The Emergence of Omicron and Its Impact

SUTRA Consortium

SUTRA Model

Key Parameters: Contact Rate β

- Measures how fast pandemic spreads in a region
  - Increases due to people not following safety protocols and more infectious mutants
  - Decreases due to lockdowns, people following safety protocols
- Closely related to Basic Reproduction Number $R_0 \approx 10\beta$

Key Parameters: Detection Factor ϵ

- Measures ratio between detected (tested +ve) and actual cases
  - Decreases when number of asymptomatic patients increase, pandemic reaches inaccessible regions, and testing reduces
  - Increases when testing rate goes up significantly

Key Parameters: Reach ρ

- Measures fraction of population over which the pandemic is active
  - It is very small initially and typically increases with time
  - Increases rapidly when there is a lot of movement across regions, many people come out of isolation
  - Captures loss of immunity and vaccination-induced immunity

Key Factors for Omicron

Loss of Immunity

- It is the most critical factor in rise of Omicron cases
- Vaccine immunity is almost completely bypassed
- Estimates for natural immunity bypass vary

Data for India is indicating 20%-30% immunity loss

- Even a 5% change in estimation causes major change in peak value!
  - Hence, predicting peak value is error-prone
- Timing of peak does not depend much on immunity loss and so can be predicted with better precision

High Contact Rate

- Value of β has gone up significantly:

Data from multiple places is indicating an increase by a factor of 2-4

Reduced Testing

- ICMR issued new guidelines for testing on January 10th:
  - Only those with symptoms or comorbidities should be tested
- In addition, many with symptoms are deciding not to get tested

This changes detection ratio

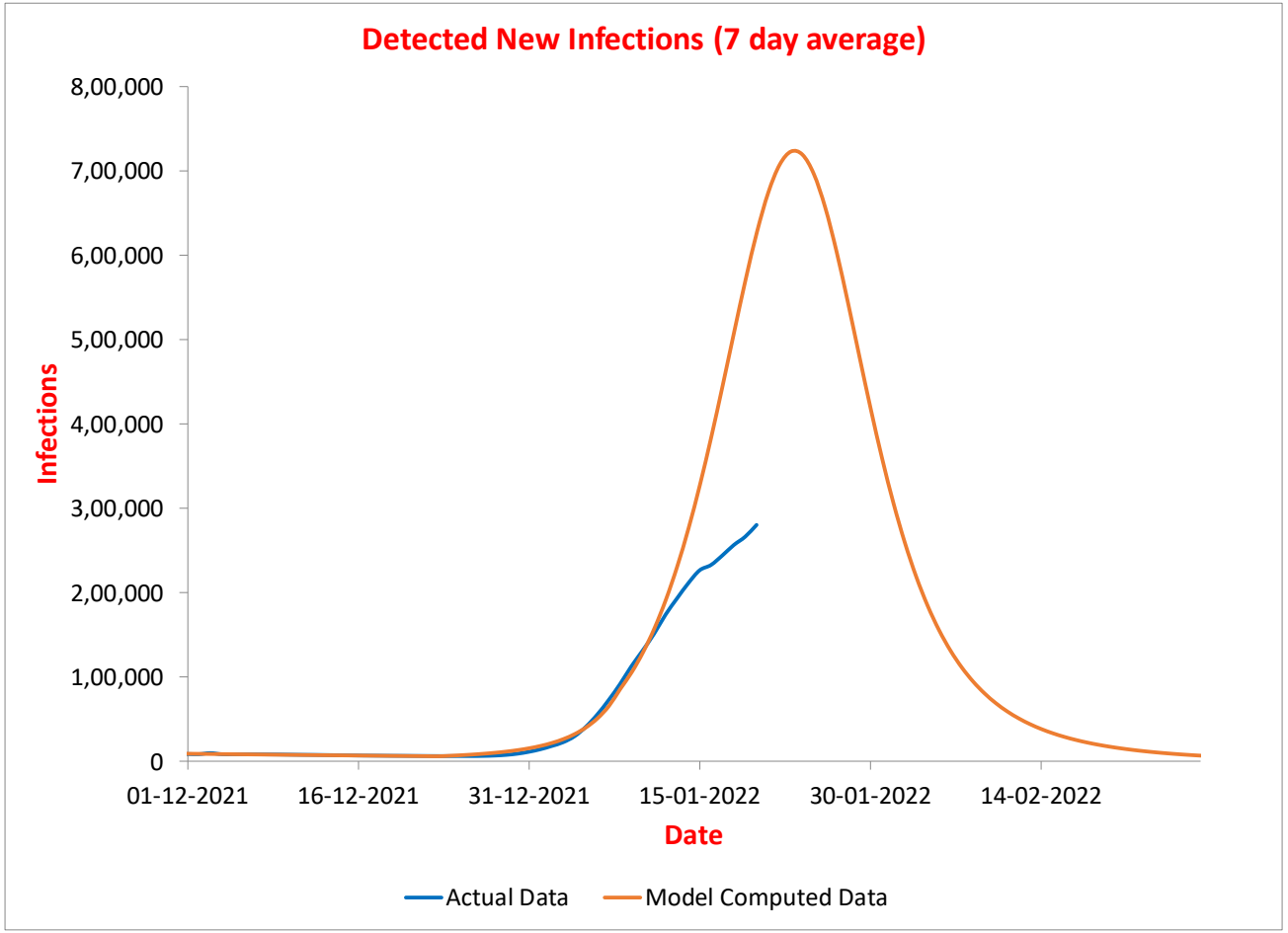
- The number of detected cases will be significantly less since a larger fraction of cases will not get detected
- The trajectory of cases will now be a scaled down version of one with earlier testing strategy, but will not change date of peaking

