

Practical Exercise

Activity Overview

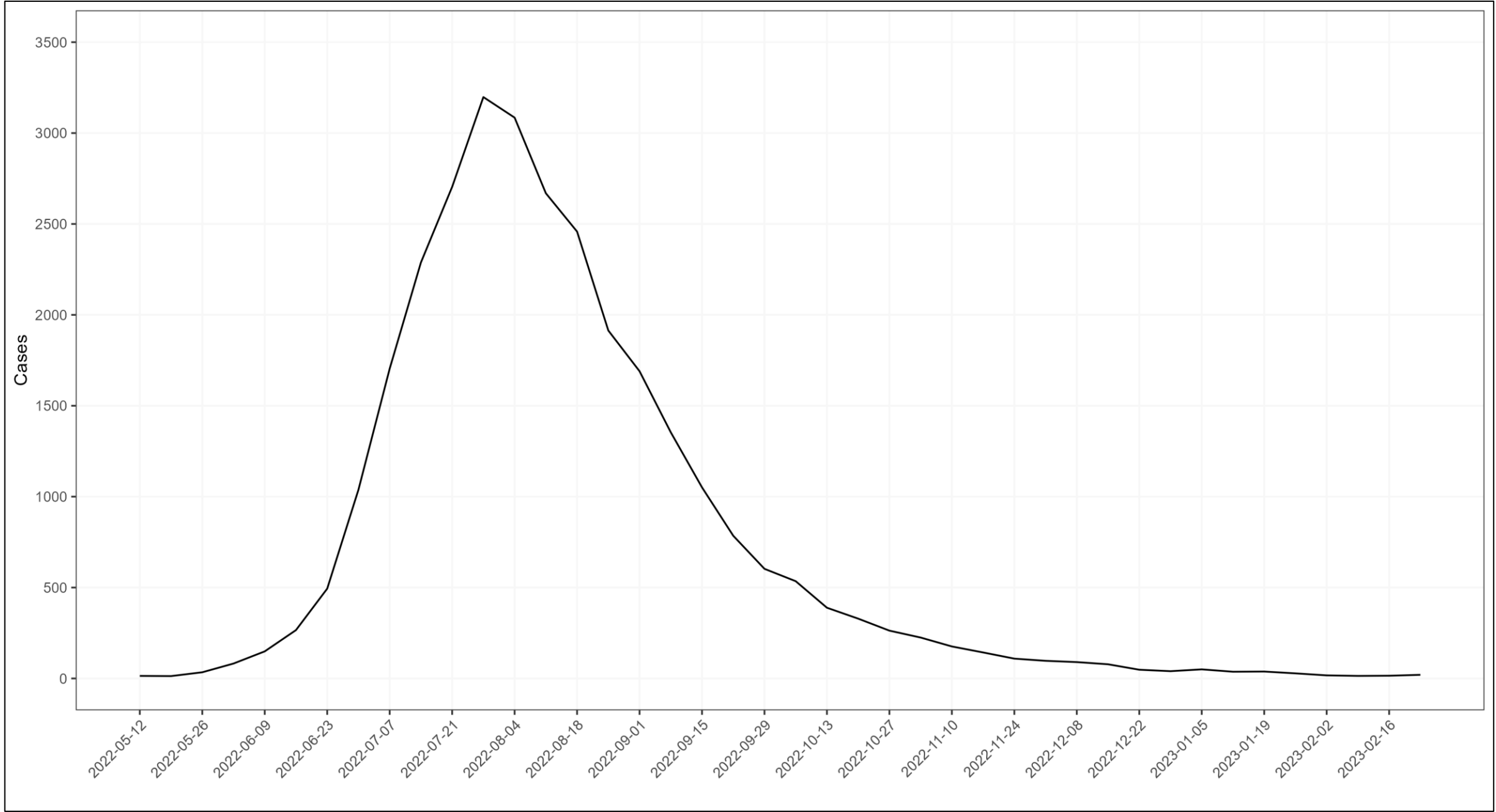
- This exercise involves editing MATLAB code, running the code, and comparing the fit and forecasting performance of a standard SEIR model against other phenomenological growth models (i.e., generalized growth model) using data from the first wave of the mpox in the United States.
- This exercise will provide:
 - (1) Hands-on experience with the *QuantDiffForecast* toolbox
 - (2) Practice with the methods discussed throughout today's lectures.

