricultural meteorology and environmental engineering in agriculture-, 285pp, Science House. [in Japanese]
- Yoshino M., Asai T., Kawamura T., Shitara H., Nitta T. and Maejima I. (1986) Dictionary of climatology and meteorology, 742pp, Ninomiya Shoten. [in Japanese]

### Devices and instruments

Model number in *italic* indicates previous or discontinued model.

#### 3.1

##### Pyranometer

- EKO INSTRUMENTS CO., LTD., Japan (MS-802, MS-402, MS-601, ML020VM)  
<http://www.eko-usa.com/>

- Hukseflux Thermal Sensors B.V., The Netherlands (SR11, LP02)  
<http://www.hukseflux.com/>
- Kipp & Zonen B.V., The Netherlands (CMP 21, CMP 6, CMP 3, SP Lite2)  
<http://www.kippzonen.com/>
- PREDE CO.,LTD, Japan (PCM-01) <http://www.prede.com/file-32html.htm>
- THE EPPLEY LABORATORY, INC., US (PSP) <http://www.eppleylab.com/>

#### Pyrheliometer

- EKO INSTRUMENTS CO., LTD., Japan (MS-56, *MS-101D*)  
<http://www.eko-usa.com/>
- THE EPPLEY LABORATORY, INC., US (NIP) <http://www.eppleylab.com/>
- Kipp & Zonen B.V., The Netherlands (*CH 1*, CHP 1) <http://www.kippzonen.com/>

#### Sun tracker

- EKO INSTRUMENTS CO., LTD., Japan (STR-21, STR-22)  
<http://www.eko-usa.com/>
- THE EPPLEY LABORATORY, INC., US (SMT-3, ST-1, ST-3)  
<http://www.eppleylab.com/>
- Kipp & Zonen B.V., The Netherlands (SOLYS 2, 2AP)  
<http://www.kippzonen.com/>
- PREDE CO., LTD, Japan (ASTX-2) <http://www.prede.com//file-32html.htm>

#### Shadow band

- Kipp & Zonen B.V., The Netherlands (CM 121B, CM 121C, SOLYS 2, 2AP)  
<http://www.kippzonen.com/>
- PREDE CO.,LTD, Japan (PSB-100, PRB-100) <http://www.prede.com/file-32html.htm>
- THE EPPLEY LABORATORY, INC., US (SBS, SDK)  
<http://www.eppleylab.com/>

#### Infrared radiometer

- EKO INSTRUMENTS CO., LTD., Japan (MS-202) <http://www.eko-usa.com/>
- THE EPPLEY LABORATORY, INC., US (PIR) <http://www.eppleylab.com/>
- Kipp & Zonen B.V., The Netherlands (CGR 3, CGR 4)  
<http://www.kippzonen.com/>

#### Net pyrradiometers and four-component net-radiation sensor

- EKO INSTRUMENTS CO., LTD., Japan (MF-11, MR-60)  
<http://www.eko-usa.com/>
- Hukseflux Thermal Sensors B.V., The Netherlands (NR01)  
<http://www.hukseflux.com/>
- Kipp & Zonen B.V., The Netherlands (NR Lite2, *CNR 1*, CNR 2, CNR 4)  
<http://www.kippzonen.com/>
- Radiation and Energy Balance Systems, Inc, US (Q\*7) or Campbell Scientific, Inc., US (Q7.1)  
<http://www.campbellsci.com/>

### Spectroradiometer

- EKO INSTRUMENTS CO., LTD., Japan (MS-700) <http://www.eko-usa.com/>
- ASD Inc., US (FieldSpec Handheld2) <http://www.asdi.com/>
- THE EPPLEY LABORATORY, INC., US (PSP) <http://www.eppleylab.com/>