Predicted Trajectories

Comments on Plots

- All plots show trajectory for the period Dec 2021 to Feb 2022
- A phase change is indicative of significant change in one or more parameter values
- Nearly all the regions are showing a phase change during Jan 9-15
- This phase change is likely due to a reduction in Detection Ratio as discussed earlier
- For regions where previous phase was stable, values of Contact Rate and Reach parameters are provided indicating change in them due to Omicron

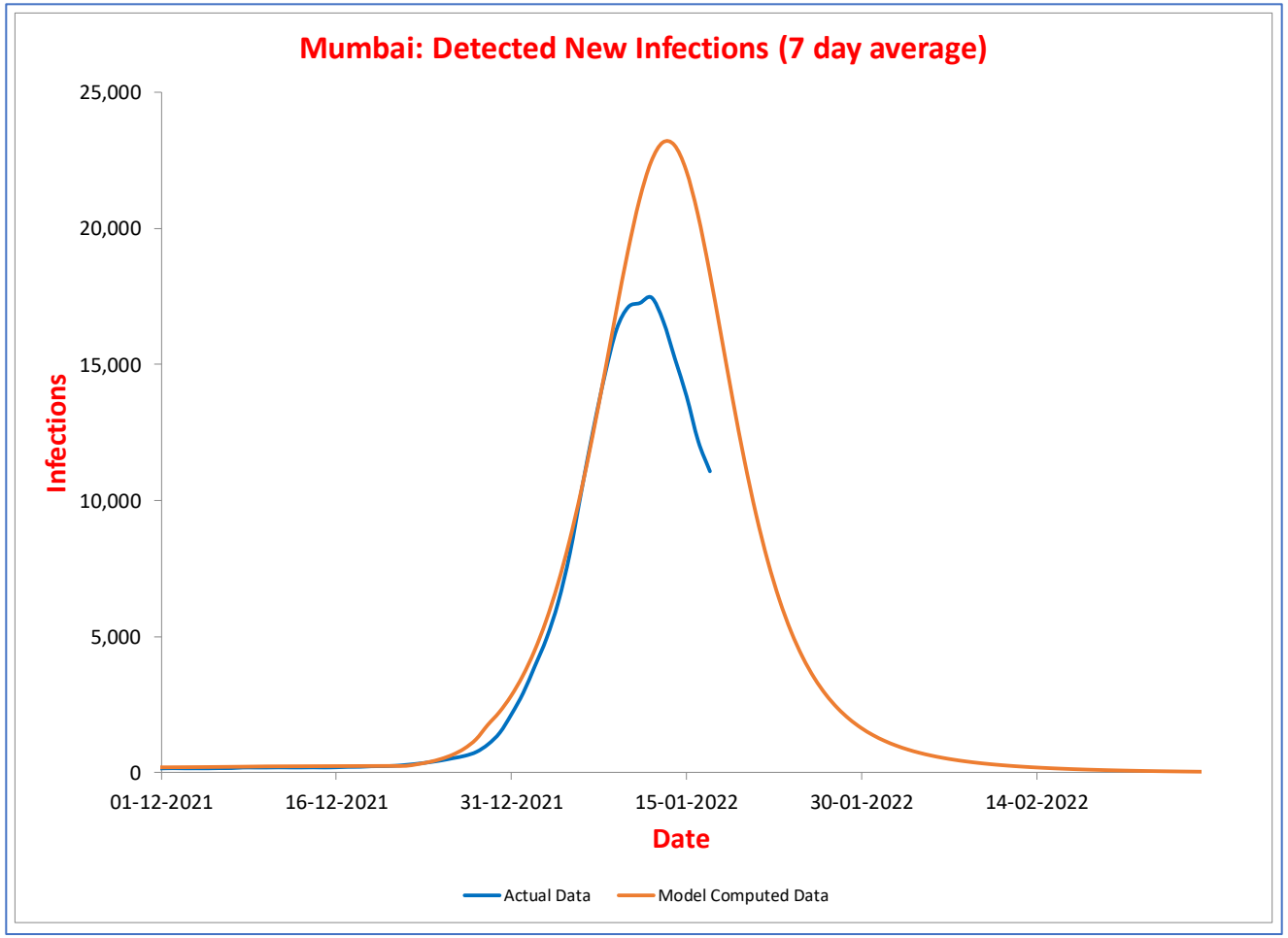
India



- Peak around 23rd Jan
- Phase change from 12th Jan

- $\beta = 0.54 \pm 0.02$ to 1.27 ± 0.19
- $\rho = 0.98 \pm 0.01$ to 1.15 ± 0.06

Mumbai

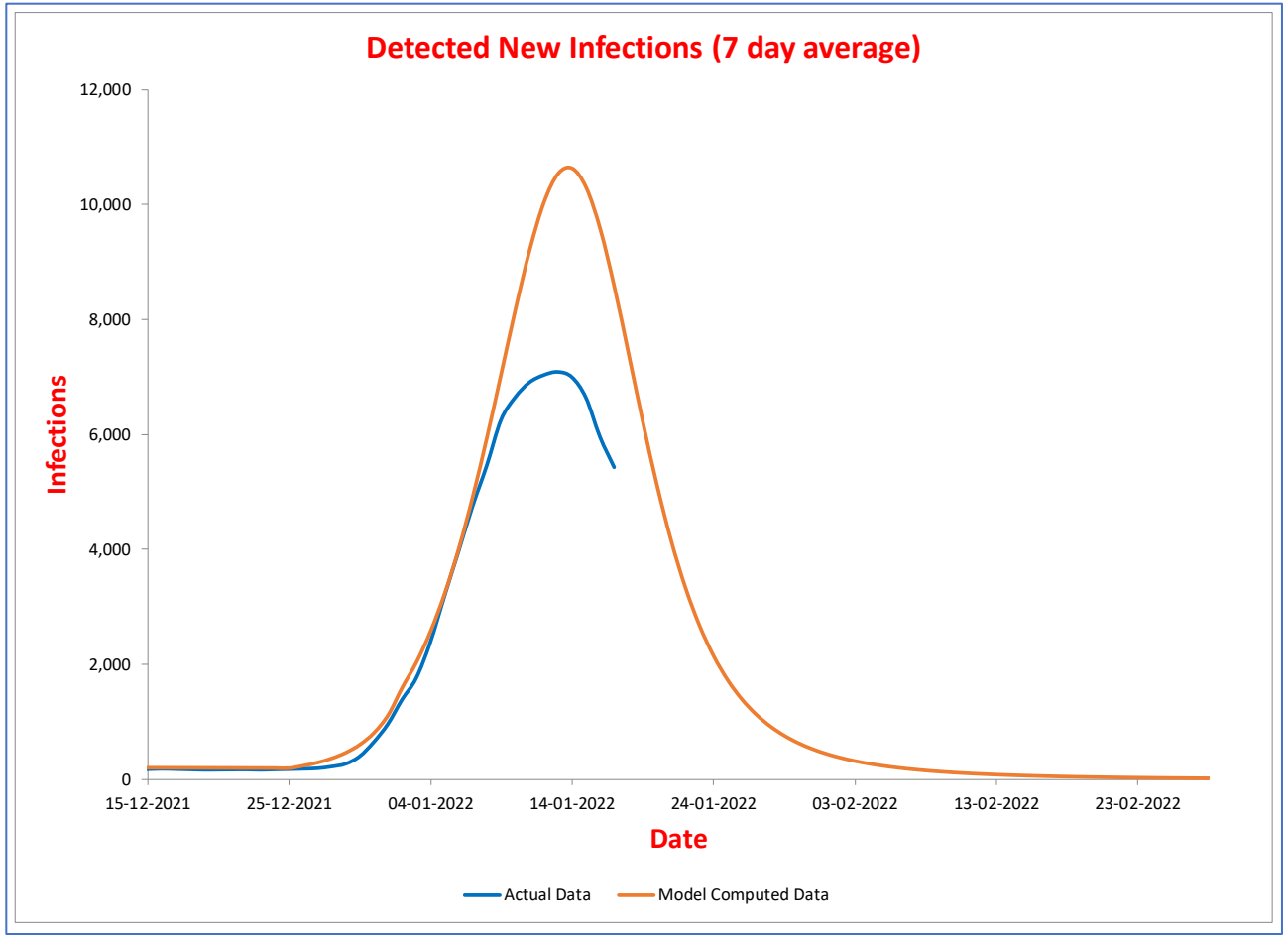


