ATMOSPHERIC BURDEN OF ORGANOCHLORINE PESTICIDES (OCPs) IN GHANA

Hogarh JN[1, 2]*, Seike N[3], Kobara Y[3], Masunaga S[1]

[1] Graduate School of Environment and Information Sciences, Yokohama National University, Yokohama, Kanagawa, 240-8501, Japan.
[2] Department of Theoretical and Applied Biology, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
[3] National Institute for Agro-Environmental Sciences, Tsukuba, Ibaraki 305-8604, Japan.

Presenter's email: jhogarh@gmail.com

BACKGROUND AND AIM

- Organochlorine pesticides are chlorinated hydrocarbons that were previously applied to control insects and pests for agricultural and medical purposes.
- Most of the members in this group are now listed and regulated as POPs under the Stockholm Convention [1].
- These chemicals are persistent, toxic, bioaccumulative, undergo long range transport and a prime source of environmental contamination.
- In this study, we monitored atmospheric burden of OCPs in Ghana, revealed former use patterns and identified some existing hotspots of contamination from some of these pollutants in the country.
- It is hoped that this study would provide data to help improve pesticide control and management in Ghana.

MATERIALS AND METHODS

Sampling: PUF-disk passive air samplers (PAS) (**Fig. 1**) were deployed across Ghana at 13 sites (**Fig. 2**) for 8 continuous weeks, between May and July 2010. These samplers are simple, cheap and do not require electricity to operate.

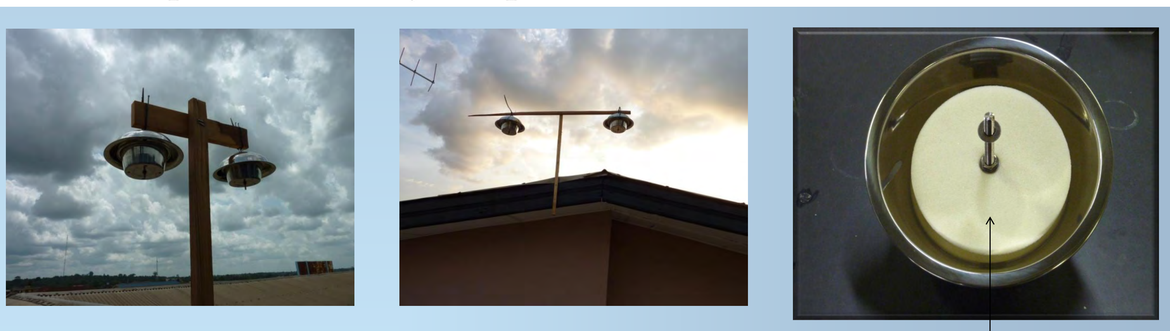

Fig. 1. PUF-disk PAS as mounted in the field in Ghana

Chemical analysis: Harvested PUFs were taken through appropriate extraction and cleanup procedures in the lab and analyzed for 8 categories of OCPs using high resolution GC/MS.

RESULTS AND DISCUSSION

KEY POINTS

Spatial resolution

Heptachlor and chlordanes were applied mostly in northern Ghana, while HCHs, DDT, and the drins (aldrin, dieldrin & endrin) were more prominent in mid to southern Ghana. The endosulfans were however prominent across the country. HCB and mirex did not vary spatially (**Fig. 2**).

Highest burden

DDTs (156 ± 36 pg/m^3) and endosulfans (153 ± 28 pg/m^3) constituted the highest burden of atmospheric OCPs in Ghana (**Fig. 2**), when sampling rate of 3.5 m^3/day was assumed [2].

OCPs with recent signatures

- *Heptachlor*: The average level of heptachlor in air (33.5 ± 11.2 pg/m^3) far exceeded its metabolite, heptachlor epoxide (0.8 ± 0.1 pg/m^3). Contamination from heptachlor may be recent.
- *DDTs*: Two different DDT isomer patterns can be identified in **Fig. 3**. One of the patterns relate to agricultural sites at Somanya, Ho and Kade, each with a *p,p'*-DDT/*p,p'*-DDE ratio > 1, which portends relatively recent contamination.
- *Endosulfans*: Endosulfans were only recently banned in Ghana, having been intensively applied for several years. The high content in air, thus, might reflect recent usage (**Fig. 2**).

