VIETNAM

Introduction

The National Hydro-meteorological Service of Socialist Republic of Vietnam (NHMS) has three ozone and UV-B observing stations, with Hanoi station (21^{o}01'N, 105^{o}51'E) established in 1992, later joined by Sapa station (22^{o}21'N, 103^{o}49'E) and Tan Son Hoa station (10^{o}47'N, 106^{o}42'E) in 1994. In April 2008, Tan Son Hoa station ceased to observe because of instrumental problems. Obervation management in NHMS has been operated by the Aero-Meteorological Observatory (AMO).

Observational activities

The total amount of atmospheric ozone (TO3) and UV-B are measured by Russia's M124 filter instruments. TO3 is measured seven times a day with sun heights between 20o and 70o, while UV-B is observed eleven times per day from 07:00 to 17:00 from May 1st to October 31st, and nine times per day from 08:00 to 16:00 from November 1st to April 30th. In 2006, AMO sent all the instruments to GGO (Petersburg, Russia) for calibration. However, since the M124 type were no longer in production, most of the instruments after calibration have not produced high quality observational data. Nonetheless, all three stations still make observations according to the National Guide for Observation.

Observation results and analysis

According to the satellite-derived Global Distribution of Total Ozone, Vietnam is located in the region with the total ozone amount between 200DU and 300DU (1), with the minimum in winter and the maximum in summer.

As shown on Table 1 and Figure 1 below, the total ozone amount measured at Tan Son Hoa station varied between 120DU and 240DU from January 2006 and December 2007, which is lower than the satellite measurements. Ozone trends were different in 2006 and 2007, with 2007 seeing an irregular trend with a rapid increase from the minimum of 120DU in February to the maximum of 240DU in June. In general, TO3 in 2006 and 2007 was lower than the normal value.

No data update has been made for TO3 observed at Tan Son Hoa station since 2008 due to instrumental problems.

Table 1: Total amount of ozone, Tan Son Hoa station (Unit: DU)

Month	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009	Year 2010
1	251	234	216	211	142			
2	247	243	205	216	120			
3	249	261	199	224	121			
4	254	263	185	219	227			
5	257	267	184	225	239			
6	243	266	183	228	240			
7	248	269	n/a	227	233			
8	260	263	n/a	226	228			
9	273	260	n/a	226	229			
10	267	256	n/a	201	221			
11	238	229	n/a	187	208			
12	241	225	n/a	144	197			

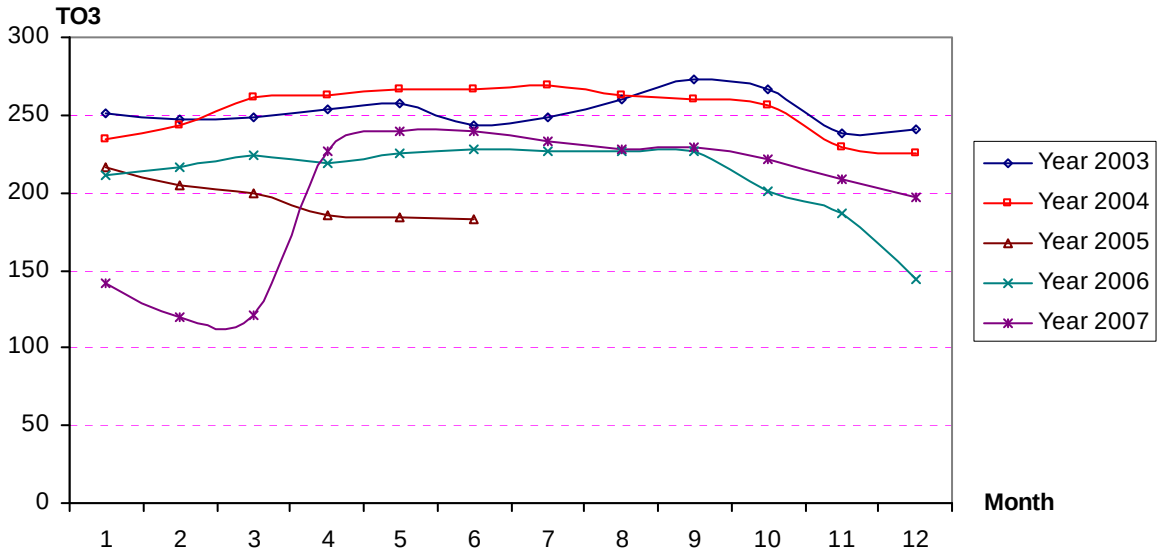

Figure 1: Total amount of ozone, Tan Son Hoa station (Unit: DU)