- Peaked 12^{th} Jan (predicted: 14^{th} Jan)
- Phase change from 10^{th} Jan

$\beta = 0.62 \pm 0.03$ to 1.25 ± 0.17

$\rho = 0.97 \pm 0.01$ to 1.15 ± 0.07

Kolkata

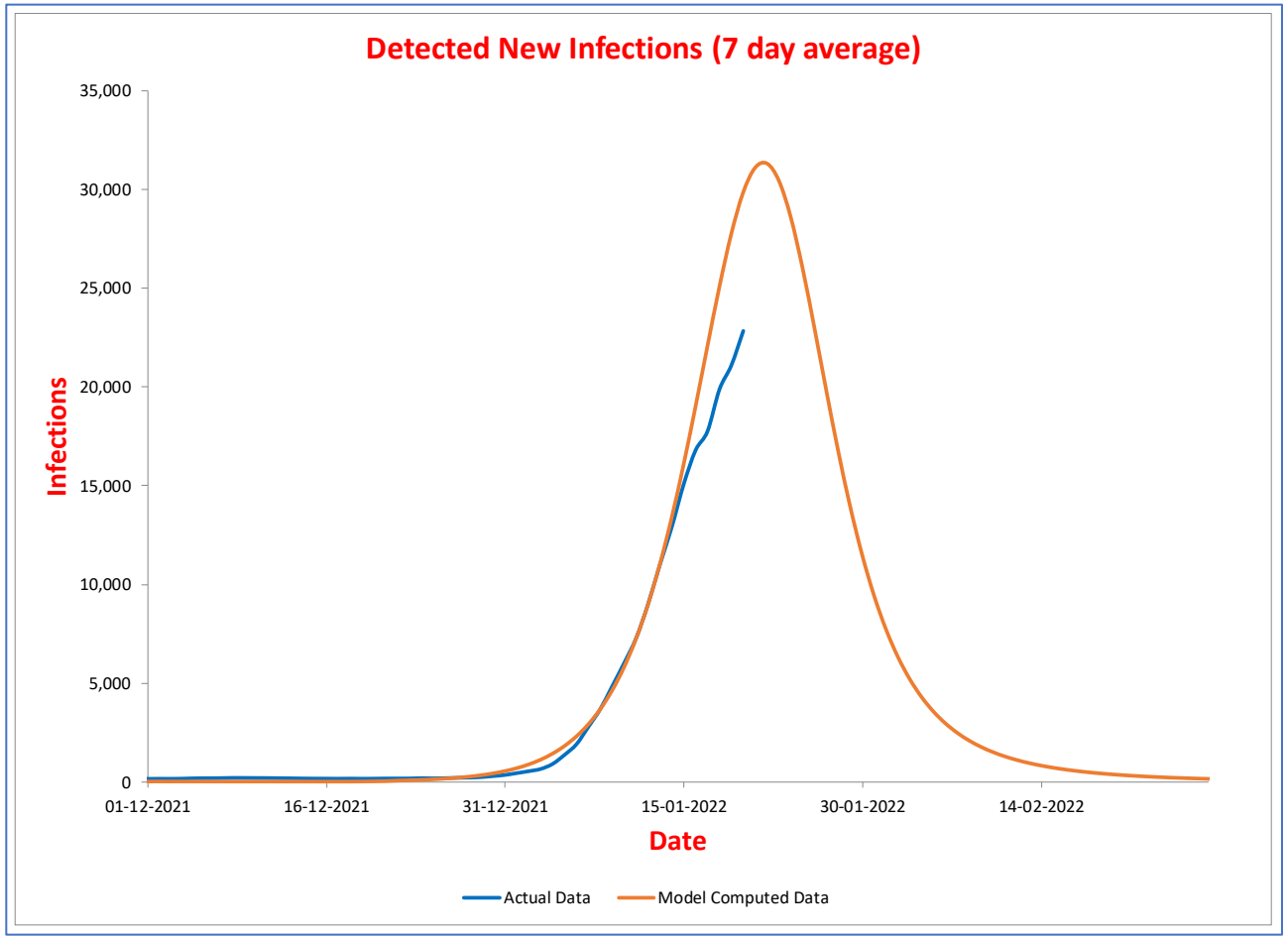


- Peaked 14^{th} Jan (predicted: 15^{th} Jan)