### PAR sensors

- LI-COR, Inc., US (LI-190) <http://www.licor.com/>
- EKO INSTRUMENTS CO., LTD., Japan (ML-020P) <http://www.eko-usa.com/>
- Kipp & Zonen B.V., The Netherlands (*PAR Lite*, PQS 1) <http://www.kippzonen.com/>
- KOITO ELECTRIC INDUSTRIES, LTD., Japan (IKS-27) <http://www.koito-ind.co.jp/eco/koito-environ/>
- PREDE CO.,LTD, Japan (PAR-01) <http://www.prede.com//file-32html.htm>
- Skye Instruments Ltd, UK (SKP 215) <http://www.skyeinstruments.com/>

## 3.2

### Vane anemometer

- R. M. Young Company, US (Model 12005 Microvane & 3-Cup Anemometer, Model 05103 Wind Monitor) <http://www.youngusa.com/>

### Wind vane

- Makino Applied Instruments Inc., Japan (VR536) <http://business1.plala.or.jp/manox/> [in Japanese]
- Yokogawa Denshikiki Co., Ltd., Japan (A-802) <http://www.yokogawa.com/jp-ydk/> [in Japanese]
- Windspeed Limited trading as Vector Instruments, UK (W200P) <http://www.windspeed.co.uk/>

### Anemometer

- Makino Applied Instruments Inc., Japan (AF750) <http://business1.plala.or.jp/manox/> [in Japanese]
- Yokogawa Denshikiki Co., Ltd., Japan (A-702) <http://www.yokogawa.com/jp-ydk/> [in Japanese]
- Windspeed Limited trading as Vector Instruments, UK (W100 Series) <http://www.windspeed.co.uk/>

### Ultrasonic anemometer

- R. M. Young Company, US (Model 85000 Ultrasonic Anemometer) <http://www.youngusa.com/>
- Vaisala Oyj, Finland (WMT700 WINDCAP) <http://www.vaisala.com/>
- Gill Instruments Ltd., UK (WindSonic) <http://www.gill.co.uk/>

### Pitot tube

- Okano Works, Ltd, Japan [http://www.okanoworks.com/en/main\\_en.html](http://www.okanoworks.com/en/main_en.html)

### Differential pressure gauge

- Setra Systems, Inc., US (Model 239) <http://www.setra.com/tra/>

### 3.3

#### Platinum resistance thermometer

- Vaisala Oyj, Finland (*HMP45A, HMP45D*) <http://www.vaisala.com>  
HMP45A and HMP45D output value in voltage and temperature respectively. HMP45 has been replaced by HMP155 Humidity and Temperature Probe since March 2009.
- Kawaso Electric Industrial Co., Ltd, Japan (Sheath thermo resistance)  
<http://www.kawaso.co.jp/en/>
- Hayashi Denko co. ltd., Japan (Platinum resistance thermometer element)  
<http://www.hayashidenko.co.jp/en/>

#### Thermocouple thermometers

- Grant Instruments (Cambridge) Ltd , UK (CS-U-VL50-0)  
<http://www.grant.co.uk/>
- CLIMATEC Inc., Japan (Ct-0.32) <http://www.weather.co.jp/> [in Japanese]
- Hayashi Denko co. ltd., Japan (Sheathed thermocouple)  
<http://www.hayashidenko.co.jp/en/>

#### Thermistor

- Campbell Scientific, Inc., US (107-L) <http://www.campbellsci.com/>
- Onset Computer Corporation, US (HOBO) <http://www.onsetcomp.com/>  
Thermocouple type of HOBO (HOBO U12 thermocouple logger) is also available.
- T&D Corporation, Japan (Thermo recorder Ondotori)  
<http://www.tandd.co.jp/> [in Japanese]  
Platinum thermometer type of Ondotori (Ondotori Pt) is also available.
- HIOKI E.E. CORPORATION, Japan (TEMPERATURE LOGGER 3632)  
<http://www.hioki.com/>
- TATEYAMA KAGAKU INDUSTRY Co.,Ltd, Japan (D717)  
<http://www.tateyama.jp/eng/>

