Dear Author,

I have the following comments at this stage of the review:

- you will find the second round of reviews from both reviewers on the GMD webpage. Please address their new comments carefully in your response
- reviewer 1 recommends accepting the manuscript as is. However, based on the comments provided, which I have repeated just below, I believe the manuscript should be accepted pending minor revisions.

  " I just have a minor technical corrections: in Figures 3, 6, 9, 10, 11, 12 the visibility of the color bar should be improved and the captions corrected (write the charge as a superscript). As for figures 2, 5 and 8, the legends can be enlarged to make them more visible."

- please note that I agree with the following reviewer 2 comment:

  "As you are not using the "real" CY49R1, but modified version of CY48R1, I would recommand to delete all reference to CY49R1 expect from the fact that the presented modifications are meant to enter in the latter."

  And I find your response to be insufficiently convincing. Several changes to the text should be made in your article to clarify things:

  - regarding the title of your article: Even though S. Remy used the terms 'ECMWF IFS-COMPO 49R1' in the title of his 2024 GMD publication, the title of your article should be modified to improve clarity. I have the following suggestion, though you may have another one:

    "An evaluation of the regional distribution and wet deposition of secondary inorganic aerosols and their gaseous precursors in IFS-COMPO preparatory to cycle 49R1"

  - the following renaming of the simulations should be applied throughout your article, as suggested below:

    Cy48r1 : unchanged

    Cy49r1: Cy49r1compo

    Cy49r1_NOE4C: Cy49r1compo_NOE4C

  - in the abstract: change " The application of the EQSAM4Clim simplified thermodynamic module in IFS-COMPO cycle 49R1" into " The implementation of the EQSAM4Clim simplified thermodynamic module in IFS-COMPO, for use in cycle 49R1"

  - In Section 2, the introductory paragraph has been revised in the updated version of your article, partly reflecting the fact that cycle 49r1 is now operational. However, the text still contains some unclear sections. I recommend rewriting it, particularly to avoid conflating the description of the IFS-COMPO system with that of the specific simulations you performed. Also, Rémy et al., 2022 and Williams et al., 2022 analyse Cy47r1. I therefore have the following proposal presented below:

    "The IFS-COMPO global composition model (previously known as C-IFS) is used for operational air quality analyses and forecasts as part of CAMS. The modelling and data assimilation framework is regularly updated. During 2023, IFS-COMPO was based on the Cy48r1 version of IFS (see https://www.ecmwf.int/en/elibrary/81374-ifs-documentation-cy48r1-part-viii-atmospheric-composition; last access: 20 February 2024). Since the end of 2024, IFS-COMPO has moved to Cy49r1. IFS-COMPO Cy49r1 has been shown to reduce the biases previously identified in key products such as O_3 and NO_2 (Huijnen et al., 2016; Huijnen et al., 2019; Williams et al., 2022; https://atmosphere.copernicus.eu/eqa-reports-global-services; last access: 17 February 2025). Several updates were introduced in Cy49r1 to improve the aerosol component, the wet deposition scheme, and the representation of pH in clouds and aerosols. These include the application of the EQSAM4Clim approach and other cloud scavenging-related developments (Metzger et al., 2016; Metzger et al., 2024; Rémy et al., 2024).

For brevity, we provide only a brief description below of the updates in Cy49r1 relevant to this study. Further details are available in Rémy et al. (2024), which also includes a schematic representation of the model component interactions, and in Metzger et al. (2024) for the EQSAM4Clim thermodynamic module. The full documentation of IFS Cy49r1 is available at https://www.ecmwf.int/en/publications/ifs-documentation, lass access 23 July 2025."

- line 150: change "Updates in IFS-COMPO Cy49r1" into "IFS-COMPO Cy49r1 updates of interest for this study"