- Phase change from 10^{th} Jan

$\beta = 0.57 \pm 0.10$ to 1.28 ± 0.29

$\rho = 1.00 \pm 0.04$ to 1.21 ± 0.10

Bengaluru

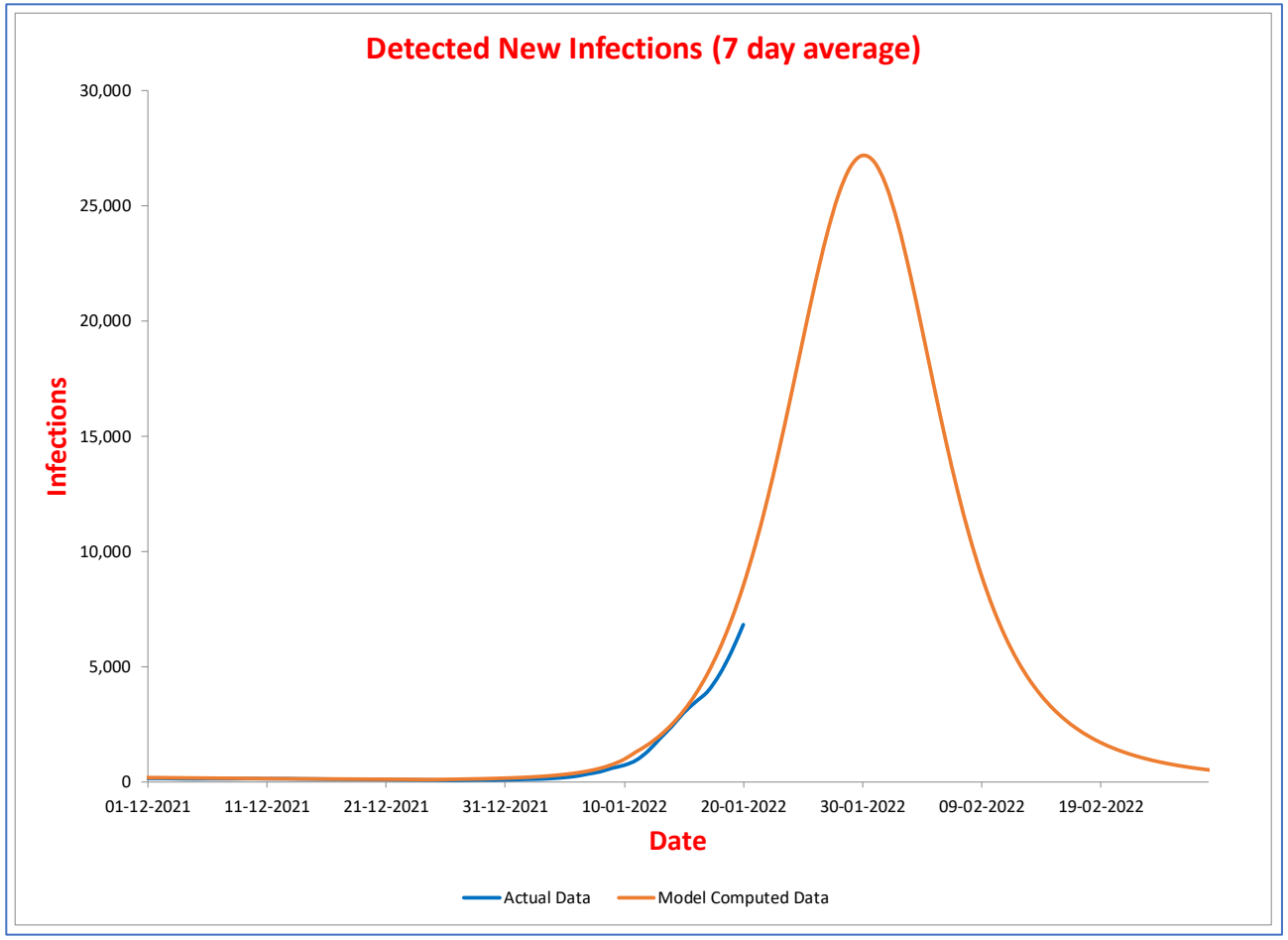


- Peaking on 22^{nd} Jan
- Phase change from 13^{th} Jan

$\beta = 0.47 \pm 0.03$ to 1.61 ± 0.11

