We really appreciate the insightful and constructive comments by the Reviewer 1 regarding our manuscript. On behalf of all the co-authors, we made every effort to address these comments and revised the manuscript accordingly to improve its quality. Following the Reviewer's comments in black, please find our point-to-point responses in blue. Hereafter, all new added or modified sentences are marked in blue and italic in this response.

General Comments:

1.The paper does a thorough job of reviewing the studies involving coupled Met-AQ modeling with aerosol feedback effects, but it does not provide summary of the methods used to represent ARI and ACI or any assessment of the realism of the different models. It seems important to explain various the methods used to represent ARI and ACI and give some information on their accuracy.

Response: We agreed that it is useful to provide more detailed information about how ARI and ACI are treated in the five two-way coupled models applied the most in Asia. Therefore in the revised manuscript, we summarized the aspects for calculating ARI (including aerosol species groups, aerosol size distribution in different aerosol mechanisms, mixing states, and short- and long-wave radiation schemes) and ACI (including CCN and IN activation methods in microphysics schemes) in WRF-Chem, WRF-CMAQ, GRAPES-CUACE, WRF-NAQPMS and GATOR-GCMOM in Table 4. Please note that according to the Reviewer 2's suggestion, relevant information of GATOR-GCMOM was extracted and added in Table 4 as well. Table B6 in Appendix B of the revised manuscript further presents description of refractive indices of different aerosol species groups used in short- and long-wave radiation schemes in WRF-Chem and WRF-CMAQ. Due to unavailability of source codes, relevant information in other three coupled models (GRAPES-CUACE, WRF-NAQPMS and GATOR-GCMOM) is not presented in this table.

Table 4. Summary of relevant information regarding calculations of aerosol-radiation interactions (ARI) and aerosol-cloud interactions (ACI) in two-way coupled models (WRF-Chem, WRF-CMAQ, GRAPES-CUACE, WRF-NAQPMS and GATOR-GCMOM) applied in Asia.

Model	*ARI*					*ACI*	
	Aerosol species groups	*Aerosol size distribution (Aerosol mechanism)*	*Mixing state‡*	*SW scheme (# of spectral intervals)*	*LW scheme (# of spectral intervals)*	*CCN (Microphysics scheme)*	*IN (Microphysics scheme)*
WRF-Chem	*1. Water 2. Dust 3. BC 4. OC 5. Sea-salt 6. Sulfate*	*1. Bulk (GOCART) 2. Modal (MADE/SORGAM, AERO5, MAM3 and MAM7) 3. Sectional (MOSAIC (4bins and 8 bins) and MADRID (8bins))*	*Internal mixing (Volume averaging, Core-shell, and Maxwell-Garnett)*	*1. Goddard (11) 2. RRTMG (14)*	*RRTMG (16)*	*Activation under a certain supersaturation in an air parcel based on Köhler theory (Morrison, Lin, Thompson, WSM 6/5/3 class and Milbrandt-Yau)*	*Ice heterogeneous nucleation of mineral dust aerosols in based on classical nucleation theory (Milbrandt-Yau and Morrison)†*
WRF-CMAQ	*1. Water 2. Water-soluble 3. BC 4. Insoluble 5. Sea-salt*	*Modal (AERO5, AERO6 and AERO7)*	*Internal mixing (Core-shell)*	*RRTMG (14)*	*RRTMG (16)*	*None*	*None*
GRAPES-CUACE	*1. Nitrate 2. Dust 3. BC 4. OC 5. Sea-salt 6. Sulfate 7. Ammonium*	*Sectional (CUACE (12 bins))*	*External mixing*	*Goddard (11)*	*Goddard (10)*	*Activation under a certain supersaturation in an air parcel based on Köhler theory (WSM 6-class)*	*None*
WRF-NAQPMS	*1. Nitrate 2. Dust 3. BC 4. OC 5. Sea-salt 6. Sulfate 7. Ammonium 8. Other primary particles*	*Modal (AERO5)*	*External mixing*	*Goddard (11)*	*RRTM (16)*	*Activation under a certain supersaturation in an air parcel based on Köhler theory (Lin)*	*None*
GATOR-GCMOM	*1. Water 2. Dust 3. BC 4. HCO_3^- 5. SOA 6. Sulfate . . . 42. $MgCO_3(s)$*	*Sectional (GATOR2012* (17-30 bins))*	*Internal mixing (Core-shell‡)*	*Toon* (318)*	*Toon* (376)*	*Activation under a certain supersaturation in an air parcel based on Köhler theory (GATOR2012*)*	*Ice heterogeneous and homogeneous nucleation (GATOR2012*)*

‡ *Specific version of WRF-Chem, WRF-NAQPMS and GOTAR-GCMOM have the ability of simulating aerosol aging (Zhang et al.,*

2014;Chen et al., 2017; Li et al., 2018; Jacobson, 2012).

† Some specific versions of WRF-Chem consider IN (Keita et al., 2020; Lee et al., 2020).

※The short- and long-wave radiation calculations in GATOR-GCMOM are based on the algorithm of Toon et al. (1989).

* GATOR2012 refers to either the aerosol or cloud microphysics scheme used in Jacobson (2012).

Table B6. Description of refractive indices and radiation schemes used in the WRF-Chem and WRF-CMAQ models applied in Asia.

