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## Vaisala MAWS201 Automatic Weather Stations in Tibet

# Everest Monitoring 2001 Expedition



The expedition Everest Monitoring 2001 belonged to a joint research program that provides data on environmental conditions in Tibet to support studies of air pollution in China. Since the air in Tibet is considered non-polluted, the observation data can be used as background and reference for studies of air pollution in Chinese cities. The expedition also aimed to observe and study the impact of the rapid development of Tibet on the environment. For this reason the study could serve as an example for other regions in the world.

**A**s part of my training period during my scholarship at the Institute of Applied Chemistry (University of Orléans, France), I participated in the project “Everest Monitoring 2001”. The three-week scientific expedition May 28 - June 17, 2002 was carried out in Tibet. The organizers of the expedition were the Institute of Atmospheric Physics of the Chinese Academy of Sciences (Professor Zou Han) and Beijing University (Professor Zhu Tong). The expedition was part of a ten-year research program extending from 2000 to 2010, during which a corresponding expedition will be carried out at the same time every year.

The program collected measurement data on several parameters of the air in Tibet, which is considered clean and non-pol-

luted. This provides background information for studies on air pollution in Chinese cities. The expeditions belonging to this program also aim to observe and quantify the impact on the environment of the rapid development in Tibet. Consequently, the program could serve as an example for other regions in the world.

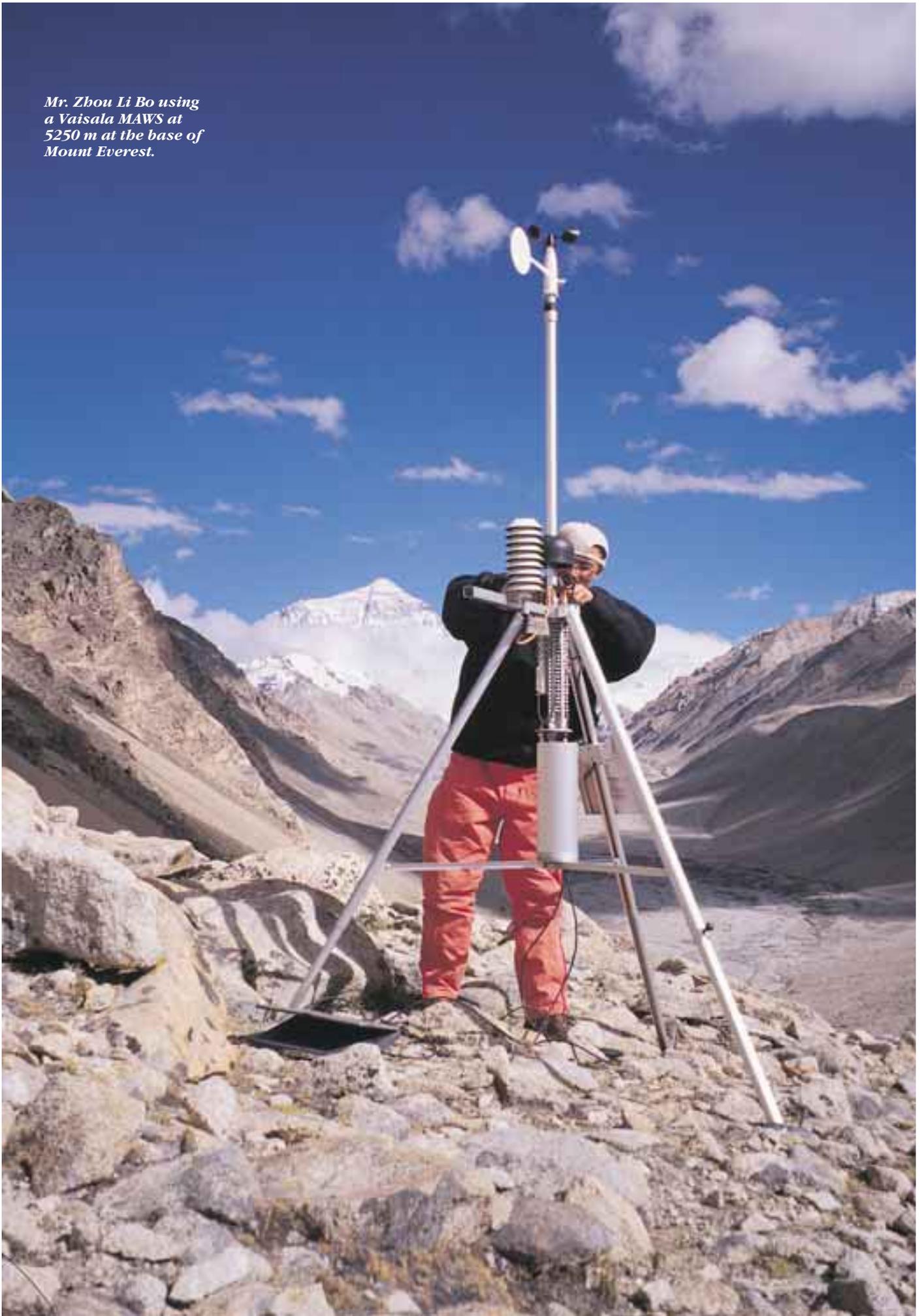
The expedition team included 17 members in all, of which 10 were scientists. The other seven members were the 5 drivers required, and two reporters who also participated in the expedition. I was the only foreigner and the only woman in the team. During the expedition to Tibet, we used a portable Vaisala MAWS201 Automatic Weather Station to carry out measurements in the mountains and on other types of terrain.

