Introduction to the Development of Agrometeorological Observation Network in Taiwan

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ABSTRACT

Crop growth is significantly affected by the weather. To analyze the relations among crop growth and climatic factors, the agrarian scientists require long-term growth and weather data. To improve the quality and quantity of collected weather data, the Council of Agriculture (COA), in cooperation with Central Weather Bureau (CWB), initiated projects to develop an agrometeorological observation network in Taiwan since 1986. The Department of Agriculture and Forestry, Taiwan Provincial Government (PDAF) takes charges of setting up the stations with assistance from CWB. Till 1992, there are 27 agrometeorological observation stations have been installed. In which, 15 stations are classified as grade-1 stations and the other 12 stations are classified as grade-2. Research and application projects, sponsored by COA, using collected weather data have also been promoted since 1989. Those projects are classified into four groups, (1) studies on the relations among agrobiology and climatic factors, (2) studies on microenvironment in greenhouses (3) studies on prevention of weather disasters to agriculture, and (4) studies on the application of climate resources.

OVERVIEW

Taiwan is located in subtropical region and has complicated topography (Fig. 1). The climatic resources around this island are thus very rich. However, weathers that cause significant agricultural disasters, such as typhoon, Mei-yu, localized heavy rainstorm, drought, and cold surges, also are often occurred.

It is recognized that weather plays an important role in determining agricultural production. However, most weather stations belong to Central Weather Bureau (CWB) were not located in agricultural area. Also, instruments used by agrometeorological stations, established in many agricultural experimental stations, had larger errors because of lacking proper care and calibration. Therefore, though agrarian scientists in Taiwan had tried to study relations between weather and crops, many of them lack either representative or complete weather data to analyze results from their field experiments.

The Council of Agriculture (COA), in cooperation with Central Weather Bureau (CWB), planed to set up an agrometeorological observation network in Taiwan in 1986. The Department of Agriculture and Forestry, Taiwan Provincial Government (PDAF) was assigned to take charge of setting the network with the assistance from CWB and funding from COA. Aims of establishing this islandwide observation network are manifolds. There are (1) to understand distribution of agrometeorological resources in Taiwan, (2) to provide enough qualified data to researchers so that schemes to improve agricultural productivity and quality can be developed, and (3) to reduce weather disasters to agriculture through warning systems using information collected by the network.

SETTING UP OF AGROMETEOROLOGICAL OBSERVATION NETWORK

It was considered that positions of stations within the network should be allocated in major agricultural area and separated as equilibrate as possible. Besides, it also considered that installed precision equipments need trained personnel to manage. Therefore, all the stations are set in agricultural experimental stations around the island and managed by designated staffs.

Those stations are classified into two categories:

(1) Grade-1 Stations:

This station has a set of full automatic meteorological observation systems (Fig. 2). Its equipment consists of sensors, transducers, data recorders and a processor, a printer, an uninterrupted power supply, and lightning protection devices. It remotely measures wind

direction, wind velocity, air temperature, humidity, insolation, earth temperature, and rainfall. In addition, data collected in each station can be reached by CWB's mainframe computer VAX 8350 via telephone line (Fig. 3). This makes it easy for COA, CWB, and PDAF to enquire local weather situations islandwide. Now, there are 15 grade-1 stations have installed (Fig. 4). The 16th station will be set up at Taihsi Branch Office, Taiwan Fishery Research Institute (TFRI) before the end of June 1993 (Table 1). According to CWB's planning, there are four other stations will be installed during the coming four years.

(2) Grade-2 Stations

Due to shortage of budget at the time of planning, some stations could only be equipped with semi-automatic facilities. Those include Campbell-Stokes sunshine duration recorder, thermograph, hygrograph, earth thermograph, and recording precipitation gauge. Those stations cost many human resources to change recording papers daily. To overcome this drawback, installed equipments are gradually updated since 1989, so that automatic datalogging will be possible (Fig. 5). There are 12 grade-2 stations having already been established before the end of 1992.