Model	Refractive indices of aerosol species groups		Radiation scheme	
	SW	LW	SW scheme (Spectral intervals)	LW scheme (Spectral intervals)
WRF-Chem	1. Water (1.35+1.524^{-8}i, 1.34+2.494^{-9}i, 1.33+1.638^{-9}i, 1.33+3.128^{-6}i) 2. Dust (1.55+0.003i, 1.550+0.003i, 1.550+0.003i, 1.550+0.003i) 3. BC (1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i) 4. OC (1.45+0i, 1.45+0i, 1.45+0i, 1.45+0i) 5. Sea salt (1.51+8.66^{-7}i, 1.5+7.019^{-8}i, 1.5+1.184^{-8}i, 1.47+1.5^{-4}i) 6. Sulfate (1.52+1.00^{-9}i, 1.52+1.00^{-9}i, 1.52+1.00^{-9}i, 1.52+1.75^{-6}i) in term of 4 spectral intervals in 0.25-0.35, 0.35-0.45, 0.55-0.65, 0.998-1.000 μm	1. Water (1.532+0.336i, 1.524+0.360i, 1.420+0.426i, 1.274+0.403i, 1.161+0.321i, 1.142+0.115i, 1.232+0.0471i, 1.266+0.039i, 1.296+0.034i, 1.321+0.0344i, 1.342+0.092i, 1.315+0.012i, 1.330+0.013i, 1.339+0.01i, 1.350+0.0049i, 1.408+0.0142i) 2. Dust (2.34+0.7i, 2.904+0.857i, 1.748+0.462i, 1.508+0.263i, 1.911+0.319i, 1.822+0.26i, 2.917+0.65i, 1.557+0.373i, 1.242+0.093i, 1.447+0.105i, 1.432+0.061i, 1.473+0.0245i, 1.495+0.011i, 1.5+0.008i) 3. BC (1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i, 1.95+0.79i,) 4. OC (1.86+0.5i, 1.91+0.268i, 1.988+0.185i, 1.439+0.198i, 1.606+0.059i, 1.7+0.0488i, 1.888+0.11i, 2.489+0.3345i, 1.219+0.065i, 1.419+0.058i, 1.426+0.0261i, 1.446+0.0142i, 1.457+0.013i, 1.458+0.01i) 5. Sea salt (1.74+0.1978i, 1.76+0.1978i, 1.78+0.129i, 1.456+0.038i, 1.41+0.019i, 1.48+0.014i, 1.56+0.016i, 1.63+0.03i, 1.4+0.012i, 1.43+0.0064i, 1.56+0.0196i, 1.45+0.0029i, 1.485+0.0017i, 1.486+0.0014i) 6. Sulfate (1.89+0.22i, 1.91+0.152i, 1.93+0.0846i,	GODDARD (0.175-0.225, 0.225-0.245, 0.245-0.260, 0.280-0.295, 0.295-0.310, 0.310-0.320, 0.325-0.400, 0.400-0.700, 0.700-1.220, 1.220-2.270, 2.270-10.00 μm) RRTMG (3.077-3.846, 2.500-3.077, 2.150-2.500, 1.942-2.150, 1.626-1.942, 1.299-1.626, 1.242-1.299, 0.778-1.242, 0.625-0.778, 0.442-0.625, 0.345-0.442, 0.263-0.345, 0.200-0.263, 3.846-12.195 μm)	RRTMG (10-350, 350-500, 500-630, 630-700, 700-820, 820-980, 980-1080, 1080-1180, 1180-1390, 1390-1480, 1480-1800, 1800-2080, 2080-2250, 2250-2390, 2390-2600, 2600-3250 cm^{-1})

		1.586+0.2225i, 1.678+0.195i, 1.758+0.441i, 1.855+0.696i, 1.597+0.695i, 1.15+0.459i, 1.26+0.161i, 1.42+0.172i, 1.35+0.14i, 1.379+0.12i, 1.385+0.122i) in term of 16 spectral intervals in 10-350, 350-500, 500-630, 630-700, 700-820, 820-980, 980-1080, 1080-1180, 1180-1390, 1390-1480, 1480-1800, 1800-2080, 2080-2250, 2250-2390, 2390-2600, 2600-3250 cm^{-1}		
WRF-CMAQ	1. Water (1.408+1.420^{-2}i, 1.324+1.577^{-1}i, 1.277+1.516^{-3}i, 1.302+1.159^{-3}i, 1.312+2.360^{-4}i, 1.321+1.713^{-4}i, 1.323+2.425^{-5}i, 1.327+3.125^{-6}i, 1.331+3.405^{-8}i, 1.334+1.639^{-9}i, 1.340+2.955^{-9}i, 1.349+1.635^{-8}i, 1.362+3.350^{-8}i, 1.260+6.220^{-2}i) 2. Water-soluble (1.443+5.718^{-3}i, 1.420+1.777^{-2}i, 1.420+1.060^{-2}i, 1.420+8.368^{-3}i, 1.463+1.621^{-2}i, 1.510+2.198^{-2}i, 1.510+1.929^{-2}i, 1.520+1.564^{-2}i, 1.530+7.000^{-3}i, 1.530+5.666^{-3}i, 1.530+5.000^{-3}i, 1.530+8.440^{-3}i, 1.530+3.000^{-2}i, 1.710+1.100^{-1}i) 3. BC (2.089+1.070i, 2.014+0.939i, 1.962+0.843i, 1.950+0.784i, 1.940+0.760i, 1.930+0.749i, 1.905+0.737i, 1.870+0.726i, 1.850+0.710i, 1.850+0.710i, 1.850+0.710i, 1.850+0.710i, 1.850+0.710i, 2.589+1.771i) 4. Insoluble (1.272+1.165^{-2}i, 1.168+1.073^{-2}i, 1.208+8.650^{-3}i, 1.253+8.092^{-3}i, 1.329+8.000^{-3}i, 1.418+8.000^{-3}i, 1.456+8.000^{-3}i, 1.518+8.000^{-3}i, 1.530+8.000^{-3}i, 1.530+8.000^{-3}i, 1.530+8.000^{-3}i, 1.530+8.440^{-3}i, 1.530+3.000^{-2}i, 1.470+9.000^{-2}i) 5. Sea-salt (1.480+1.758^{-3}i, 1.534+7.462^{-3}i, 1.437+2.950^{-3}i, 1.448+1.276^{-3}i, 1.450+7.944^{-4}i, 1.462+5.382^{-4}i, 1.469+3.754^{-4}i, 1.470+1.498^{-4}i, 1.490+2.050^{-7}i, 1.500+1.184^{-8}i, 1.502+9.938^{-8}i, 1.510+2.060^{-6}i, 1.510+5.000^{-6}i, 1.510+1.000^{-2}i) in term of 14 wavelengths at 3.4615, 2.7885, 2.325, 2.046, 1.784, 1.4625, 1.2705, 1.0101, 0.7016, 0.53325, 0.38815, 0.299, 0.2316, 8.24 μm	1. Water (1.160+0.321i, 1.140+0.117i, 1.232+0.047i, 1.266+0.038i, 1.300+0.034i) 2. Water-soluble (1.570+0.069i, 1.700+0.055i, 1.890+0.128i, 2.233+0.334i, 1.220+0.066i) 3. BC (1.570+2.200i, 1.700+2.200i, 1.890+2.200i, 2.233+2.200i, 1.220+2.200i) 4. Insoluble (1.482+0.096i, 1.600+0.107i, 1.739+0.162i, 1.508+0.117i, 1.175+0.042i) 5. Sea-salt (1.410+0.019i, 1.490+0.014i, 1.560+0.017i, 1.600+0.029i, 1.402+0.012i) in term of 5 thermal windows at 13.240, 11.20, 9.73, 8.870, 7.830 μm	RRTMG (3.077-3.846, 2.500-3.077, 2.150-2.500, 1.942-2.150, 1.626-1.942, 1.299-1.626, 1.242-1.299, 0.778-1.242, 0.625-0.778, 0.442-0.625, 0.345-0.442, 0.263-0.345, 0.200-0.263, 3.846-12.195 μm)	RRTMG (10-350, 350-500, 500-630, 630-700, 700-820, 820-980, 980-1080, 1080-1180, 1180-1390, 1390-1480, 1480-1800, 1800-2080, 2080-2250, 2250-2390, 2390-2600, 2600-3250 cm^{-1})

The following two paragraphs and Table 4 are added into a newly added Section 3.3 (Summary of modeling methodologies) in the revised manuscript. We also changed the title of Section 3 to "Basic overview" to reflect these changes.