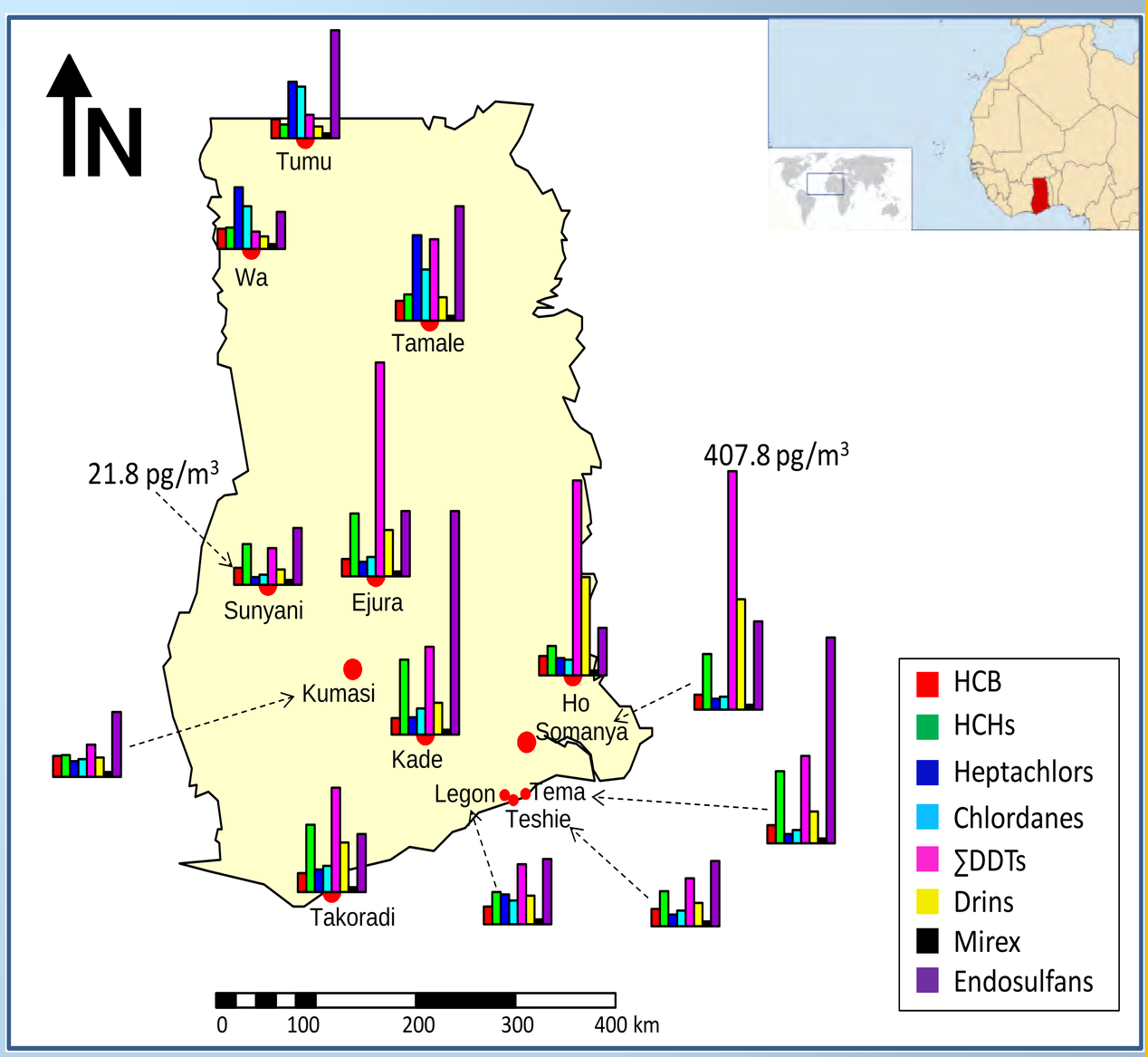

Fig. 2. Sampling sites and spatial distribution of atmospheric OCPs in Ghana

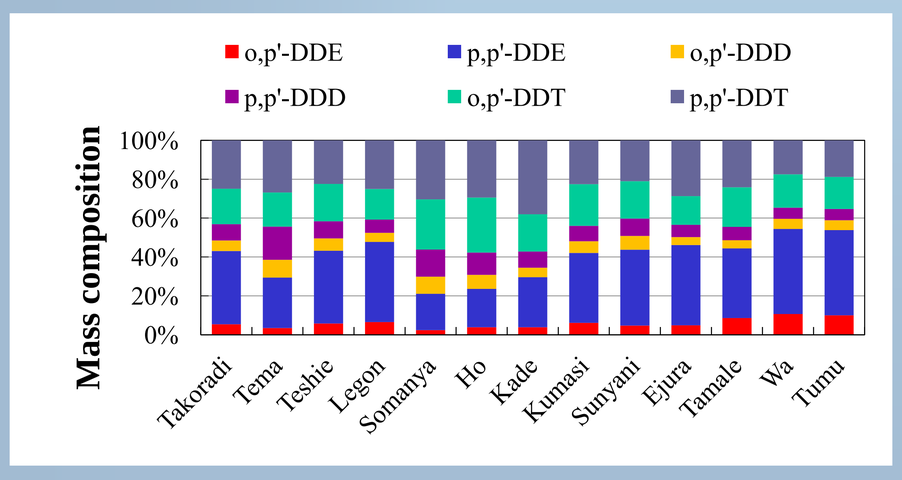

Fig. 3. Atmospheric DDT isomer profile in Ghana

CONCLUSION

Former use pattern of several OCPs varied spatially in Ghana. Recent signatures of heptachlor and DDT were identified in some farming communities, underscoring local challenges at pesticides control in Ghana. These hotspots would be further monitored to establish the source of these pesticides for effective management.

REFERENCES

1. Stockholm Convention on Persistent Organic Pollutants (POPs) as amended in 2009. *www.pops.int*. Accessed on May 24, 2012.
2. Jaward, F.M., Zhang, G., Nam, J.J., Sweetman, A.J., Obbard, J.P., Kobara, Y., Jones, K.C. (2005) *Environ. Sci. Technol.* 39:8638-8645.

ACKNOWLEDGEMENTS: We are grateful to all persons that helped with sampling in Ghana. This study was supported by the Leadership Program in Sustainable Living with Environmental Risk (SLER) at the Yokohama National University funded by the Ministry of Education Programs of Special Coordination Funds for Promoting Science and Technology Training Base of Strategic Leaders, the Joint Research Program of the Faculty of Environment and Information Sciences, Yokohama National University and the Global Center of Excellence (GCOE) Program "Global Eco-Risk Management from Asian Viewpoints" of the Ministry of Education, Culture, Sports, Science and Technology of Japan.