The first stage of establishing the agrometeorological observation network will be completed in 1997. Then, there will be 20 grade-1 stations and 12 grade-2 stations around this island. Most of these stations located on the plain area. Setting up weather stations on mountain area will be considered at the next stage.

DEVELOPMENT OF RESEARCH ACTIVITIES

Projects concerning agrometeorological researches, sponsored by COA, have been underway since 1989. In the past five years, researches concerning agrometeorology have been growing rapidly beyond expectance. About thirty research projects were approved and cost around five hundred thousand US dollars in each fiscal year. In addition, research teams have been organized in many research organizations, such as Taiwan Agricultural Research Institute (TARI), and each District Agricultural Improvement Stations (DAIS). Furthermore, Chinese Society of Agrometeorology has been set up in 1992 to help in project promotion and staff training.

To use the funding more effectively, a long term research guideline was drafted after a joint meeting of COA, CWB, PDAF and professors in universities. According to the guideline, research projects are classified into four groups. A coordinator has been assigned to each group to organize and review projects submitted from all research institutes. These four research topics are:

(1) Studies on relations among agrobiology and climatic factors:

Its main objectives are to better our knowledge on how weather affecting agricultural production, and to develop growth models for yield prediction.

(2) Studies on microenvironments in greenhouses:

Its main objectives are to investigate changes of microenvironment within greenhouses and other artificial coverages to understand its effect to crop/animal growth, and to study ways to control the microenvironmental conditions.

(3) Studies on prevention of weather disaster to agriculture:

Its main objectives are to improve accuracy of weather forecasting for local area, to develop warning systems for various disasters that may occur, to improve and/or design proper measures to reduce agricultural losses caused by disaster weather, and to develop methods for damage prediction and assessment.

(4) Studies on application of climatic resources:

Its main objectives are to compile climatic databases, and to integrated climatic resources with established soil databases to assess land use suitability.

CONCLUSION

The development of the agrometeorological observation network in Taiwan has been under way for only five years. Research activities using data collected by established stations have been prosperous. It is believed that fruitful results could be expected in the near future due to devotion of all agrarian scientists in this field.