"Table 4 further lists various aspects with regards to how ARI and ACI being calculated in the five two-way coupled models (WRF-Chem, WRF-CMAQ, GRAPES-CUACE, WRF-NAQPMS, and GATOR-GCMOM) applied in Asia. Note that the information in this table was extracted from the latest released version of WRF-Chem (version 4.3.3) and WRF-CMAQ (based on WRF v4.3 and CMAQ v5.3.3) as well as relevant references for GRAPES-CUACE (Wang et al., 2015), WRF-NAQPMS (Wang et al., 2014) and GATOR-GCMOM (Jacobson et al., 2010; 2012). These models all use the Mie theory to compute ARI effects but differ in representations of aerosol optical properties and radiation schemes. To simplify the calculation, aerosol species simulated

by the chemistry module/model are put into different groups (Table 4) and the refractive indices of these groups are directly from the Optical Properties of Aerosols and Clouds (OPAC) database (Hess et al., 1998) in WRF-Chem and WRF-CMAQ (Table B6 in Appendix B). In WRF-Chem, the aerosol optical properties (AOD, extinction/scattering/absorption coefficient, single scattering albedo and asymmetry factor) are calculated in terms of four spectral intervals (listed in Table B6 in Appendix B) and then inter/extrapolated to 11 (14) SW intervals defined in the GODDARD (RRTMG) scheme. For SW and LW radiation in both WRF-CMAQ and WRF-Chem, these optical parameters are computed at each of corresponding spectral intervals in the RRTMG scheme. The aerosol optical property for LW radiation is considered only at 5 thermal windows (listed in Table B6) in WRF-CMAQ. No detailed information regarding how aerosol optical property and relevant parameters being calculated in GRAPES-CUACE and WRF-NAQPMS can be found from the relevant references.

With respect to ACI effects, the simulated aerosol characteristics (such as mass, size distribution and species) are utilized for the calculation of cloud droplet activation and aerosol resuspension based on the Köhler theory (Abdul-Razzak and Ghan, 2002) in several (one) microphysics schemes (scheme) in WRF-Chem (GRAPES-CUACE). GATOR-GCMOM is the first two-way coupled model adding IN activation processes including heterogeneous and homogeneous freezing (Jacobson et al., 2003). None of the other four two-way coupled models considers the IN formation processes (including immersion freezing, deposition freezing, contact freezing, and condensation freezing) but they have been included in some specific versions of WRF-Chem (Keita et al., 2020; Lee et al., 2020), which are not yet in the latest release version 4.3.3 of WRF-Chem."

Hitherto in Asia, there are no assessment studies targeting how the various aspects of ARI and ACI calculations in two-way coupled models affect the accuracies of model simulations and rather limited studies in US and Europe. Baró et al. (2015) evaluated the impacts of two microphysics schemes (Morrison and Lin) on WRF-Chem simulations for a European domain and found out that no conclusive results indicating which scheme was more accurate, even though WRF-Chem with these two schemes did produce different cloud properties in various areas and seasons. Three combinations of gaseous and aerosol mechanisms (CBMZ-MOSAIC, MOZART-MOZAIC and RADM2-MAD/SORGAM) in WRF-Chem were compared over the Eastern Mediterranean by Georgiou et al. (2018) and the WRF-Chem with RADM2-MADE/SORGAM simulated O_3 and $PM_{2.5}$ slightly better than the other two mechanisms. Targeting a summertime aerosol pollution episode occurring in central Europe, Palacios-Peña et al. (2020) tweaked parameters set in the bulk size distribution and GOCART mechanism in WRF-Chem and investigated the sensitivities of AOD to different parameters defining aerosol size distribution in various modes.

2. The paper is very long, and I found it very difficult to read through the seemingly endless recitation of statistics that have very wide ranges without any explanation for the different results. The variety of modeling techniques, domains, resolutions, data assimilation, ICs and BCs, emissions, etc, should be considered in these comparisons. Why such wide ranges of results? Perhaps investigate the extremes to find out and maybe exclude studies with serious issues.

Response: To improve the paper's readability, we moved Section 5.1.2 and Section 5.2.2 to Appendix C in the revised manuscript. We thank the Reviewer 1 for pointing out that we should also outline the various aspects of how modeling studies being set up, which can affect the results of simulations and statistical analyses. A new Table S4 in Supplement of our revised manuscript illustrates the relevant information, and it is organized in the same order as Table 1 of the revised manuscript and contains extra/auxiliary information about model setup in the two-way coupled model applications in Asia.

Table S4. Basic information of model setup for two-way coupled model applications in Asia.

