Replies to reviewer #2 comments:

Comment: The back-trajectory analysis was done for trajectories within the boundary layer only (lines 114ff). This automatically excludes long-range transport of atmospheric constituents in the free troposphere. You also wrote (lines 155f) "The HALO Doppler lidar wind profiles show that there is significant transport aloft (from the direction of the Gulf) throughout the early morning and during the day, which corresponds to the larger mesoscale wind direction (north-westerly flow) for the region which seems to be persistent all year round (citations…).
Q: was this persistent mesoscale wind circulation confirmed by the wind lidar and/or trajectories during the 1-year campaign?

Reply: Yes, this persistent mesoscale wind circulation was confirmed by the wind lidar and trajectories during our 1-year campaign.

Comment: Why 5 day back trajectories were calculated when the mean wind is 2m/s and the refineries and cities are located within 70-80km (~11 h)? 12h or 24h trajectories seem sufficient. However, in case that the reason is capturing the elevated SO_2 concentrations in Iran and Iraq as seen by Tropomi then figure 1 should show a larger area. Why not combining fig. 1 and 11?

Reply: No, the trajectory analysis is not restricted to within the boundary layer. Only the back-trajectory starting points were restricted to start within the boundary layer as it says in the text. A back trajectory can well escape the boundary layer, which also expected. This is why the back-trajectory analysis cannot be restricted to e.g. 12 as suggested by the reviewer since transport aloft is more efficient. The fact that we start back-trajectories within the boundary layer, because we have this information, makes the back-trajectory analysis more sound. The reviewer is correct that 5 days is too long to track SO_2 in the region and we have changed the wording in the revised manuscript as we just used the first 48 hours of the trajectories in the analysis. 48 hours was chosen as the atmospheric lifetime of SO_2 is only a few days in the boundary layer. This was clarified in the text as "A set of ~~5-day~~ 48-hour backward trajectories were computed…" There is no need to say that we calculated 5-day back trajectories when we only used the first 48 hours of them.
We would like to keep Fig. 1 and 11 separate as Fig. 11 with three panels would be quite busy and zooming out Fig. 1 to the same scale and in Fig. 11 would make it impossible to see where the measurement location is on the peninsula.

Minor comment:
Comment: Fig.2: please state either in the text or in the figure caption which device was used for the wind roses (Vaisala weather station or Halo wind lidar)

Reply: The clarifying text was added to the figure caption: The figure shows data from the automatic weather station.

Comment: Fig. 3: the same as for fig. 2

Reply: The clarifying text was added to the figure caption: The figure shows data from the automatic weather station.

Comment: Fig. 11: the caption of the color scale should have a unit and correspond to the figure caption.

Reply: The color scale is unitless. The color scale label was on top of the color bar. The label "RD" is now to the right of the color bar, which is the relative difference (RD) between the different trajectories. The equation for the relative difference is explained in the figure caption.