UMS scientist bound for Antarctica

KOTA KINABALU: Malaysian atmospheric scientist Assoc. Prof. Dr Justin Sentian will be in Antarctica this coming Austral summer to carry out a climate and atmospheric science research project.

The Universiti Malaysia Sabah (UMS) lecturer is the first Malaysian scientist to collaborate with the Chinese Arctic and Antarctic Administration (CAA) in research expedition at the Great Wall Station, Antarctica. He will be departing from Malaysia to Punta Arena (Chile) on 14 December and is expected to land on King George Island, Antarctica on December 18.

He will be at Wall Station for more than a month, and is expected to return to Malaysia by the end of January 2019. The main objective of the collaborative research expedition is to investigate the vertical stratospheric ozone transport in the polar region into upper troposphere layer, commonly known as Stratosphere-Troposphere Exchange (STE).

In addition to the downward fluxes of ozone from the stratosphere into the troposphere, other factors affecting the tropospheric ozone chemistry will be investigated, such as climate change and the enhancement of other chemical constituents such as short lived halogenated halocarbons.

Dr Justin (centre) receiving the YPASM Research Grant presented by Sultan Mizan Zainal Abidin ibni Almarhum Sultan Mahmud Al-Muktafi Billah Shah (second right) in October 2017 in Terengganu.

Sensitivity analyses could also provide better insight into which of those factors are more important to the net production of tropospheric ozone. The research output will certainly enhance understanding of the oxidation capacity status of the polar atmosphere under changing climate scenarios.

The potential sources of the halocarbon could also be determined, helping to understand the roles of these compounds in polar tropospheric chemistry. Tropospheric ozone, a secondary pollutant as well as an important greenhouse gas, is generally understood to be generated largely from photochemistry reactions. However, a substantial amount of ozone has also been found to be transported from the stratosphere.

This downward flux is not only a constituent of the main transport mechanism, but is also responsible for stratospheric ozone depletion and significant input of reactive species into the tropospheric chemical system. In Antarctica, it was found that ozone in the troposphere largely originates from the stratosphere through a variety of processes known as stratosphere-troposphere exchange (STE). However, investigation into the roles of future climate scenarios in STE and tropospheric ozone chemistry in the polar region remains relatively limited.

In addition, polar tropospheric ozone chemistry may be further complicated by a high degree of variability of halocarbons mixing ratios originating from marine sources.

This limited understanding of these combined effects on future tropospheric ozone in the polar region warrants a strategic research approach combining field measurements (meteorology, trace gases, vertical ozone profiles and halocarbons) and modelling (climate model, atmospheric chemistry and transport model).

Therefore, this Antarctic collaborative research aims to investigate the occurrence of the STE phenomenon and to characterize the tropopause and tropospheric ozone chemistry.

To further assist with these challenges in understanding STE, ozonesondes will be deployed to profile the vertical ozone mixing ratio as well as meteorological conditions. This investigation will be supported by the application of the coupled climate-air quality model (i.e. WRF-CMAQ Model) for the synoptic situation analysis of STE event under changing climate scenarios (RCPs).

This research will significantly contribute to the global community's ongoing efforts towards understanding the potential sources and chemistry of tropospheric ozone under future climate scenarios.

This includes scientific findings on the seasonal phenomena of ozone intrusion from stratosphere layer, and the influence of halocarbons emissions on tropospheric ozone chemistry and indirectly the oxidation capacity of the atmosphere.

This study will also further elucidate the transport of tropospheric ozone and related constituents due to stratosphere-troposphere exchange (STE). Under changing climate scenarios, the occurrence of the tropopause fold and its effect on ozone intrusion and atmospheric chemistry can be further evaluated for future ozone budgets and global climate projections.

Last year, Justin was awarded the Yayasan Penyelidikan Antartika Sultan Mizan (YPASM) research grant for a duration of three years for research entitled 'Modelling Approach in Simulating Stratosphere-Troposphere Exchange (STE) under Climate Change Scenarios: Occurrence and Characterization of Tropopause and Tropospheric Ozone Chemistry.'