



China Sniffs Carbon Dioxide from Space

By XIN Ling (Staff Reporter)

On the early morning of December 22, 2016, China joined Japan and the U.S. to become a third country in the world to have launched a satellite that is dedicated to the precise measurements of carbon dioxide from space. Sent from Jiuquan Satellite Launching Center to about 700 km above the Earth, the 620 kg TanSat aims to acquire CO₂ concentrations in the global atmosphere and identify carbon sources and sinks with expected measurement precision of 1-4 ppm (parts per million).

The mission uses a grating spectrometer called CarbonSpec to collect the near-infrared absorption of CO₂ in reflected sunshine, and an auxiliary Cloud and Aerosol Polarimetry Imager (CAPI) to compensate the measurement errors of the CarbonSpec.

Compared with ground-based detection, carbon satellites can better obtain the spatial distributions and variations of CO₂ in the cloud-free atmosphere. However, it is also very challenging in terms of precise measurement from space, reliable data analysis and data validation, especially the bias estimation and correction of the analyzed CO₂ concentration data.

In 2009, Japan launched the world's first carbon dioxide satellite – the Greenhouse gases Observing SATellite (GOSAT), followed by the U.S. in 2014 with its Orbiting Carbon Observatory-2 (OCO-2).

According to Tatsuya Yokota, Project Acting Leader of GOSAT from the National Institute for Environmental Studies of Japan, TanSat will be another “strong tool for space-based CO₂ measurement”. In contrast to GOSAT, TanSat “has a good advantage of grating spectrometer which yields a lot of data like OCO-2, and its cloud and aerosol imager CAPI is the first of its kind ever,” he commented. Data from the satellite trio will be

supplemental and comparable with each other, he added.

However, TanSat first needs to address a major challenge in orbit – data calibration – which is “very technically demanding and would require international collaboration,” said Yi Liu, a leading scientist of the project from the Institute of Atmospheric Physics under the Chinese Academy of Sciences (CAS).

With a similar design to OCO-2, the mission was seen by many in China as a good opportunity to work with international partners. Liu and his coworkers even suggested that TanSat be included in the NASA-led Afternoon Train Constellation (A-Train), which involves a number of earth observation satellites from Japan, Europe, Canada and the U.S. that are placed only a few minutes apart from each other at about the same height of TanSat and cross the equator together at a location that varies each day at around 0130 pm solar time. Their proposal did not work out due to technical and political difficulties.

“Anyway, I really expect TanSat will provide much more data of CO₂ to worldwide researchers,” Yokota told *BCAS*.

The 300 million yuan mission was sponsored by the Ministry of Science and Technology of China, and co-developed by CAS and China Meteorological Administration. It is also part of a national research project to address fundamental scientific issues about China's carbon budget. One major conclusion of the research, published last year in the journal *Nature*, is that China's carbon emissions had been overestimated by about 14%. By collecting first hand data, TanSat will “help the Chinese government win a better position in international climate negotiations and make more rational emission reduction goals for the long run”, insiders said.