In the same period (2006-2007), TO3 measured at Hanoi station was slightly higher (see Table 2 and Figure 2) than at Tan Son Hoa station. Notably, in 2007 and 2010, total ozone amount abnormally peaked in February instead of summer.

From 2008, TO3 sees a more stable and slighlty increasing trend in comparision to 2007, with 2010 having the highest TO3 and 2008 the lowest.

Table 2: Total amount of ozone, Hanoi station (Unit: DU)

Month	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009	Year 2010
1	288	373	274	281	350	263	292	329
2	290	390	284	296	394	279	280	348
3	322	439	310	338	292	292	394	378
4	360	424	310	340	312	300	373	376
5	385	454	308	344	291	294	373	374
6	417	478	291	342	283	294	391	366
7	422	376	311	349	284	291	384	357
8	377	365	305	344	292	290	379	348
9	450	314	310	365	285	294	380	336
10	431	297	316	365	281	289	358	336
11	431	257	273	367	276	288	351	350
12	412	267	280	356	265	277	345	320

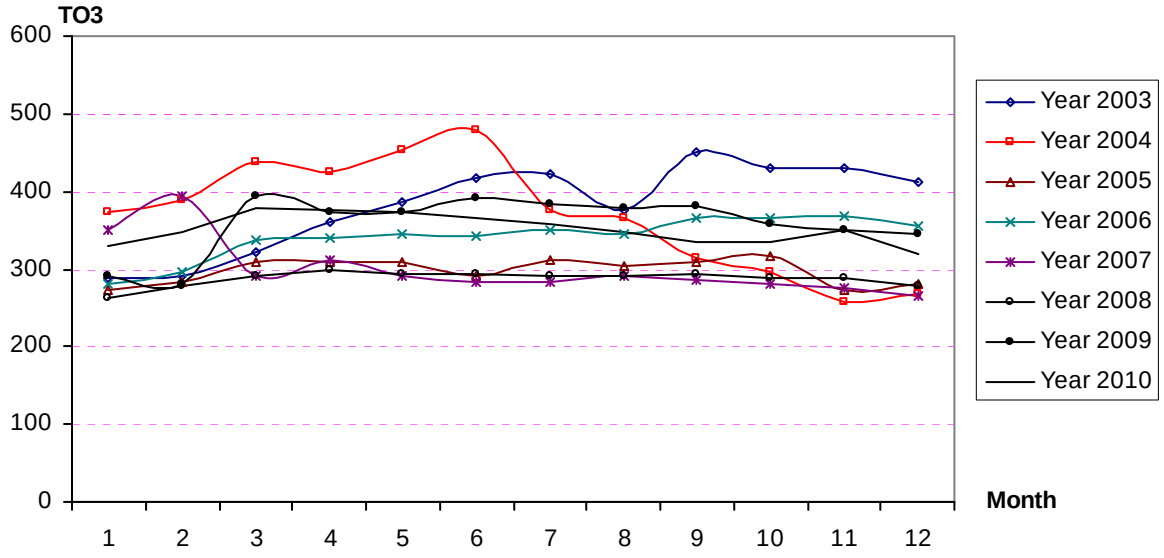

Figure 2: Total amount of ozone, Hanoi station (Unit: DU)

TO3 measured at Sapa station ranged from 200DU to 300DU during 2006-2007 (see Table 3 and Figure 3 below). However, the 2007 trend was not consistent with the Global Distribution of Total Ozone. The total amount of ozone in 2010 was the highest since 2004, emphasizing the overall upward trend since 2008. In general, annual TO3 at Sapa station decreased from January to December, except for February.