- other remarks:
  - is it correct that you present results for 2018, while Remy et al. 2024 present results for 2019?
  - you indicate that in your simulations meteorology is "initialised every 24 hours based on ERA5 reanalysis data". Is it the same protocol in Remy et al. 2024?
  - what is the reference for the climatology of DMS emissions you used?
  - please detail how biomass burning emissions and SO2 emissions are applied
  - two additional remarks/questions about your simulations: please indicate whether meteorology can differ across simulations, depending on whether aerosol–radiation interactions are activated or not. And what about the gazeous chemistry scheme, is it identical across all your simulations?
  - line 18 : please write in full "IFS"
  - line 29: I propose to change: "There is also a shift in the size of particles towards the fine mode nitrate away from the coarse mode. " into "There is also a shift in particle size distribution, with nitrate moving from the coarse mode toward the fine mode."
  - line 52: change "The SIA occurs" into "Secondary inorganic aerosols (SIA) are found throughout the troposphere."
  - line 53: change "and the concentrations" into "and concentrations"
  - line 54: no capital letter to sulphur dioxide, ammonia, nitric acid, particulate matter . And add a "," before ammnonia
  - line 55: please refer to the exact definitions of PMP1.0, etc... particles smaller than ...
  - line 62: in the form "OF" NO...
  - line 63: no capital letter to sulphur and nitrogen
  - line 65: change " SIA being from NH4NO3" in " SIA consists of NH4NO3"
  - line 129 : change "Model description of IFS-COMPO versions" into "General information on the most recent IFS-COMPO versions"
  - line 66: please reformulate 'increased meteorological instability'
  - line 67: do you mean: 'reducing the potential for long-range transport out of the source regions"?
  - line 68: most SIA: consider it as singular
  - line 68: "At high RH values": please specify a threshold
  - line 70: change "the optical properties" into "its optical properties"
  - line 71: change ' and interactions' into 'and its interactions"
  - line 73: change "-1" into "1"
  - line 83: change 'whose cumulative oxidation rate is dependent on the prescribed pH in solution' into 'whose overall oxidation rate varies according to the specified pH of the solution."
  - line 85: "for the determination of trends": please be more precise
  - line 89: change 'solution pH' into 'the pH of the solution'

- line 93: please reformulate to clarify the sentence: 'The more buffering of solution by NH3, the faster the conversion rate as dictated by the reaction of HSO3- being less than that for SO3 = '
- line 95: please change 'One dominant loss term for SIA is wet deposition in precipitation to the surface ' into 'SIA is primarily removed from the atmosphere through wet deposition, as it is scavenged by precipitation and transported to the surface'
- line 101: please precise what you mean by 'the distribution of the cloud liquid water content' and by the 'cloud Surface Area Density, SAD'
- line 104: please move the reference Peuch et al 2022 after "CAMS". Similarly, William et al 2022 does not refer to IFS-COMPO. Please reformulate.
- line 110: change "is the reduction of biases and increase in correlation for aerosol products" into 'was the reduction of biases and increase in correlation of aerosol products with observations'
- line 111: please reformulate : 'In that, acidic deposition and N-loading can also be output from the model means such that improving the deposition term via an improved distribution in PM will foster the development of this IFS-COMPO future product. '
- line 114: please reformulate the first sentence of the paragraph, with shorter sentences. Please specify now that you assess the performance of both IFS-COMPO Cy48r1 and an evolution of this version with updates that will be part of Cy49r1.
- line 118: please change ' This work is complementary to the recent evaluation of the performance of IFS-COMPO Cy48r1 and Cy49r1 and of the impact of using EQSAM4Clim with respect to regional PM2.5 distributions and Aerosol Optical Depth presented in Rémy et al (2024). into 'This work is both parallel and complementary to the recent assessment of global and regional PM2.5 and Aerosol Optical Depth (AOD) distributions presented in Rémy et al (2024).
- line 121: please clarify what you mean by 'upgrades to EQSAM4Clim'
- line 124 "we provide details of the changes": which changes are you referring to?
- line 125: please rewrite: 'in Sect. 5, we compare annual mean wet deposition fluxes over Europe, the U.S., and Southeast Asia using model outputs and observations...'
- line 154: no capital letters for "desert dust" and "sea-salt"
- line 156: change "has also" to "have also", "which improves" into "which improve"
- ...

- I will stop here with my suggestions for textual revisions. I note that in general the readability of the article could be greatly improved by enhancing the fluency of the English. Numerous tools are available for this purpose... Thank you for making all efforts in that direction. For some parts of the text, please rely on the formulations used by Remy, GMD 2024, which appear very clear.

  I do hope that the next version of the manuscript will be easy to read, yet include all the necessary details that contribute to the quality of a scientific article. Moreover, it will reflect the second round of comments from the reviewers, along with my own remarks. I will then reread the entire article for any final suggestions.

  Regards, Martine Michou