No.	Grid resolution (km)	Vertical layer	Aerosol mechanism	Gas phase chemical mechanism	PBL scheme	Meteorological ICs and BCs	Chemical ICs and BCs	Anthropogenic emission	Natural emission	Reference
1	†	†	†	†	YSU	†	†	†	†	Singh et al. (2020)*
2	30	28	MADE/SORGAM	RADM2	YSU	†	†	†	†	Bharali et al. (2019)
3	†	†	MOSACI	CMBZ	†	†	†	†	†	Shahid et al. (2019)
4	18, 6	42	MOSAIC (8 bins)	CBMZ	YSU	FNL	MOZART	2010 MEIC	†	Wang et al. (2019)
5	12	35	AERO5	SAPRC99	MYJ	FNL	MOZART	2012 MEIC	MEGAN	Wu et al. (2019a)
6	12	35	AERO5	SAPRC99	MYJ	FNL	MOZART	2012 MEIC	MEGAN	Wu et al. (2019b)
7	36	35	MADE/SOGARM	RADM2	YSU	FNL	†	†	†	Yuan et al. (2019)
8	27, 9	†	MOSAIC	CMBZ	YSU	FNL	†	†	†	Zhang et al. (2019)
9	36	37	MOSAIC (4 bins)	CBMZ	YSU	FNL	MOZART	2012 MEIC/2010 MIX	MEGAN/Dust	Zhou et al. (2019)
10	50	29	MOSAIC	†	YSU	†	†	†	†	Bran et al. (2018)
11	60	28	MOSAIC (8 bins)	CBMZ	YSU	FNL	Default profile	MIX	MEGAN/GFED/Dust	Gao et al. (2018b)
12	12, 4	24	MOSAIC	CBMZ	YSU	†	†	†	†	Li M. M. et al. (2018)
13	20	42	†	†	†	†	†	†	†	Li and Sokolik (2018)
14	9	40	MOSAIC(4 bins)	CMBZ	MYJ TKE	FNL	†	†	†	Liu et al. (2018)
15	15	21	MADE/SOGARM	RADM2	YSU	†	†	†	†	Miao et al. (2018)
16	30	27	MADE/SORGAM	RADM2	†	†	†	†	†	Soni et al. (2018)
17	36, 12	23	MOSAIC	CBMZ	YSU	†	†	†	†	Wang L. T. et al. (2018)
18	4	100	MOSAIC	CMBZ	YSU	†	†	†	†	Wang Z. L. et al. (2018)
19	25	30	MOSAIC (4 bins)	GOCART	MYJ	FNL	†	†	†	Yang et al. (2018)
20	20	30	MOSAIC	CMBZ	YSU	FNL	†	MEIC	MEGAN	Zhou et al. (2018)
21	81, 27	†	MOSAIC(8 bins)	CBMZ	YSU	ECMWF	†	2010 MIX	MEGAN/Dust	Gao et al. (2017c)
22	81, 27, 9, 3	24	MOSAIC(8 bins)	CBMZ	YSU	FNL	†	2012 MEIC	MEGAN/Dust	Li et al. (2017a)
23	81, 27, 9, 3	21	MOSAIC	CBMZ	YSU	†	†	2012 MEIC	MEGAN	Li et al. (2017b)
24	90, 30, 10	33	MOSAIC(8 bins)	CBMZ	YSU	FNL	MOZART	2010 MIX	MEGAN/FINN/Dust/Sea salt	Qiu et al. (2017)
25	27, 9, 3	41	MOSAIC (4 bins)	CBMZ	MYJ	CFSR	MOZART	†	MEGAN/GFED	Yang and Liu (2017a)
26	27, 9, 3	41	MOSAIC (4 bins)	CBMZ	MYJ	CFSR	MOZART	†	MEGAN/GFED	Yang and Liu (2017b)
27	75, 25	25	MOSAIC (4 bins)	†	YSU	†	†	†	†	Yao et al. (2017)
28	81, 27, 9	27	MOSAIC	CBMZ	ACM2	†	†	†	†	Zhan et al. (2017)
29	12	27	GOCART	MOZART	MYJ	†	†	†	†	Feng et al. (2016)
30	81, 27	27	MOSAIC(8 bins)	CBMZ	YSU	FNL	MOZART	MEIC	MEGAN	Gao et al. (2016b)
31	36	23	MADRID(8 bins)	CB05	†	FNL	GEOS-Chem	2006 INTEX-B	†	Liu et al. (2016)
32	20	30	MOSAIC	†	YSU	FNL	†	†	Dust	Liu et al. (2016)
33	13.5, 4.5	48	MADE/SOGARM	RADM2	YSU	†	†	†	†	Miao et al. (2016)
34	36	32	MOSAIC	CBMZ	QNSE	FNL	MOZART	2006 INTEX-B	†	Wang et al. (2016)
35	3	40	MOSAIC	CBMZ	YSU	†	†	†	†	Yang et al. (2016)
36	20	31	MADE/SORGAM	RADM2	†	†	†	†	†	Zhong et al. (2016)
37	12	†	GOCART	MOZART	MYJ	†	†	†	†	Govardhan et al. (2015)
38	50	15	MOSAIC(4 bins)	CBMZ	YSU	FNL	†	2006 INTEX-B	MEGAN/FINN/Dust/Sea salt	Huang et al. (2015)
39	54	27	MOSAIC	CBMZ	YSU	FNL	†	2006 INTEX-B	MEGAN	Chen et al. (2014)

