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Interactive comment on "Evaluation of flushing time, groundwater discharge and associated nutrient fluxes in Daya Bay, China" *by* Yan Zhang et al.

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In this study, we estimated water and nutrient fluxes based on the steady state models that neglect the variation of radium storage in the bay. The referee doubts the validity of steady state models. About the steady state in our model, we have the following explanations:

1. This steady state is a common and typical approach for tracer-based SGD studies and has been used in all the previous studies of SGD by radium isotope methods (e.g., Moore, 1996; Kim et al. 2005; Moore et al., 2006; Moore et al., 2008).

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2. During our observation period (wet season), both SFGD and rivers approximately reach their maximum discharging rates so that the mass of radium in the whole bay is approximately at its maximum. In other words, the observation time is near an extreme point of the function of total radium mass in the bay with respect to time. Since the variation of radium storage in the whole bay approaches zero near the extreme point, the steady state is approximately valid during our sampling period.

3. The referee suggests that the bay system is very dynamic due to the high spatial variability of radium. In fact, the radium concentrations in seawater are associated with various factors, such as offshore distance, lithology and geological conditions. From point scale, the radium concentrations vary significantly among stations. When taking the whole bay as the study subject, the system is under steady-state condition (see explanation 2). The SGD and nutrient fluxes in our study were estimated based on the scale of the whole bay. Moreover, the meteorological conditions were stable and did not show obvious variations during our sampling period. Thus the sampled concentrations could represent the steady state conditions and the steady state used in this study is reasonable.

Strict quantification of the error induced by steady state assumption needs not only much more radium measurement data in terms of time series, but also quantification of the seawater flow in the whole bay for a long period (at least one year) by a numerical model. This will be a major task and is indeed beyond the scope of this paper.

The estimated evapotranspiration is actual one in our study. The actual evapotranspiration in this basin was estimated as the product of the area of the basin and daily evapotranspiration. The daily evapotranspiration was assessed based on the monthly evapotranspiration. The monthly evapotranspiration was estimated by the Gaoqiao equation (Guo and Li, 2008) using monthly mean air temperature and precipitation data from 2005 to 2015.

The referee indicates that tidal prism is depending on the GW level. In fact, the tidal prism is associated with sea level (not GW level). Because the intertidal zone in Daya Bay is narrow, the change of the water surface area over the tidal cycle can be neglected. Thus, the tidal prism can be estimated approximately as the product of the tidal range and water surface area.

With the dispersion coefficient, sediment mixing coefficient, adsorption coefficient, production rate of the radionuclide in sediments and porosity, the radium input from sediments could be estimated based on an empirical formula (Eq. (7)) reported by Moore et al. (2011). In Eq. (7), the values of the dispersion coefficient and sediment mixing coefficient for typical marine sediments could be found in Zlotnik et al. (2010) and Moore et al. (2011). The activities of radium quartet in sediments can be obtained based on the contents of uranium (U) and thorium (Th) in coastal sediments of Guangdong Province, China. Using the radium activities in sediments, leachable ratios and sediment density, we can estimate the production rate of radium quartet. The calculation details for each term in Eq. (7) see Section 4.3.3. No assumptions for Eq. (7) were used.

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