Table 3: Total amount of ozone, Sapa station (Unit: DU)

Month	Year 2003	Year 2004	Year 2005	Year 2006	Year 2007	Year 2008	Year 2009	Year 2010
1	291	382	274	241	286	234	307	406
2	313	370	257	250	308	243	309	415
3	342	425	263	283	318	269	344	435
4	377	452	301	292	261	275	350	451
5	354	444	292	303	250	282	344	460
6	352	390	279	298	248	307	391	451
7	352	459	283	311	239	n/a	417	452
8	353	436	277	309	259	n/a	421	434
9	365	419	276	312	262	304	413	445
10	335	460	267	289	256	307	394	447
11	373	454	246	294	251	298	398	455
12	330	538	243	288	238	291	399	434

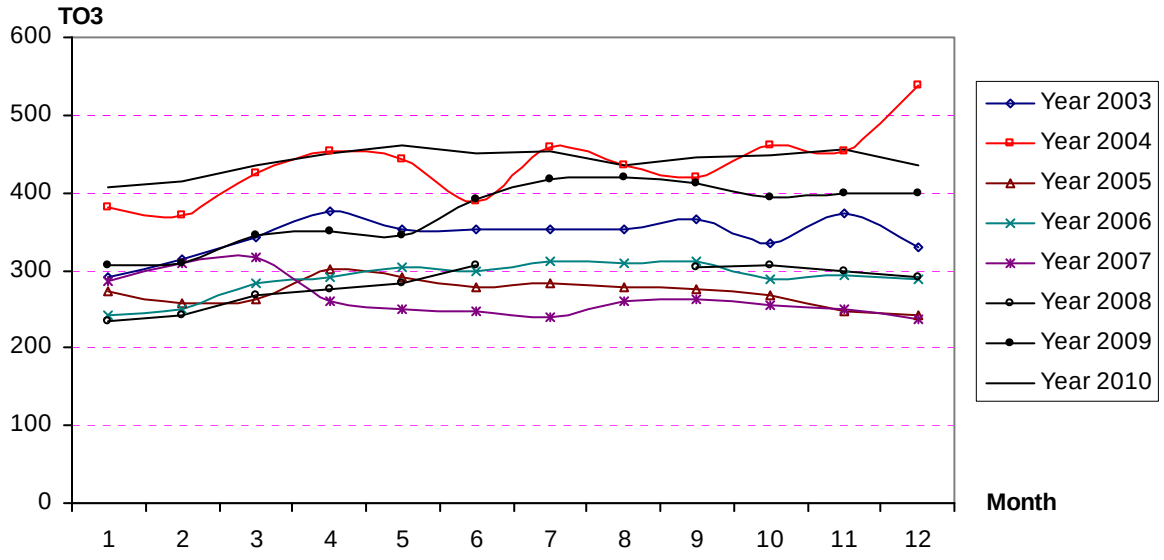

Figure 3: Total amount of zone, Sapa station (Unit: DU)

In addition, column ozone measurements are currently initiated at Hanoi station in collaboration with Japan, with a planned schedule of 1-2 times per month.

Due to the instrumental obsolesence and limited budget for equipment calibration, the ozone data have not been verified, leading to unverified UV-B. Thus UV-B dataset is not presented in this report.

Future Plan

Currently, NHMS is in the process of replacing old M124 intruments with Brewer spectrophotometers. The replacement process was planned to complete at the end of 2010. Due to some difficulties, however, it has to be extended into the first half of 2011.

Recommendations

In order to improve the observtion and measurement of TO3 and UV-B to meet the data quality requirement, there is a strong need for new, modern equipments along with capacity strengthening for NHMS. It is essential that NHMS receive financial and technical support for its instrumental upgrade and staff capacity-building programmes. In particular, NHMS calls for support for the ozonesounding activity in Hanoi, which is planned to take place at least once a week, in parrallel to the twice-a-day radiosounding by Finland-manufactured DigiCORA-RS sonde.

References

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