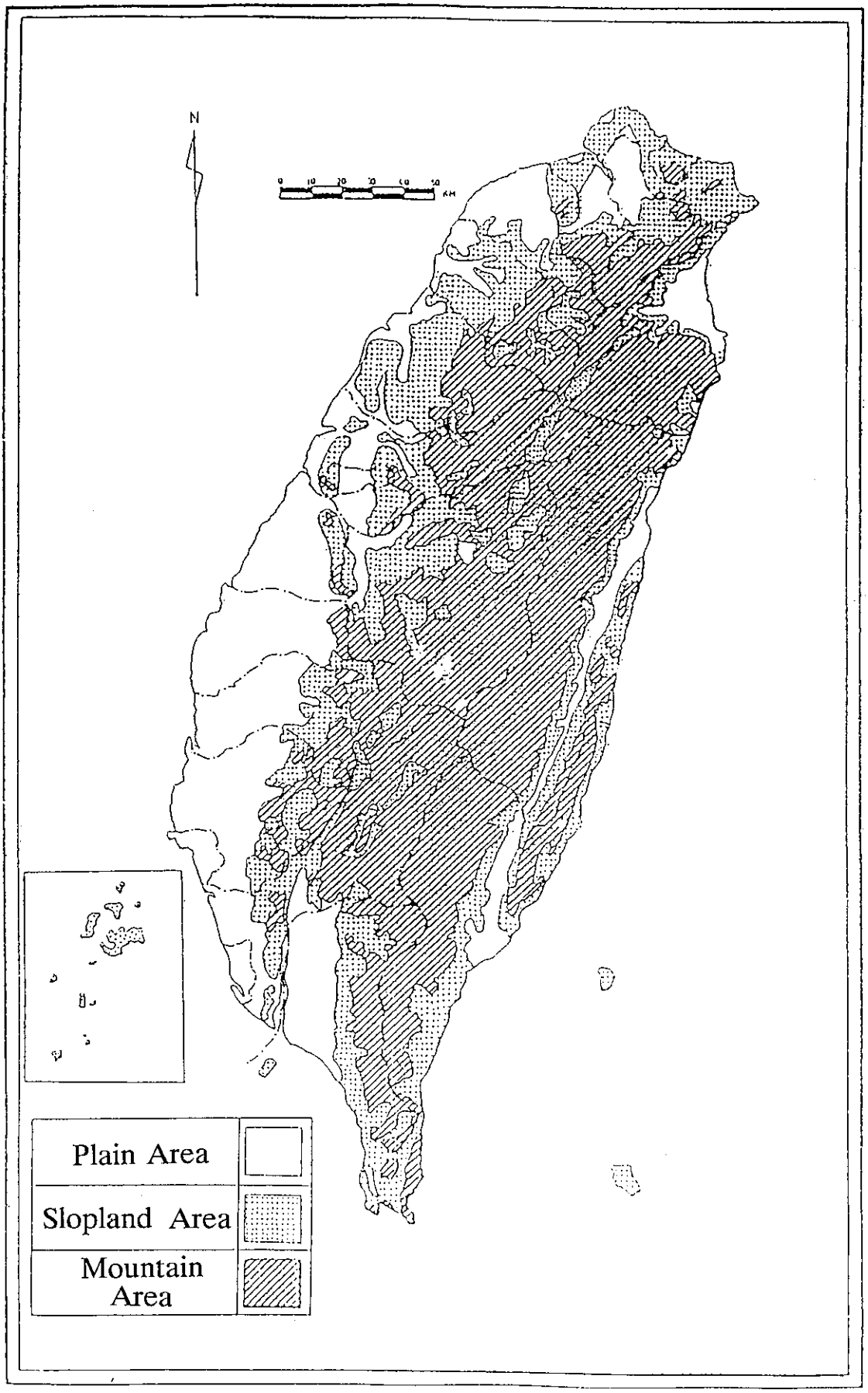

Figure 1 MAP OF LAND RESOURCE

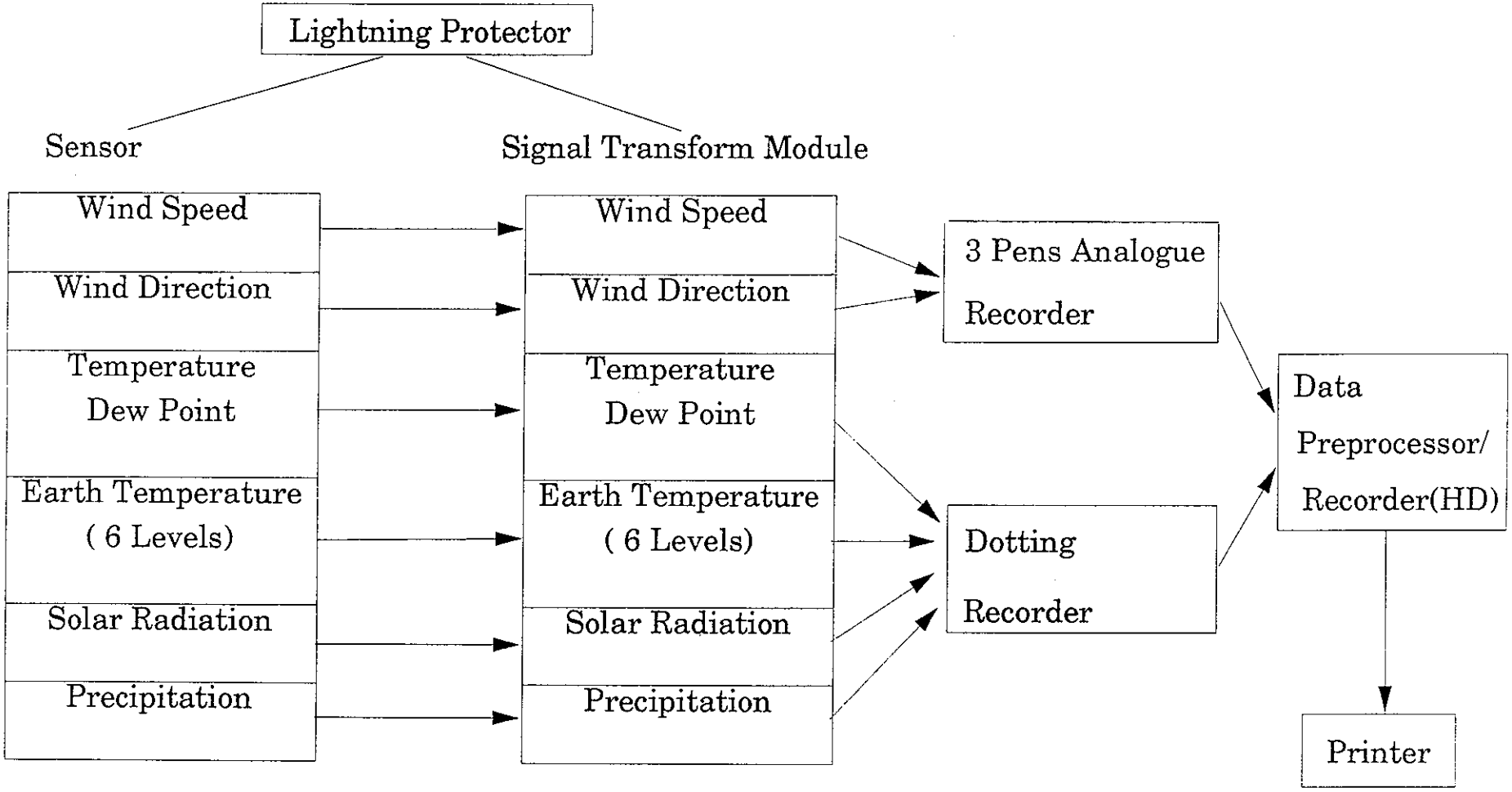

Figure 2 NAKAASA Agrometeorological Observation System

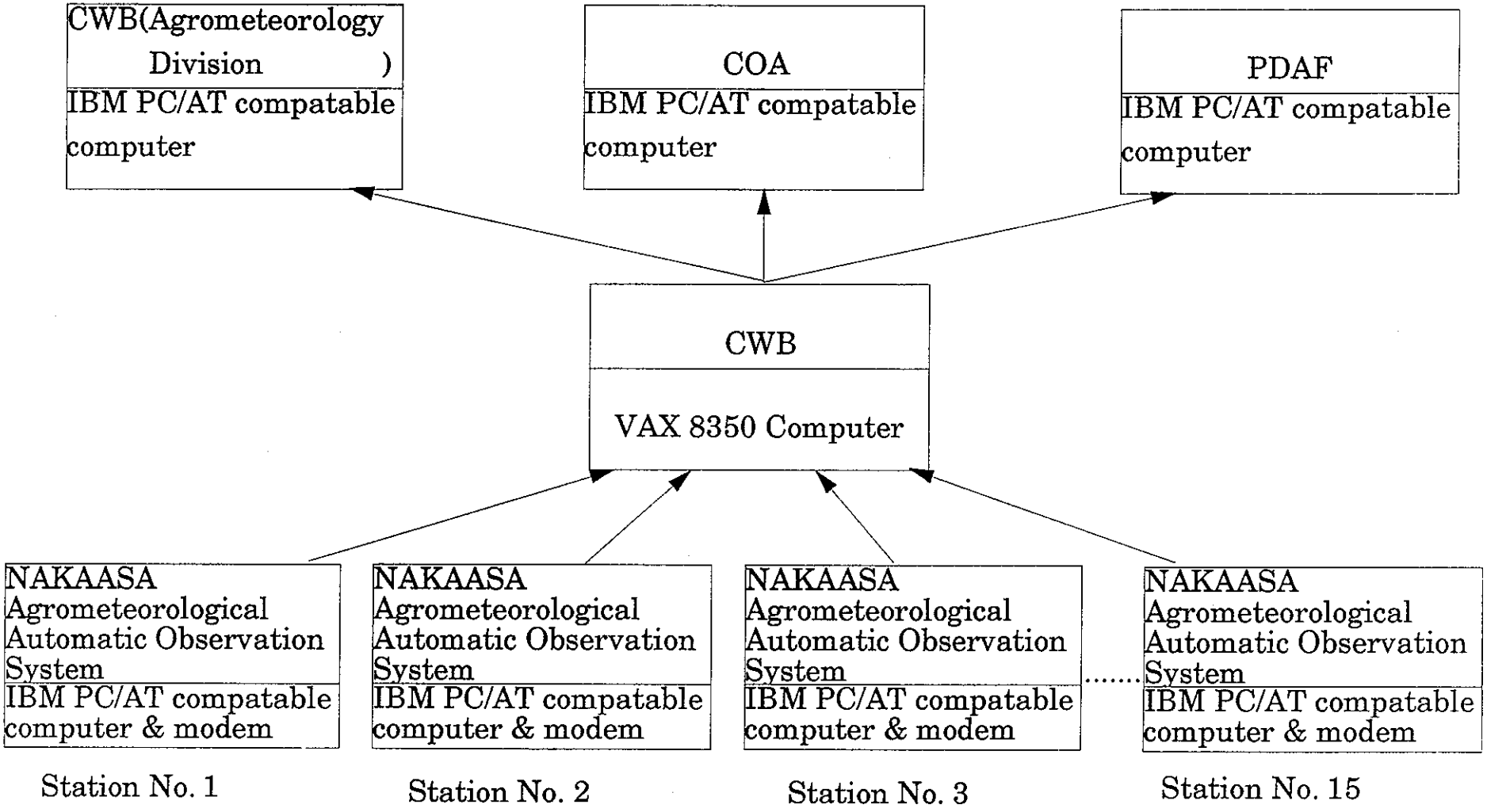

Figure 3 Agrometeorological Automatic Observation Network in Taiwan

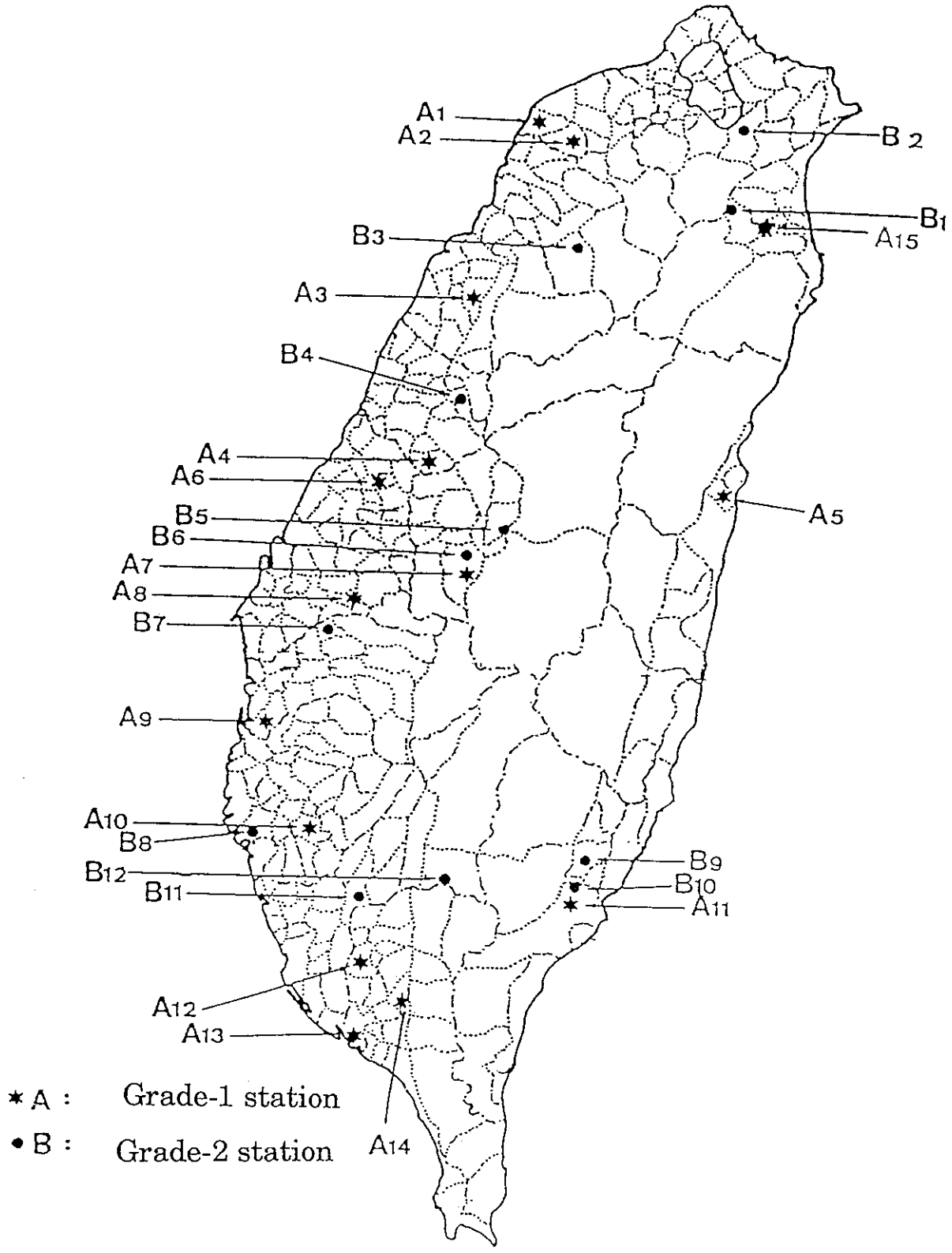

