Scenario Clarifications/ Errata

Updated 04.03.2024

Epi Use Case

1) S1
    i. Q1: One of the models is a combination of compartmental + statistical components. Just extract the compartmental part.
    ii. Q7: don't assume this is related to a specific Covid wave in the human population
2) S2
    i. You may assume that since this time period is around the beginning of the time the Omicron was active and spreading across the world, almost everybody was susceptible to it, even if they had been previously infected in an earlier Covid wave, and recovered. Therefore, you may assume R(0) is a very small number ≈ 0.
    ii. For forecasting questions: Note on ForecastHub model data provided in supplementary – the 'actual' values in those datasets are incident deaths, infections, and hospitalizations, over the course of each week being forecast.
    iii. Question 2c – note that models from the ForecastHub have made multiple forecasts for a given date, so they will have a range of error data points. You can just plot your model's error against that range. Also note that the SuEIR model doesn't appear to have forecasts for the first part of the test period, so you can just compare against the BPagano model errors.
    iv. Question 3b – This question will be broken down into two parts: one mandatory and one optional
        1. Mandatory: Train your ensemble on data from December and forecast for the first four weeks of January. (Then compare the forecasts and the errors as specified in c and d)
        2. Optional (only to be done after all other questions are answered): Take a moving window approach where
            a. Train on December and test on first 4 weeks of January
            b. Train on last 3 weeks of December and first week of January and test on the following 4 weeks
            c. Train on last 2 weeks of December first 2 weeks of January and test on the following 4 weeks… etc.
    v. Question 8: Correct expression should be $(1 - test\_access * test\_dec\_transmission)$

3) S3

   i. There was a typo in the equations. Here are the correct equations.

$$\frac{dS_i}{dt} = -\beta * \frac{S_i}{N} * (1 - m_{ew} * m_{cw}) * \sum_{j=1} M_{ijw} * I_j$$

$$\frac{dE_i}{dt} = \beta * \frac{S_i}{N} * (1 - m_{ew} * m_{cw}) * \left(\sum_{j=1} M_{ijw} * I_j \right) - r_{E \to I} * E_i$$

$$\frac{dI_i}{dt} = r_{E \to I} * E_i - r_{I \to R} * I_i$$

$$\frac{dR_i}{dt} = r_{I \to R} * I_i$$

   ii. For Scenario 3, there are two approaches you can take beginning with Q2, Model Calibration:
      1. Deterministic approach: Follow the instructions in both bullet points (in the main scenario doc) and complete questions 3, 4, 5, and 6 as asked.
      2. Probabilistic approach: Complete only the second bullet (in the main scenario doc) in the Model Calibration approach. Average all runs together and put a prior on β to get a posterior distribution as the output. Then, complete questions 5 and 6 using that posterior distribution (so you do not need to fit a distribution in Q5a.)

   iii. For Q5, change the first masking intervention to start at t = 10 to make the question more solvable.

Climate Use Case

1) S1

   i. For the landing distance equation, instead of Eq. 1 stated in the scenario, please use the following equations:

$S_L = S_A + S_B$	• S_L = landing distance [m] • S_A = prior to braking distance [m] • S_B = after braking distance [m]
$\mu_{rolling} = 0.02$ $\mu_b = 0.5$	• *Coefficients of Friction (dimensionless)* • *Note when each coefficient is to be used* • $\mu_{rolling}$: *use in the calculations for prior to braking distance* • μ_b: *use in the calculations for after braking distance*
Ground Drag Coefficient $C_{D_g} = \frac{2T_{ac}}{\rho(1.3V_s)^2 S_{ref}}$ **Note:** V_s is given with respect to certain atmospheric conditions (STP, where ρ=1.225). As such the drag coefficient for the Boeing 747 aircraft can be treated as a constant (**0.070138138**) for the calculation. The constant values for other aircraft would be different, and you can calculate it with the above equation under STP conditions.	• ρ = air density [kg/m^3] = 1.225 • S_{ref} = wing reference area [m^2]; use the value for Boeing 747-8F (511 m^2) • T_{ac} = aircraft thrust [N]. Since landing is being considered in this scenario, the aircraft thrust will be small in comparison to thrust needed for cruise speed at altitude. As a default, use the value for the Boeing 747-8F (13,000 lbf = 59,185 Newtons) • V_s = stall velocity [m/s]; as a default use the value for Boeing 747-8F (101 mph)
Ground Lift Coefficient $C_{L_g} = \frac{2W_L}{\rho(1.3V_s)^2 S_{ref}}$ **Note:** V_s is given with respect to certain atmospheric conditions (STP, where ρ=1.225). As such the lift coefficient for the Boeing 747 aircraft can be treated as a constant (**0.391071817**) for the calculation. The constant values for other aircraft would be different, and you can calculate it with the above equation under STP conditions.	• W_L = landing weight [kg]; as a default use the value for Boeing 747-8 (weight = 330,000 kg) • ρ = air density [kg/m^3] = 1.225 • S_{ref} = wing reference area [m^2]; use the value for Boeing 747-8F (511 m^2) • V_s = stall velocity [m/s]; as a default use the value for Boeing 747-8F (101 mph)
Variable **A** $A = -g\mu$	• g = gravitational acceleration = 9.80665 [m/sec^2] • *Note the correct coefficient to be used*
Variable **B** $B = \frac{g}{W_L}\left[\frac{1}{2}\rho S_{ref}(C_{D_g} - \mu C_{L_g})\right]$	• *Note the correct coefficient to be used* • ρ = air density [kg/m^3] • S_{ref} = wing reference area [m^2]; use the value for Boeing 747-8F (511 m^2) • g = gravitational acceleration = 9.80665 [m/sec^2]

	• W_L = landing weight [kg]; as a default use the value for Boeing 747-8 (weight = 330,000 kg)
Distance Before Braking: $$S_A = \frac{1}{2B}\ln\left[\frac{A - B(1.3V_s)^2}{A - B(1.04V_s)^2}\right]$$	• For the before braking distance, we need to calculate the variables A and B. Remember to use the correct friction coefficient ($\mu_{rolling}$) in the calculations for A and B. • V_s = stall velocity [m/s]; as a default use the value for Boeing 747-8F (101 mph)
Distance After Braking: $$S_B = \frac{1}{2B}\ln\left[\frac{A - B(1.04V_s)^2}{A}\right]$$	• For the after braking distance, we need to recalculate the variables A and B. Remember to use the correct friction coefficient (μ_b) in the calculations for A and B. • V_s = stall velocity [m/s]; as a default use the value for Boeing 747-8F (101 mph)

In addition, for Question 6, we are adding a second part, Q6b:

"In this scenario, we used various simplifications for the equations relating to landing distance as described in various textbooks (with simplified assumptions). Compare your plots against the plots in Zhu et al (2016) (https://www.worldscientific.com/doi/10.1142/S2010194516601745), where the equations for calculating landing distance are much more involved. How do your plots compare, and what are the implications of using the simplified equations for this scenario?"

ii. In Barometric Law (Equation 8 in original scenario doc), let Hb = 0m
iii. For Q5b, ignore the bullet on "Assume ISA standard conditions…" ~~For each location, start with altitude H, and the temperature T from the climate model outputs, and calculate the rest using the equations given.~~ Explanation was sent via Teams to Workbench and Baseline modelers, and by email on Friday, Mach 29th.
iv. For Table 2, C-5 Wing Area should be 576.1 m^2
v. For Table 2, the 'Per Engine Thrust' should be changed to total thrust for the aircraft

2) S2
   i. Use this data set for Greenland ice thickness: https://nsidc.org/data/idbmg4/versions/5
   ii. For anything in the scenario stating "2019" use data from "1993" instead (first year of above dataset)
3) S3
   i. See https://github.com/fund-model/MimiFUND.jl/blob/master/examples/main.jl for boilerplate code for running model