#### Radiation thermometer

- CLIMATEC Inc., Japan (C-IRR-P) <http://www.weather.co.jp/> [in Japanese]
- NEC Avio Infrared Technologies Co., Ltd., Japan (Infrared thermograph)  
<http://www.nec-avio.co.jp/jp/products/ir-thermo/en/>

#### Shelter

- CLIMATEC Inc., Japan (CPR-AS-1, vertical type) <http://www.weather.co.jp/> [in Japanese]
- PREDE CO.,LTD, Japan (PFH-01) <http://www.prede.com/file-32html.htm>
- EKO INSTRUMENTS CO., LTD., Japan (MH-120) <http://www.eko-usa.com/>  
<http://www.eko.co.jp/eko/a/a08-fr.html> [in Japanese]

#### Unit water bath, Low temperature water bath unit

- TAITEC Co., Ltd., Japan (Thermominder SX-10R, Cool bath CB-40)  
<http://e-taitec.com/>

### 3.4

#### Ventilated psychrometer

- PREDE CO.,LTD, Japan (PFH-01) <http://www.prede.com/file-32html.htm>
- CLIMATEC Inc., Japan (CPR-AS-1/2) <http://www.weather.co.jp/> [in Japanese]
- EKO INSTRUMENTS CO., LTD., Japan (MH-120) <http://www.eko-usa.com/>  
<http://www.eko.co.jp/eko/a/a08-fr.html> [in Japanese]

#### Dew-point hygrometer

- Yokogawa Denshikiki Co., Ltd., Japan (E-771) <http://www.yokogawa.com/jp-ydk/>

#### Polymeric humidity sensor

- Vaisala Oyj, Finland (*HMP45A, HMP45D*) <http://www.vaisala.com>  
HMP45 has been replaced by HMP155 Humidity and Temperature Probe since March 2009. This new sensor is protected with a sintered PTFE filter therefore having a longer response time (90%, 60sec) and the probe is larger (40mm in diameter and 279mm in length) thus compatibility should be carefully considered when replacing the old model.

#### Infrared hygrometer

- LI-COR, Inc., US (LI-840, LI-7000, LI-7500) <http://www.licor.com/>

### 3.5

#### Thermistor

- Onset Computer Corporation, US (S-TMA) <http://www.onsetcomp.com>
- Campbell Scientific, Inc., US (107-L) <http://www.campbellsci.com/>

#### Platinum resistance

- CLIMATEC Inc., Japan (C-HPT-5-JM) <http://www.weather.co.jp> [in Japanese]

#### Radiation thermometer

- CHINO Corporation, Japan (IR-SAB) <http://www.chino.co.jp/english/>

#### Heat flux transducer

- PREDE CO.,LTD, Japan (PHF-100L) <http://www.prede.com/file-32html.htm>
- EKO INSTRUMENTS CO., LTD., Japan (MF-180M) <http://www.eko-usa.com/>

### 3.6

#### Soil moisture sensor

- Decagon Devices, Inc., US (EC-5 ,Capacitance/Frequency Domain Method) <http://www.decagon.com>
- Campbell Scientific, Inc., US (CS616-L, Time Domain Reflectometry Method) <http://www.campbellsci.com>
- Stevens Water Monitoring Systems, Inc., US (Hydra Probe Soil Moisture and Salinity Sensor , Amplitude Domain Reflectometry Method) <http://www.stevenswater.com>
- Delta-T Devices Ltd, UK (ML2x) <http://www.delta-t.co.uk>
- Sentek Pty Ltd, Australia (EnviroSCAN) <http://www.sentek.com.au/>

## Tensiometer

- Daiki Rika Kogyo Co., Ltd., Japan (DIK-3042) <http://www.daiki.co.jp/en>
- CLIMATEC Inc., Japan (UNSUC CSK-5500EL) <http://www.weather.co.jp> [in Japanese]
- UIZIN Co.,Ltd, Japan (UIZ-SMT) <http://www.uizin.co.jp> [in Japanese]