Figure 4 Location of Agrometeorological Observation Stations

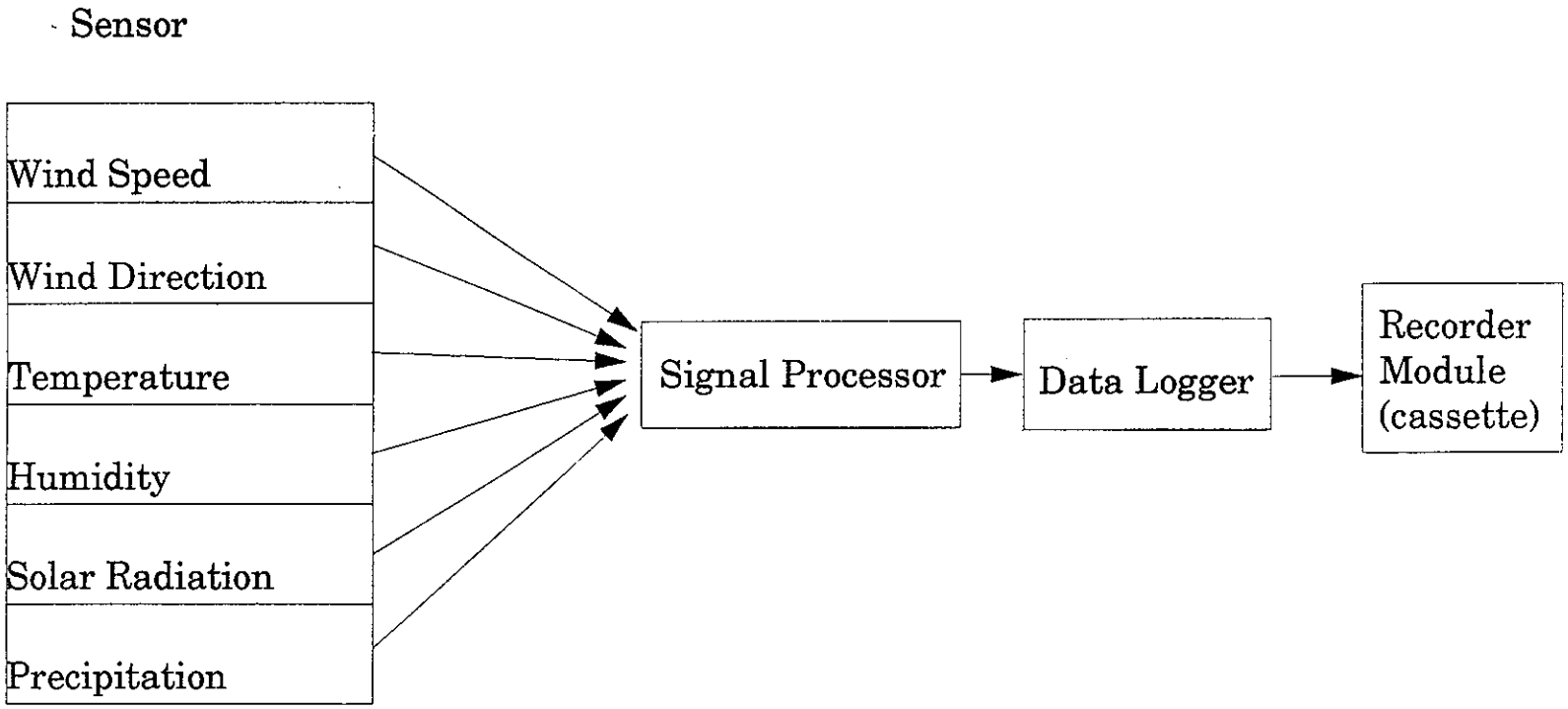

Figure 5 Agrometeorological Observation System for grade-2 Stations

Tabel 1 Location of Agrometeorological Observation Stations

Grade-1 Stations	Grade-2 Stations
A1 Taoyuang DAIS	B1 Fusan Branch Station, Taiwan Forestry Research Institute