40	36	35	MADE/SOGARM	RADM2	†	FNL	†	2006 INTEX-B	MEGAN/GFED	Gao et al. (2014)
41	81, 27	27	MADE/SOGARM	RADM2	YSU	FNL	†	FLAMBE	†	Ge et al. (2014)
42	30	51	MOZART-4	GOCART	†	FNL	†	†	†	Kumar et al. (2014)
43	60	31	MOSAIC(8 bins)	CBMZ	YSU	†	†	†	†	Li et al. (2014)
44	27	35	MADE/SOGARM	RADM2	MYJ	FNL	†	2006 INTEX-B	FINN/Dust	Lin et al. (2014)
45	27, 9	50	†	†	MYJ	†	†	†	†	Chen et al. (2013)
46	27	50	GOCART	†	BouLac	†	†	†	†	Dipu et al. (2013)
47	45	51	RADE/SOGARM	†	MYJ	†	†	†	†	Kumar et al. (2012a)
48	45	51	RADE/SOGARM	†	MYJ	†	†	†	†	Kumar et al. (2012b)
49	25	19	MOSAIC(8 bins)	CBMZ	†	FNL	†	†	†	Seethala et al. (2011)
50	75	18	†	†	†	FNL	†	†	†	Zhuang et al. (2011)
51	20, 4	41	MOSAIC (4 bins)	CBMZ	YSU	†	†	†	†	Liu et al. (2020)*
52	5	33	MADE/SOGARM	RADM2	QNSE	FNL	†	2006 INTEX-B	†	Jia et al. (2019)
53	20	28, 40, 60	MOSACI	CMBZ	YSU	†	†	†	†	Wang et al. (2019)
54	27	51	MOSACI	CMBZ	YSU	†	†	†	†	Nicholls et al. (2019)
55	25	†	MOSAIC (4 bins)	CBMZ	YSU	FNL	†	2016 MEIC	MEGAN	Li et al. (2019)
56	75, 25	72	MADE/SORGAM	RADM2	YSU	†	†	†	†	Kedia et al. (2019a)
57	50	37	MADE/SORGAM	RADM2	YSU	FNL	†	EDGAR	MEGAN/MODIS_Fire	Kedia et al. (2019b)
58	45	†	MADE/SORGAM	RADM2	YSU	†	†	†	†	Huang et al. (2019)
59	15	26	MOSAIC(4 bins)	MOZART	YSU	†	†	†	†	Ding et al. (2019)
60	27, 9	29	MOSAIC (8 bins)	CBMZ	YSU	FNL	MOZART	MIX	MEGAN/GFED/Dust/Sea salt	Chen et al. (2019b)
61	35	12	†	†	MYJ	†	†	†	†	An et al. (2019)
62	27, 9	28	MADE/SORGAM	RADM2	YSU	†	†	†	†	Liu et al. (2018)
63	27, 9, 3	35	MADE/SOGARM	CB05	YSU	FNL	MOZART	†	MEGAN/FINN/Dust/Sea salt	Liu et al. (2018)
64	36	46	MOSAIC (4 bins)	CBMZ	YSU	FNL	MOZART	MEIC	MEGAN/Dust	Zhang et al. (2018)
65	36, 12	38	MOSAIC	CMBZ	YSU	†	†	†	†	Gao et al. (2018)
66	36	23	MAM3	CBMZ	†	†	†	†	†	Zhang et al. (2017)
67	12	24	MOSAIC (4 bins)	CBMZ	YSU	†	†	†	†	Wu et al. (2017)
68	27, 9, 3	25	MADE/SOGARM	RADM2	YSU	†	†	†	†	Sun et al. (2017)
69	3	50	MADE/SORGAM	RADM2	MYJ	FNL	Quasi-global WRF-Chem simulation	2006 INTEX-B	MEGAN/FINN/Dust/Sea salt	Zhong et al. (2017)
70	81, 27	27	MOSAIC (8 bins)	CBMZ	YSU	FNL	MOZART	2012 MEIC	MEGAN	Gao et al. (2017a)
71	81, 27	†	MOSAIC(8 bins)	CBMZ	YSU	ECMWF	†	2010 MIX	MEGAN/Dust	Gao et al. (2017b)
72	54	27	†	†	†	†	†	†	†	Ma et al. (2017)
73	27, 9	61	†	†	†	†	†	†	†	Lau et al. (2017)
74	20, 9	35	MADE/SOGARM	RADM2	MYJ	†	†	REAS v2/GFED v3.1	Dust/Sea salt	Kajino et al. (2017)
75	15	30	MOSAIC	†	MYJ	FNL	MOZART	2006 INTEX-B	MEGAN	Yang et al. (2017)
76	36	23	MAM3	CBMZ	†	†	†	†	†	He et al. (2017)
77	36, 12, 4	†	†	†	†	†	†	†	†	Campbell et al. (2017)
78	27, 9	30	MADE/SORGAM	RADM2	QNSE	FNL	†	2012 MEIC	†	Zhang et al. (2016)
79	54	30	MOSAIC	CBMZ	YSU	FNL	†	†	†	Ma et al. (2016)
80	36	23	MOSAIC	CBMZ	YSU	†	†	†	†	Zhang et al. (2016a)
81	36	23	MOSAIC	CBMZ	YSU	†	†	†	†	Zhang et al. (2016b)
82	20, 4	31	MOSAIC	CBMZ	YSU	FNL	†	MEIC	MODIS_Fire	Huang et al. (2016)
83	81, 27, 9	36	MOSAIC	CBMZ	MYJ	†	†	†	†	Xie et al. (2016)
84	45, 15, 5, 1.67	27	MOSAIC(4 bins)	CBMZ	YSU	†	†	†	†	Srinivas et al. (2016)
85	25	28	MADE/SOGARM	RADM2	YSU	†	†	†	†	Kedia et al. (2016)
86	54	30	MADE/SOGARM	†	YSU	†	†	†	†	Jin et al. (2016a)