**3.7**

## Tipping bucket rain gauge

- Yokogawa Denshikiki Co., Ltd., Japan (WB0011) <http://www.yokogawa.com/jp-ydk/>
- Onset Computer Corporation, US (HOBO Data Logging Rain Gauge RG-3n)  
<http://www.onsetcomp.com/>

## Snow gauge

- Niigata Electric Co., Ltd, Japan (SDM-301s) <http://www.snowcon.com/> [in Japanese]
- SONIC CORPORATION, Japan (SL-370) <http://www.u-sonic.co.jp/english/>
- Campbell Scientific, (Canada) Corp., Canada (SR-50A)  
<http://www.campbellsci.ca/>

## Snow weight meter

- Niigata Electric Co., Ltd, Japan (MN-301s) <http://www.snowcon.com/> [in Japanese]

**3.8**

## Ultrasonic water level meter

- Keyence Corporation, Japan (UD-300 series) <http://www.keyence.co.jp/>
- General Electric Company, US (PDCR/PTX 1730/1740)  
<http://www.ge-mcs.com/en/>

## Capacitive water level meter

- Unidata Pty Ltd, Australia (Model: 6521 series) <http://www.unidata.com.au/>
- Senecom, Inc., Japan (Trutrack series) <http://www.senecom.co.jp/> [in Japanese]

## Hydrostatic water level meter

- CLIMATEC Inc., Japan (agency of CSTS series) <http://www.weather.co.jp/> [in Japanese]

## Hydrological observation weir

- Environmental Measurement Japan, CO., LTD., Japan (MIJ-09K)  
<http://www.environment.co.jp/> [in Japanese]
- Senecom, Inc., Japan (Parshall flume) <http://www.senecom.co.jp/> [in Japanese]
- IKEDA KEIKI MANUFACTURING, INC., Japan (PF series)  
<http://www.ikeda-keiki.co.jp/> [in Japanese]

## Measuring weir in general

- Takeuchi Tekkosho, Japan  
ph: +81-562-82-7851

**3.9**

## Multi-channel data logger

- Campbell Scientific, Inc., US (CR1000, CR800) <http://www.campbellsci.com/>
- Etodenki Coporation, Japan (CADAC2, CADAC21, CADAC3)  
<http://www.etodenki.co.jp/> [in Japanese]

- GRAPHTEC Corporation, Japan (GL220, GL800, GL820)  
<http://www.graph-tec.com/>
- HIOKI E.E. CORPORATION, Japan (MEMORY HiLOGGER 8420, MEMORY HiLOGGER 8430-20)  
<http://www.hioki.com/>
- OMRON Corporation, Japan (ZR-RX40A) <http://www.ia.omron.com/>

#### Single-function data logger

- HIOKI E.E. CORPORATION, Japan (TEMPERATURE LOGGER 3632, TEMPERATURE LOGGER LR5011, HUMIDITY LOGGER LR5001, PULSE LOGGER LR5061, VOLTAGE LOGGER 3635/3645, VOLTAGE LOGGER LR5041/5042/5043) <http://www.hioki.com/>
- T&D Corporation, Japan (Thermo recorder Ondotori TR-51S/52S, TR-51i/52i, TR-71Ui/72Ui, Precipitation recorder Amembo RF-3, Voltage logger VR-71) <http://www.tandd.co.jp/> [in Japanese]
- Onset Computer Corporation, US (Temperature/Relative Humidity Data Logger HOBO U23 Pro v2)  
<http://www.onsetcomp.com>

#### RS-232-to-RS-422/485 converter

- Moxa Inc., US (Transio A52/53) <http://www.moxa.com/>

#### RS-232-to-USB conversion cable

- I-O DATA DEVICE, INC., Japan (USB-RSAQ5 series)  
<http://www.iodata.com/>  
<http://www.iodata.jp/product/mobile/serial/>  
[in Japanese]
- RATO Systems international, Inc., Japan (REX-USB60F)  
<http://www.ratocsystems.com/english/>  
<http://www.ratocsystems.com/products/rs232c.html>  
[in Japanese]

It can be used for connecting an Ondotori data logger (T&D Corporation) with a PC with a multiple-core CPU.

