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Geoscientific
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Interactive comment on "Coupling global chemistry transport models to ECMWF's integrated forecast system" *by* J. Flemming et al.

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We thank the reviewer#1 for the insightful comments and suggested corrections.

Reviewer#1's biggest concern seems to be the interpretation of the displayed tendency profiles in the PBL. This concern might only be caused by our use of the term "diffusion", which should be named more precisely "vertical turbulent tracer flux in the PBL" to avoid any confusion with numerical or horizontal diffusion. The emissions and dry deposition fluxes are the surface boundary conditions for the vertical turbulent tracer flux. We agree with reviewer#1 that the difference in the parameterisation of the PBL schemes leads to different vertical turbulent tracer fluxes. We believe that analysing the tracer tendencies caused by this flux is a good way to visualise the differences of these schemes, which are otherwise more difficult to demonstrate.

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Reviewer#1 pointed out that there is no reason to only simulate the gases mentioned in the paper. O3, CO, NOx, HCHO and SO2 were the species for which the coupled system has been applied so far. All gases included in the chemical mechanism of the CTM can be considered for the coupling, if their concentration changes on a time scale larger than the coupling interval. It might be an interesting prospect, as suggested by reviewer#1, to apply the assimilation apparatus of the coupled system also to ClO and BrO to assist the assimilation of stratospheric ozone, which is a typical task of the coupled system. We are going to change the text accordingly.

The very long lived species methane is fixed in the used CTMs because of its effect on OH concentrations. It is therefore not a good candidate for the coupled system. However, methane and other long lived greenhouse gases such as CO2 have been assimilated (also as part of the GEMS project) by the IFS without coupling of a CTM. In this case, a climatology from model values has been used to account for the source and sink terms.

The evaluation with observations has been kept short because of the more technical nature of the paper and the journal. The focus has been to show that the concentration fields of the IFS do not differ to a large extent from the CTM concentration field in all levels of the model domain, i.e. that the concentration fields used for the assimilation by the IFS are very similar to the CTM fields. We included the comparison with observed surface data because the IFS and CTM surface concentrations are most likely to differ. We wanted to show that these differences, which occur because of the transformations in the coupling, are small compared to differences against observations.

We would like to refer to Ordonez et al. (Atmos. Chem. Phys. Discuss., 9, 16853-16911, 2009) as an example for the evaluation of the coupled system in the troposphere during the 2003 European heat wave. A paper in preparation will aim at the evaluation in terms of stratospheric ozone. Comparison against satellite observations of O3, CO, NOx, HCHO and SO2 can be found in Innes et al. (2009). The "GEMS GRG Comprehensive Validation Report project report" (Cammas et al. 2009, available

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at http://gems.ecmwf.int/do/get/GEMS) contains more evaluation studies of the CTMs and the coupled system.

We will improve the figure captions according to the suggestions. STC stands for Santa Cruz and no CO data were available for Neumayer Station. The figures 5, 6, 7 and 8 have been referenced in the text at p. 777 l 23, p. 775 l. 6, p. 775 l. 23 and p.775 l. 23 respectively but we are going to re-arrange the figure numbers according to their appearance in the text.

Interactive comment on Geosci. Model Dev. Discuss., 2, 763, 2009.