$\rho = 0.79 \pm 0.01$ to 0.90 ± 0.03

Andhra Pradesh

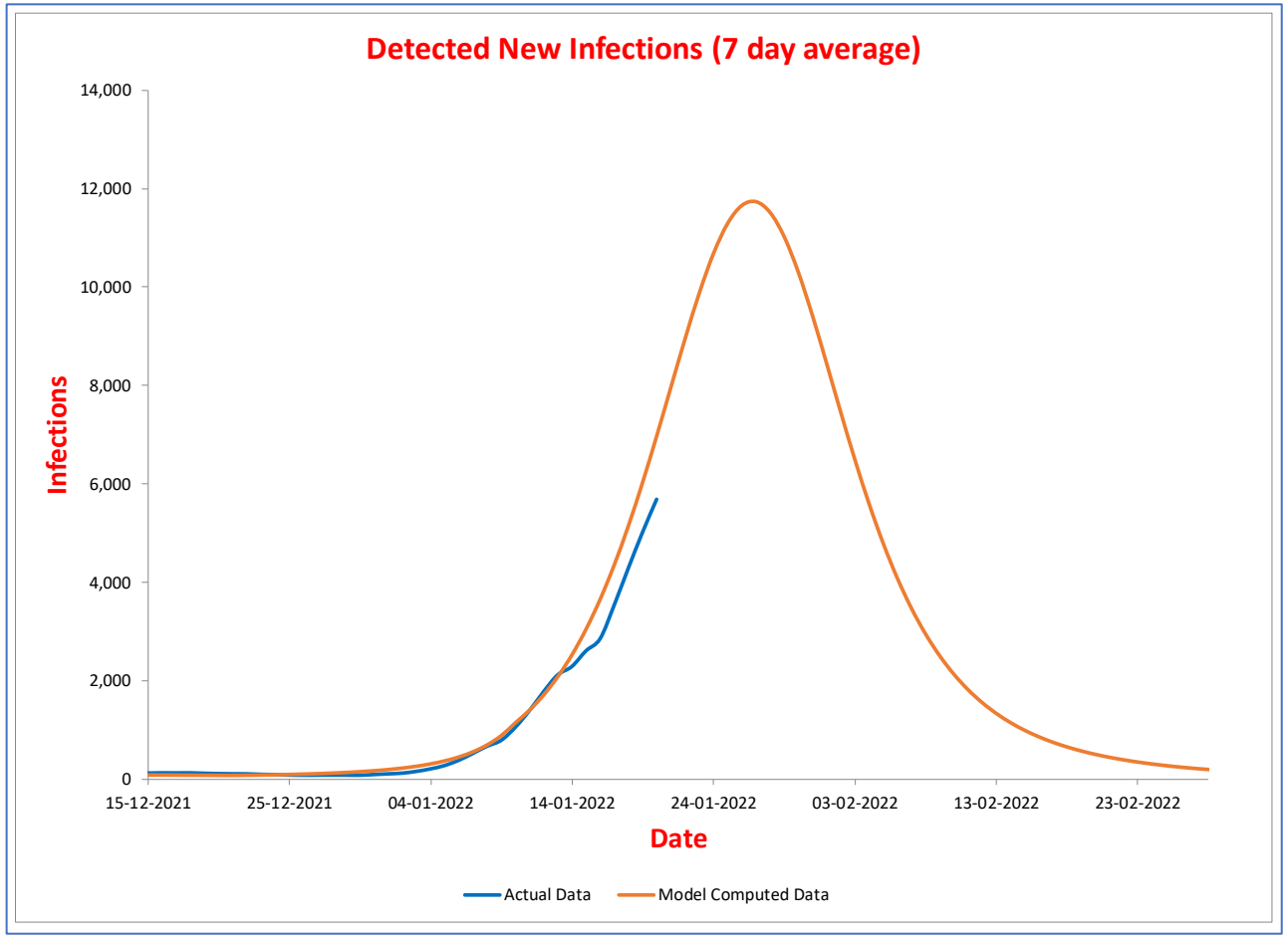


- Peaking on 30th Jan
- No phase change yet

$\beta = 0.50 \pm 0.07$ to 1.96 ± 1.35

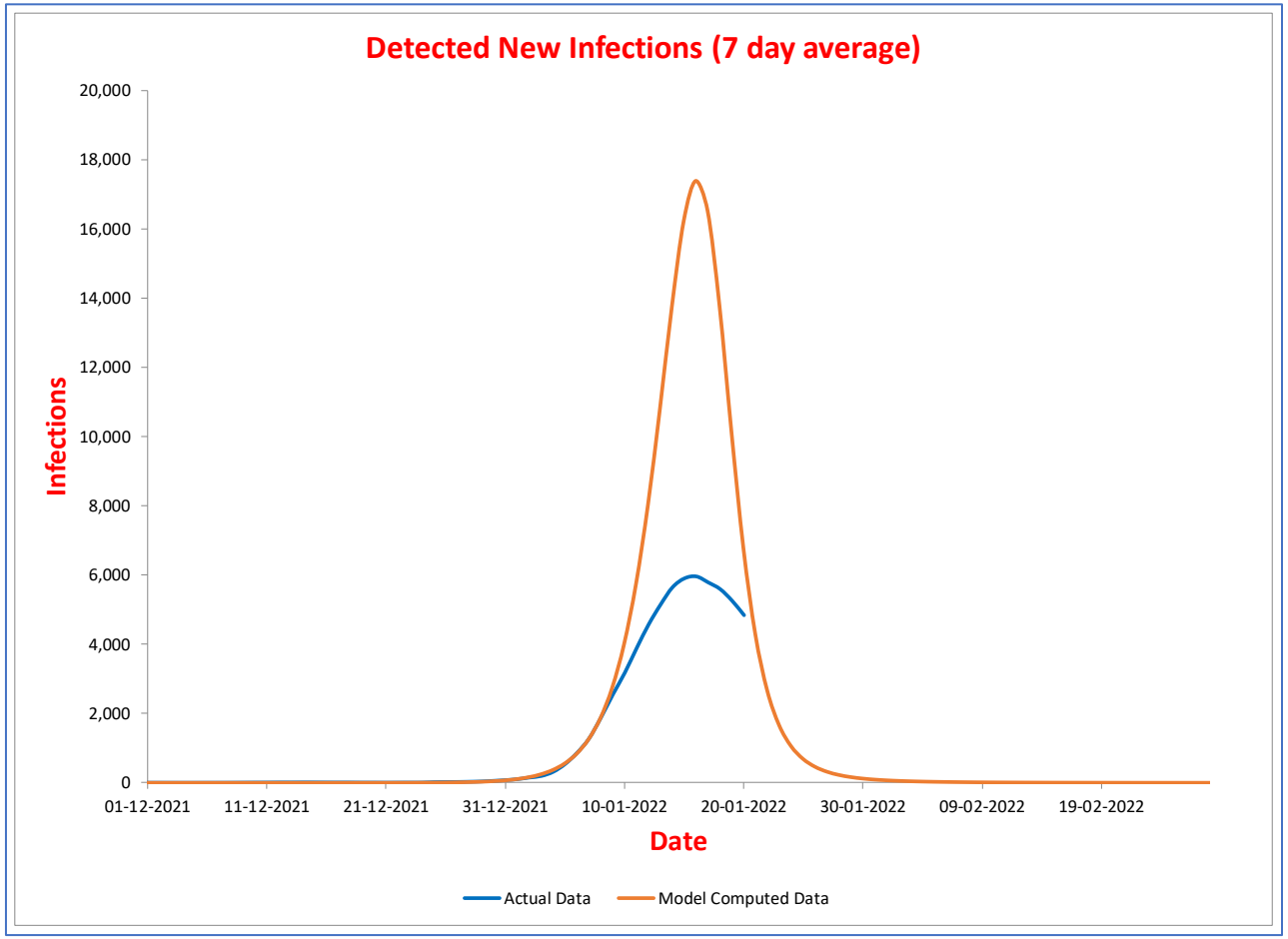