### Challenging conditions

The expedition team faced a multitude of challenges when carrying out the project in Tibet. The main difficulties were related to language: only Tibetan is spoken in most remote areas. Isolation is also characteristic of Tibet, which is still an underdeveloped area. Additionally, the altitude posed its challenges both to the expedition team and the equipment. The team members had to be aware of the risk of altitude sickness, while the instruments had to adapt to the very low pressure in the altitude.

The expedition schedule included 3 days in Lhasa (3600 m), 2 days in Xigaze (3900 m), 4 days in Dingri (4300 m), and 5 days in Everest Base Camp (5000 m). Moreover, a week was allocated for travel be- ➤

*Mr. Zhou Li Bo using  
a Vaisala MAWS at  
5250 m at the base of  
Mount Everest.*





*Transportation conditions in Tibet were tough and at times the roads were broken.*



tween each location and for altitude acclimatization. The team traveled by jeep and a truck was used for all the instruments.

### **Air, water and meteorological measurements**

The main research fields studied were air and water samples collection, meteorological studies, ozone layer study at Everest Base Camp, UV-B measurement and on-line measurements of  $O_3$ ,  $CO$ ,  $SO_2$ ,  $NO_x$ ,  $CO_2$ , VOC, and semi-VOC. Moreover, an atmospheric photochemistry study and a study of energy exchanges between soil and the atmosphere were carried out.  $CO_2$  exchanges, i.e. emission and absorption between soil, plants and the atmosphere, were also studied.

We used a Vaisala MAWS201 Mobile Automatic Weather Station successfully in the difficult conditions. The complex Tibetan Plateau's atmospheric boundary layer was again studied during this expedition. We measured wind direction, wind speed, pressure, humidity, temperature (1.50 m from the ground), soil temperature, global radiation, and net radiation. In the Everest valley we used three MAWS stations to study the stream in this specific area. One MAWS was set up in our camp at 5000 m and another at 3 km upstream in the valley at 5050 m. The third MAWS was located on the slope above our camp at 5250 m. The weather is rather quiet in the morning in the Everest valley, but in the afternoon high cold winds coming from the top of Mt Everest (8848 m) are typical. This phenomenon is an issue to be studied more closely in years to come.

### **The Vaisala MAWS201 Automatic Weather Station**

We found the Vaisala MAWS201 Automatic Weather Station very

easy to use. The aluminum tripod provides efficient installation. Each leg of the tripod is adjustable, which makes installation easy in field conditions, even on slopes. No electricity is needed for use, as there is already a solar panel and an internal battery. With a portable computer it is easy to collect the data recorded by the MAWS.

Furthermore, the MAWS is very stable: all of the stations withstood a snowstorm at an altitude of 5000 meters! Nor were the stations damaged by the transport conditions, which were very rough at times. In fact, roads are often very bad in Tibet. The truck which was carrying all of our instruments fell into rivers many times, as roads or bridges were broken. In contrast to other instruments, we didn't need to fix the legs with ropes and stones or the like in order to make sure the MAWS was stable enough.

In addition, the MAWS was rapidly set up by one or two persons, and it was easy for one person to move it to a new measurement site, despite the high altitude. However, to set up one station on the slope above our camp, we had to walk for an hour carrying the station all the way. We decided to pack the station into its box to avoid possible damages caused by falling stones. As such the AWS was quite heavy and not very comfortable to carry, especially at such a high altitude. For this reason, I'd suggest a slight product improvement: it would be a good idea to design a model that could be carried as a back pack in demanding and difficult-to-reach conditions like these. However, despite this wish, we were satisfied with the overall reliability and accuracy of the Vaisala Mobile Automatic Weather Station. It served us well despite the extreme conditions to which it was exposed in Tibet. ●



*A Vaisala MAWS201  
Automatic Weather  
Station at Dingri, at an  
altitude of 4300 m.*