Goal

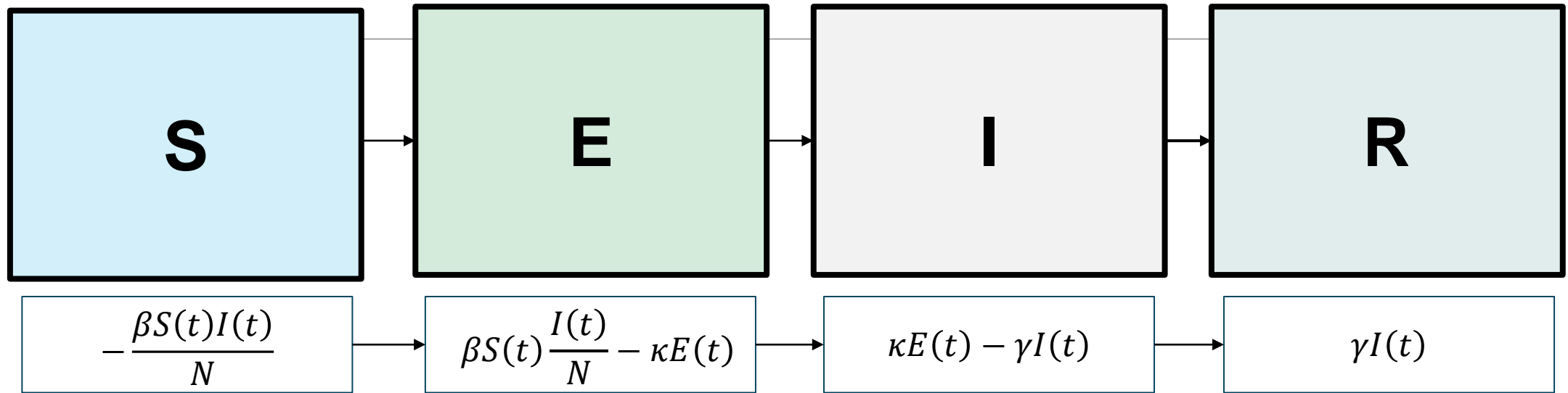
To determine the best approach, using the provided SEIR model, to fit and forecast the 2022-2023 epidemic in the United States employing the tools covered today.

2022-2023 Mpox Epidemic

- In May 2022, an unprecedented, epidemiologically unique, surge in mpox cases was observed around the globe
 - Transmission
 - Symptomology
 - Impacted Communities
- Over 94,584 cases and 163 deaths reported worldwide in non-endemic regions (June 30th, 2024)
- **Highest impacted countries:** Brazil, Canada, France, Germany, Spain, the United Kingdom, and the United States



Susceptible-Exposed-Infectious-Recovered model



- Expands upon the SIR model with the inclusion of latency period via an exposed class.
- **Latency Period ($1/\kappa$)**: Time elapsed from effective exposure to the infectious agent to infectiousness.
- R_0 can still be calculated as β/γ

Parameters

Parameter	Initial	LB	UB	Fixed
β	6.59	0.001	10	No
N	550000	550000	550000	Yes
κ	0.526	0.526	0.526	Yes
γ	0.2439	0.2439	0.2439	Yes
r	1.9	0.001	10	No
p	0.83	0	1	No

Initial Conditions

Parameter	Initial
$S(t)$	<code>params.initial(4) - 5</code>
$E(t)$	0
$I(t)$	5
$R(t)$	0
$C(t)$	5

Additional Specifications

- **Model:** Susceptible-Infectious-Recovered, Neg. Binomial Distribution
- **Comparison Models:** Generalized Growth Model (GGM)
- **Forecasting Dates:**
 - 2022-07-14 (Use 11-weeks calibration period)
 - 2023-02-23 (Use all data for calibration)
- **Forecasting Horizon:** 4-weeks
- **Calibration period length:**
 - Weekly: 11-weeks and All data
- **Bootstrapping:** Use between 100-300 samples, set start points to 10

Using this information, and the parameters provided on other slides, prepare the `options_fit.m` files and conduct a model comparison analysis.

Comparing Models: Example Table

Model	MAE	MSE	Coverage 95% PI	WIS
Calibration Performance				
Forecast Performance				

Questions

- (1) Which model would you use to fit the early phase of the mpox epidemic?
- (2) Which model would you use to forecast during the early phase of the mpox epidemic?
- (3) Which model would you use to fit the entire mpox epidemic curve?
- (4) Which model would you use to forecast 4-weeks into the future, calibrating the model with all available weeks of data?

Please submit your responses on the course website.