A2 TTES	B2 Wensan Substation, TTES
A3 TASES	B3 Wufon Workstation, Taoyuang DAIS
A4 TARI	B4 Taiwan Seed Service
A5 Hualien DAIS	B5 Yuchi Substation, TTES
A6 Taichung DAIS	B6 Tongding Workstation, TTES
A7 The Experimental Forest, NTU	B7 Chikou Experiment Farm, TARI
A8 Yunlin Substation, Tainan DAIS	B8 Tainan DAIS
A9 Yichu Workstation, Tainan DAIS	B9 Taitung Substation, TTES
A10 TLRI	B10 Pinlang Orchard, Taitung DAIS
A11 Pangchiu Substation, Taitung DAIS	B11 Chinang Substation, Kaohsiung DAIS
A12 Kaohsiung DAIS	B12 Lukuei Branch Station, Taiwan Forestry Research Institute
A13 Tonkang Branch Station, TFRI	
A14 National Pintung Institute of Technology	
A15 Lanyang Substation, Hualien DAIS	
A16 Taihsi Branch Station, TFRI	

***** DAIS : District Agricultural Improvement Station
TTES : Taiwan Tea Experiment Station
TASES : Taiwan Apicultural and Sericultural Experiment Station
TARI : Taiwan Agricultural Research Institute
NTU : National Taiwan University
TLRI : Taiwan Livestock Research Institute
TFRI : Taiwan Fishery Research Institute