#### Parts and supplies (Some examples)

1. Arrestor (SG-GV series): OTOWA Electric Co., Ltd., Japan  
<http://www.otowadenki.co.jp/eng/> [3.1]
2. Signal circuit arrestor (CN226 series): Fuji Electric Technica Co., Ltd., Japan  
<http://www.fe-technica.co.jp/> [in Japanese] [3.1]
3. BNC connector (UG-89/U (40)): HIROSE ELECTRIC CO., LTD., Japan  
<http://www.hirose.com/> [3.1]
4. Coaxial cable (RG58A/U): Fujikura Ltd., Japan <http://www.fujikura.co.jp/eng/> [3.1]
5. DC reference voltage generator (3K02): NEC Avio Infrared Technologies Co., Ltd., Japan  
<http://www.nec-avio.co.jp/en/> [3.1]
6. Digital multi-meter (PC510a): Sanwa Electric Instrument Co., Ltd., Japan  
<http://overseas.sanwa-meter.co.jp/> [3.1]

7. Ethanol (99.5, 500 ml): Wako Pure Chemical Industries, Ltd., Japan  
<http://www.wako-chem.co.jp/english/> [3.1]
8. Hand auger: Daiki Rika Kogyo Co., Ltd., Japan <http://www.daiki.co.jp/en> [3.5, 3.6]
9. Paper towel, ("Kimwipes", S.Ply 4.4"×8.4" /Bx 280): Kimberly-Clark Corporation, US  
<http://www.kimberly-clark.com/> [3.1]
10. Plastic adhesive tape (0.2 mm×19 mm×10 m): NITTO DENKO CORPORATION, Japan  
<http://www.nitto.com/> [3.1, 3.3, 3.4, 3.5, 3.6]
11. Precision resistance (RNS1/8YCT52A1001Bmetal-film resistor, 0.1% accuracy and 1kΩ resistance): KOA Corporation, Japan <http://www.koaproducts.com/english/> [3.1]
12. Double-layer slit conduits: PMA AG, Switzerland [http://www.pma.ch/pma\\_com/](http://www.pma.ch/pma_com/) [3.5]
13. Flexible pipe ("PanaFleki" DM316, φ23 mm): Panasonic Electric Works Co., Ltd., Japan  
<http://panasonic-denko.co.jp/> [in Japanese] [3.5]
14. Regulated DC Power Supplies (PS series): TEXIO, NIKKE TECHNO SYSTEM CO.,LTD., Japan (former Kenwood)  
<http://www.nikketechno.jp/> [in Japanese] [3.3]
15. Sampling tube: Daiki Rika Kogyo Co., Ltd., Japan <http://www.daiki.co.jp/en> [3.6]
16. Sealant ("BATHCAULK", 50 g, transparent): CEMEDINECo., ltd., Japan  
<http://www.cemedine.co.jp/e/> [3.1, 3.5]
17. Self-fusing tape ("Hi-Bon" NO.2, 0.5 mm×19 mm×10 m): Hitachi Chemical Co., Ltd, Japan  
<http://www.hitachi-chem.co.jp/english/> [3.1, 3.3, 3.4]
18. Silica gel (Blue coloured, medium grain, 500 g): Kishida Chemical Co.,Ltd., Japan  
<http://www.kishida.co.jp/english/> [3.5]
19. Spiral wrap (RPST-20): HIRAKAWA HEWTECH CORP., Japan  
<http://www.hewtech.co.jp/e/> [3.5, 3.6]
20. Spiral wrap tubing: Waytek, Inc, US <http://www.waytekwire.com/> [3.5, 3.6]
21. Washing bottle: SANPLATEC CORPORATION, Japan <http://www.sanplatec.co.jp/en/> [3.4]
22. Weather-resistant banding band (7.4 mm×250 mm, φ2.5-72 mm): HellermannTyton, UK  
<http://www.hellermannntyton.com/> [3.3]