87	54	30	MADE/SOGARM	†	YSU	†	†	†	†	Jin et al. (2016b)
88	81, 27, 9	27	MOSAIC(8 bins)	CBMZ	YSU	FNL	MOZART	MEIC	MEGAN	Gao et al. (2016a)
89	36	35	MADE/SOGARM	RADM2	†	†	†	†	†	Gao et al. (2016)
90	36	25	MOSAIC	CMBZ	YSU	FNL	†	MEIC	MEGAN	Ding et al. (2016)
91	27, 9	42	MADE/SOGARM, MADE/SORGAM_aq, MOSAIC(8 bins) & MADE/SORGAM	RADM2, RADM2, CBMZ & CBMZ	YSU	FNL	†	2010 MEIC	MEGAN/FINN/Dust/Sea salt	Yang et al. (2015)
92	54	28	MADE/SORGAM	RADM2	†	FNL	†	†	MEGAN/FINN/Dust/Sea salt	Shen et al. (2015)
93	36	23	MAM3	CBMZ	UW	FNL	†	REAS v2.1	†	Zhang et al. (2015a)
94	36	23	MAM3	CBMZ	UW	FNL	CMAQ/GEOS-Chem	MEIC/INTEX-B	MEGAN/Dust/Sea salt	Chen et al. (2015)
95	36, 12, 4	35	MADE/SOGARM	RADM2	YSU	FNL	Quasi-global WRF-Chem simulation	2006 INTEX-B	MEGAN/FINN/Dust/Sea salt	Zhong et al. (2015)
96	54	30	MADE/SOGARM	†	YSU	†	†	†	†	Jin et al. (2015)
97	36	†	GOCART	MOZART-4	BouLac	†	†	†	†	Jena et al. (2015)
98	27	51	MOSAIC(8 bins)	CBMZ	†	FNL	MOZART	†	†	Gao Y. et al. (2015)
99	†	40	MOSAIC	CBMZ	†	†	†	2006 INTEX-B	MEGAN/FINN/Dust/Sea salt	Fan et al. (2015)
100	54	27	MOSAIC	CBMZ	YSU	FNL	†	2006 INTEX-B	MEGAN/FINN/Dust/Sea salt	Chen et al. (2015)
101	27	28	MOSAIC	CBMZ	YSU	FNL	MOZART	MEIC	MEGAN	Zhang et al. (2015)
102	36	†	MADE/SOGARM	†	YSU	†	†	†	†	Wu et al. (2013)
103	45, 15, 5, 1.67	27	MOSAIC(4 bins)	CBMZ	YSU	†	†	†	†	Beig et al. (2013)
104	5	33	MOSAIC (4 bins)	CBM-IV	QNSE	†	†	†	†	Jia et al. (2012)
105	†	27	MADRID	CB05	YSU	†	†	†	†	Zhang et al. (2012)
106	36	35	MADE/SOGARM	RADM2	MYJ	†	†	†	†	Gao et al. (2012)
107	27, 9, 3	28	MOSAIC (4 bins)	CBMZ	YSU	FNL	†	2016 MIX	†	Bai et al. (2020)*
108	81, 27, 9, 3	24	MOSAIC	CBMZ	MYJ	†	†	†	†	Liu et al. (2019)
109	36, 12, 4	23	MAM3	CBMZ	UW	†	†	†	†	Wang K. et al. (2018)
110	27, 9	40	GOCART	†	MYJ	†	†	†	†	Su et al. (2018a)
111	27, 9	40	GOCART	†	MYJ	†	†	†	†	Su et al. (2018b)
112	27	15	MADE/SOGARM	RACM	YSU	FNL	MOZART	2015 MAPS-Seoul campaign emission	MEGAN	Park et al. (2018)
113	36	35	MOSAIC	CBMZ	†	†	†	†	†	Gao and Zhang (2018)
114	18, 6	45	MADE/SOGARM	RADM2	YSU	FNL	†	2006 INTEX-B	MEGAN	Shen et al. (2017)
115	36	24	MOSAIC	CBMZ	YSU	FNL	Default profile	2010 MIX	MEGAN/Dust	Zhao et al. (2017)
116	4.5	†	†	†	†	†	†	†	†	Bhattacharya et al. (2017)
117	36, 12, 4	31	MADE/SOGARM	RADM2	YSU	†	†	†	†	Jiang et al. (2016)
118	36	23	MAM3	CBMZ	UW	FNL	†	†	†	Zhang et al. (2015b)
119	27, 9, 3	34	MOSAIC(4 bins)	CBMZ	MYJ	FNL	†	†	†	Sarangi et al. (2015)
120	36	23	†	†	†	†	†	†	†	Zhang et al. (2014)
121	36	45	MAM3	†	YSU	†	†	†	†	Lin et al. (2014)
122	†	†	†	†	†	†	†	†	†	Bennartz et al. (2011)
123	20	†	MOSAIC	CBMZ	†	FNL	AM3	2008 MEIC/REAS/EDGAR v4.2	MEGAN/FINN	Zhong et al. (2019)
124	30	27	MOSAIC (4 bins)	MOZART-4 using KPP	MYNN2	FNL	MOZART	†	Dust	Conibear et al. (2018a)
125	30	27	MOSAIC (4 bins)	MOZART-4 using KPP	MYNN2	FNL	MOZART	†	Dust	Conibear et al. (2018b)
126	36	†	GOCART	MOZART-4	BouLac	†	†	†	†	Ghude et al. (2016)
127	81, 27, 9	†	MOSAIC(8 bins)	CBMZ	†	FNL	MOZART	2010 MEIC	MEGAN	Gao M. et al. (2015)
128	36	34	AERO6	CB05	†	†	†	†	†	Dong et al. (2019)
129	27	†	AERO6	CB05	ACM2	FNL	Default profile	†	†	Jung et al. (2019)
130	45	30	AERO6	CB05	ACM2	FNL	MOZART	JEI-DB/INTEX-B	MEGAN/FINN	Nguyen et al. (2019a)

131	72, 24	30	AERO6	CB05	ACM2	FNL	†	HTAP v2/MEIC v1.2	†	Nguyen et al. (2019b)
132	12	30	AERO6	CB05	ACM2	FNL	†	MEIC	†	Yoo et al. (2019)
133	45	30	AERO6	CB05	ACM2	FNL	MOZART	JEI-DB/INTEX-B	MEGAN/FINN	Sekiguchi et al. (2018)
134	36	23	AERO6	CB05	ACM2	FNL	CESM	2008 MIX	BEIS3/Dust	Hong et al. (2017)
135	36	23	AERO6	CB05	ACM2	FNL	†	MEIC	†	Xing et al. (2017)
136	108	44	AERO6	CB05	ACM2	FNL	†	EDGAR	†	Xing et al. (2016)
137	108	44	AERO6	CB05	ACM2	FNL	†	EDGAR	†	Xing et al. (2015a)
138	108	44	AERO6	CB05	ACM2	FNL	†	†	†	Xing et al. (2015b)
139	108	44	AERO6	CB05	ACM2	FNL	†	EDGAR	MEGAN/Dust/Sea salt	Xing et al. (2015c)
140	36	44	AERO6	CB05	ACM2	FNL	†	†	†	Wang et al. (2014)
141	12, 4	29	AERO6	CB05	ACM2	FNL	CESM	2008 MIX	BEIS3/Dust	Chang et al. (2018)
142	36	23	AERO6	CB05	ACM2	FNL	CESM	2008 MIX	BEIS3/Dust	Hong et al. (2019)
143	108	44	AERO6	CB05	ACM2	†	†	†	†	Wang et al. (2017)
144	†	†	CUACE	RADM2	MRF	†	†	†	†	Wang H. et al. (2018)
145	†	†	CUACE	RADM2	†	†	†	†	†	Wang et al. (2015)
146	†	†	†	†	†	†	†	†	†	Wang et al. (2013a)
147	†	†	†	†	†	†	†	†	†	Wang et al. (2013b)
148	54	24	CUACE	RADM2	†	†	†	†	†	Zhou et al. (2012)
149	†	†	†	†	†	†	†	†	†	Wang et al. (2010)
150	†	†	†	†	†	†	†	†	†	Zhou et al. (2016)
151	45	20	†	CMBZ	†	†	†	†	†	Li J. et al. (2018)
152	45, 15, 5	28	†	CBMZ	MYJ	†	MOZART	REAS v2.1	†	Wang et al. (2014)
153	80, 20	20	†	CBMZ	MYJ	†	MOZART	REAS v2.1	GEIA	Wang et al. (2014)
154	†	†	†	GATOR	GATOR	†	†	†	†	Ten et al. (2012)
155	†	†	†	GATOR	GATOR	†	†	†	†	Jacobson et al. (2019)
156	†	†	†	GATOR	GATOR	†	†	†	†	Jacobson et al. (2015)
157	†	†	†	†	†	†	†	†	†	Chen et al. (2019a)
158	†	†	†	†	†	†	†	†	†	Li et al. (2019)
159	†	†	†	†	†	†	†	†	†	Gao et al. (2018a)
160	†	†	†	†	†	†	†	†	†	Govardhan et al. (2016)

*†: Unclear; *: A preprint version of this study was available online on October 31, 2019, and was formally published on January 1, 2020.*

The following paragraph is added into the newly added Section 3.3 of the revised manuscript.

