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Interactive comment on “Ratios among atmospheric trace gases together with winds imply exploitable information for bird navigation: a model elucidating experimental results” by H. G. Wallraff

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Thanks for the friendly comment. Here a few replies:

The model does not aim to provide testable predictions for navigation experiments, but it aims to provide basic atmospheric peculiarities from which an air-chemical approach can be evolved. It is focussed on the environment whose related properties are just going to become visible and need to be explained on a physical / chemical / meteorological basis. The direction of necessary approaches is reversed against the usual

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case in biology where we ask whether and/or in what way an animal makes use of well-known physical features. As concerns other problems of animal orientation, this or that partner discipline (e.g. astronomy, geophysics) provides precise formulae, tables, or maps on well-defined parameters such as the sun's path in dependence on geographical position, time of year and day, or the geomagnetic vector in dependence on position. In the case of olfactory navigation, however, we do not know, a priori, potentially exploitable regularities of the chemical atmosphere, which had not been expected to exist at all before pigeons gave us decisive hints. Thus, we cannot resort to readily prepared data of another discipline, but we need cooperation with atmospheric chemistry in order to recognise related intra-atmospheric interrelationships.

Replies to referee's specific comments: 1) GPS tracks. I certainly could simulate full homing tracks on the basis of the present model, as I have done it earlier (Wallraff 2000, see Fig. 7.34 in my 2005 book). However, I cannot simulate realistic potential detours (course change just here or there), as they are expected to depend on a set of unknown particular chemical compounds which the birds actually utilize. Moreover, detours flown by real pigeons are not only caused by olfactory input (as they are in my virtual birds), but also by visual topographic features. (The reverse experiment, only vision, could be made with real pigeons: If made anosmic after 2 or 3 flights from the same site, do they show the same degree of path stereotypy as described by the Guilford group in untreated birds, i.e., do the stereotyped routes exclusively depend on visual input?) 2) Migratory navigation. At the moment I would be happy if I could understand the air-chemical background of home-finding over some hundreds of kilometres. I do not exclude, however, that migratory birds and seabirds might cope with more complex patterns of overlapping gradient fields. As concerns bird migration, a combination with purely directional compass orientation appears possible (see Fig. 10.8 in my book).

Technical corrections: p. 12456, line 21: no, not "also help", but "also THIS problem" (i.e., beyond navigation), perhaps "... this problem as well". Possibly I shall change

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the sentence. p. 12469, line 11: Of course, “Less certain ...” is simpler; perhaps “Somewhat less ...” (i.e., not very much less)?

Interactive comment on Biogeosciences Discuss., 10, 12451, 2013.

BGD

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