"Not only the choice of methodologies for ARI and ACI calculations can impact simulation results, but also the various aspects regarding the setup of modeling studies by applying two-way coupled models. The extra/auxiliary information about model configuration, including horizontal and vertical resolutions, aerosol and gas phase chemical mechanisms, PBL schemes, meteorological and chemical initial conditions (ICs) and boundary conditions (BCs), anthropogenic and natural emissions, were extracted from the 160 papers and presented in Table S4 in Supplement, which is organized in the same order as Table 1.

For two-way coupled model applications in Asia, horizontal resolutions were from a few to a hundred kilometers, sometimes with nests, and vertical resolutions from 15 to about 50-70 levels, with one study performed at 100 levels for studying a fog case (Wang Z. L. et al., 2018). Wang K. et al. (2018) evaluated the impacts of horizontal resolutions on simulation results and found out surface meteorological variables were better modeled at finer resolution but no significant improvements of ACI related meteorological variables and certain chemical species between different grid *resolutions. Through applying a single column model and then WRF-Chem with ARI, Wang et al. (2019) unraveled that better representation of PBL structure and relevant variables with finer vertical resolution from the surface to PBL top could reduce model biases noticeably, but balancing between vertical resolution and computational resource was important as well. Among the 160 applications of two-way coupled models in Asia, the frequently used aerosol module and gas-phase chemistry mechanism in WRF-CMAQ (WRF-Chem) were AERO6 (MOSAIC and MADE/SOGARM) and CB05 (CBMZ and RADM2), respectively. For PBL schemes, most studies selected YSU in WRF-Chem and ACM2 in WRF-CMAQ. Regarding to meteorological ICs and BCs, the FNL data were the first choice, and outputs from the Model for Ozone and Related Chemical Tracer (MOZART) were used to generate chemical ICs and BCs by most researchers. Georgiou et al. (2018) also unraveled that boundary conditions of dust and* O_3 *played an important role in WRF-Chem simulations. The modeling applications in Asia utilized global (EDGAR), regional (e.g., MIX, INTEX-B, and REAS), and national (e.g., MEIC and JEI-DB) anthropogenic emission inventories. Natural emission sources, such as mineral dust (Shao, 2004), biomass burning (FINN (Wiedinmyer et al., 2011) and GFED (Guido et al., 2010)), biogenic VOCs (MEGAN (Guenther et al., 2006)), and sea salt (Gong et al., 1997) were also considered. It should be noted that only one paper by Gao et al. (2017) reported that the WRF-Chem model with the Gridpoint Statistical Interpolation (GSI) data assimilation could improve the simulation accuracy during a wintertime pollution period."*

Since no study assessing the accuracies of different methodologies in terms of ARI and ACI calculations in two-way coupled models has been conducted in Asia, we added a sentence "*Special attention needs to be paid to assess the accuracies of different methodologies in terms of ARI and ACI calculations in two-way coupled models in Asia and other regions.*" in the Conclusion section of the revised manuscript.

Specific Comments:

(1) Lines 103-108: This sentence is confusing. Are those names of 5 models in the parentheses?

Response: The names in the parentheses are the 5 models reviewed by Zhang (2008). To make the sentence more readable, we deleted the parentheses in this sentence. Now the sentence is "*Zhang (2008) overviewed the developments and applications of five coupled models in the United States (US) and the treatments of chemical and physical processes in these coupled models with emphasis on the ACI related processes.*".

(2) Lines 145-146: This is misleading. While the current versions of WRF is 4.3 and CMAQ 5.3.2, these were not the version used by Wong et al 2012. Those were WRFv3.0 and CMAQv4.7.1.

Response: We deleted the reference and the sentence is revised to "*Different from current released version of WRF-CMAQ model (based on WRF version 4.3 and CMAQ version 5.3.3) that only includes ARI, WRF-Chem with ACI (starting from WRF-Chem version 3.0, Chapman et al., 2009) has been implemented for analyzing the complicated aerosol effects that lead to variations of cloud properties, precipitations and PM2.5 concentrations (Bai et al., 2020; Liu Z. et al., 2018; Park et al., 2018; Zhao et al., 2017).*".

(3) Lines 410-413: I don't understand this sentence. What is accounting for 80% of what? Please clarify.

Response: We rewrote the sentence in Lines 410-413 as follows:

"*Besides the ARI effects of dust, 80 % of the net reductions of O_3, NO_2, NO_3, N_2O_5, HNO_3, ·OH, HO_2· and H_2O_2 were attributed to the heterogeneous chemistry on dust particles' surface added in WRF-Chem when a springtime dust storm striking the Nanjing megacity of EC (Li M. M. et al., 2017a).*"

(4) Lines 428-432: This sentence is too long and complicated to follow. For example, "enhanced (reduced) radiative forcing at the TOA". The bit in parentheses generally refers to the opposite effect on something. What that something is, is not clear here. Is it reduced atmospheric stability and all the things in the parentheses?
Response: We deleted all the parentheses and now the sentence is "*In the Maritime SEA region, peat and forest fire triggered by El Niño induced drought conditions released huge amount of smoke particles, which promoted dire air pollution problems in the downstream areas, and their ARI effects simulated by WRF-Chem enhanced radiative forcing at the TOA and the atmospheric stability (Ge et al., 2014).*"

(5) Lines 493-496: this sentence does not make sense.
Response: This sentence has now been re-written as follows:
"*As the most important absorbing aerosol, BC induced the largest positive, positive and negative mean DRF at the TOA, in the ATM, and at the surface, respectively, over China during 2006 (Huang et al., 2015).*"

(6) Line 498: "prohibited" is not the right word. Suppressed might be better.
Response: Thanks for the suggestion and "prohibited" is replaced by "suppressed". Now the sentence is "*Ding et al. (2016) and Wang Z. et al. (2018) further applied WRF-Chem with feedbacks to investigate how aerosol-PBL interactions involving BC suppressed the PBL development, which deteriorated air quality in Chinese cities and was described as "dome effect" (namely BC warms the atmosphere and cools the surface, suppresses the PBL development and eventually results in more accumulation of pollutants).*"

(7) Line 545: CA is use here as carbonaceous aerosols and further back as central Asia.
Response: Now we use "CAs" as the abbreviation for carbonaceous aerosols and keep CA for central Asia throughout the revised manuscript.

(8) Line 617-621: This sentence seems self-contradictory. Please clarify.
Response: This sentence is modified to "*With the process analysis methodology in WRF-Chem, Gao J. et al. (2018) indicated that comparing to simulations without BC, the BC and PBL interaction slowed the O_3 growth from late morning to early afternoon somewhat before O_3 reaching its maximum value at noon due to less vertical mixing in PBL.*"

(9) Line 639: Pool should be Poor.
Response: We have fixed the typo and now the sentence is "*Poor air quality posts risks to human health (Brunekreef and Holgate, 2002; Manisalidis et al., 2020), therefore, in the past several decades, air quality models had been used in epidemiology related research to establish quantitative relationships between concentrations of various pollutants and burden of disease (including mortality or/and morbidity) as well as associated economic loss (Conti et al., 2017).*"

(10) Line 684-686: This sentence is badly worded.
Response: We rewrote this sentence as "*This section provides a summary of model performance by presenting the SI of meteorology and air quality variables as shown in Table S2. These SI were collected from the selected papers that supplying these indices and being defined as papers with SI (PSI) (listed in Tables B2-B3 of Appendix B).*"

(11) Figure 3: Why are there so many more samples for PSI than for ARI and no-ARI?
Response: Samples for PSI included all the relevant statistical indices we found from the selected papers, which could include the evaluations of model simulations with ARI or/and ACI. But the sample size for statistical analysis of model simulations with ARI and without ARI were limited, due to many papers did not report their results differentiating between with and without ARI.

(12) Lines 734-735: It seems from Figure 3 that RH2 has 2 but the SH2 has 6 not 1 PSI with ARI/no-ARI.
Response: In the original manuscript, we deleted the sentence "It should be noted that only 2 or 1 PSI supplying statistical analysis of modeled RH2 and SH2 with/without ARI effects may not be enough to make these comparisons statistically significant and further investigations are much needed." in Lines 734-735 and also deleted "very" in Line 738 to reflect the limited numbers of PSI supplying statistical analysis of modeled RH2 and SH2 with/without ARI effects. Now, it is revised as "*Overall, the modeled RH2 and SH2 were in good agreement with observations with slight over- and under-estimations, respectively, and the limited studies showed that RH2 and SH2 simulated by models with ARI turned on had marginally larger positive biases relative to the results without ARI.*"

(13) Line 742: should be that rather than the
Response: The sentence is modified as "*The meta-analysis also indicated that the most modeled WS10 tended to be overestimated (81 % of the samples) with the average MB value of 0.79 $m \cdot s^{-1}$, and the mean RMSE value was 2.76 $m \cdot s^{-1}$.*"

(14) Line 747: Figure 3 say 9 and 10 PSI with ARI/no-ARI, not 5.
Response: The sentence now reads as "*The PSI with ARI effects suggested that the correlation of wind speed was slightly improved (mean R from 0.56 to 0.57) and the average RMSE and positive MB decreased by 0.003 $m \cdot s^{-1}$ and 0.051 $m \cdot s^{-1}$, respectively (Fig. 3h).*"

(15) Section 5.1.2: I think this analysis needs more explanation. Were these different studies of different lengths where the PSI were grouped according temporal scale? Is daily scale, PSI simulations that only lasted one day? I don't see the significance of this analysis.
Response: The model simulations and statistical indices from the PSI were on different time scales so that we did the meta-analysis and grouped SI according to annual, seasonal, monthly, and daily scales. Even though some model simulations lasted more than one day, we classified the statistical indices as daily scale as long as they were reported daily from the relevant PSI. As mentioned before, we move Section 5.1.2 and Section 5.2.2 to Appendix C of the revised manuscript to improve the paper's readability, but intend to provide more detailed information about the model performances at different temporal scales.

(16) Section 5.1.3: This section is also of questionable value. The meteorological performance of these models is more related to the physics options, FDDA, initial and boundary conditions, resolution, domain, time period, etc, of the WRF setup than whether it is WRF-Chem or WRF-CMAQ. The meteorology performance is due to WRF not Chem or CMAQ parts.
Response: We agree that many factors can affect meteorological performance of two-way coupled models and add Table S4 in Supplement and Section 3.3 to summarize the limited evaluations towards the effects of different aspects of model setup on model performance. However, inter-comparisons of different models are extremely valuable even though many aspects of model setup are not the same, which is demonstrated in the coordinated studies such as AQMEII and MICS-Asia and also in the last paragraph of Section 3.1 (Lines 273-280 in the revised manuscript). Figure 3 (e-h) indicates surface meteorological variables can be affected by aerosol feedbacks and Section 5.1.3 of original manuscript (now it is Section 5.1.2 in the revised manuscript) serves as a critical part of our overview and meta-analysis to reveal how turning on aerosol feedbacks impact model performance of meteorological variables in different two-way coupled models.

(17) Line 974: When reporting daily results are these day and night together?
Response: When PSI presented daily SI, we categorized them as "daily" that should include results during day and night together. On the other hand, hourly results reported by PSI during day or night time were put into the "hourly" category.

(18) Lines 1018-1020: This sentence is unclear. Which effect increased (decreased)?
Response: This sentence is revised as "*Under the high emission levels as well as at slightly different humidity levels of RH > 85 % with increasing emissions, the ACI effects of anthropogenic aerosols induced precipitation increase in the MRYR area of China. Over the same area, precipitation decreased due to the ACI effects of anthropogenic aerosols with the low emission levels and RH < 80 %.*"

(19) Lines 1020-1022: Again, doesn't make sense. Trying to say too much in single sentences.
Response: We rewrite this sentence as "*In PRD, wintertime precipitation was enhanced by the ACI effects of anthropogenic aerosols but inhibited by ARI. In SK, summertime precipitation was both enhanced and inhabited by the ACI and ARI effects of anthropogenic aerosols.*"

(20) Lines 1056: what increase (decrease)?
Response: The whole sentence is revised as "*Simulation results showed that turning on aerosol feedbacks in coupled models generally made $PM_{2.5}$ concentrations increased in different regions of Asia at various time scales, which stemmed from decrease of shortwave radiation, T2, WS10 and PBLH and increase of RH2.*"

(21) Lines 1079-1081: Way too many parentheses constructs. Can't follow.
Response: We rewrite this sentence as "*The seasonal SO_2 reduction was rather large, which related to higher PBLH induced by the ACI effects of dust aerosols in the NCP area of EA (Wang K. et al., 2018). The slight increase of seasonal SO_2 was reported in the whole domain of EA due to lower PBLH caused by ARI effects of anthropogenic aerosols (Nguyen et al., 2019b).*"

(22) Line 1108: severe rather than server?
Response: The typo is corrected.