$\rho = 0.84 \pm 0.20$ to 0.88 ± 0.09

Assam



- Peaking on 27th Jan
- Phase change on 14th Jan

Bihar

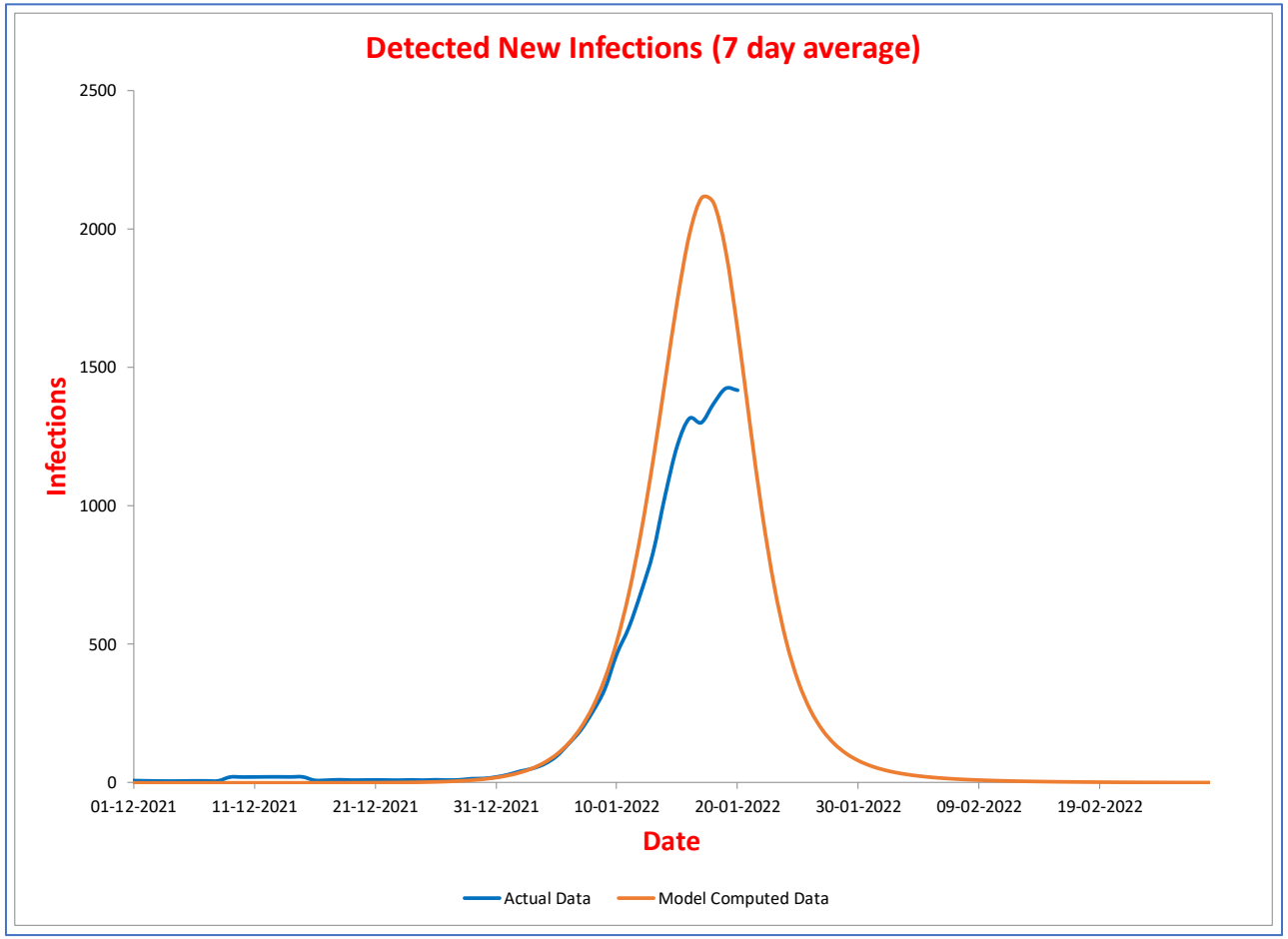


- Peaked 16^{th} Jan (predicted: 16^{th} Jan)
- Phase change from 10^{th} Jan

$\beta = 0.44 \pm 0.07$ to 3.36 ± 1.21

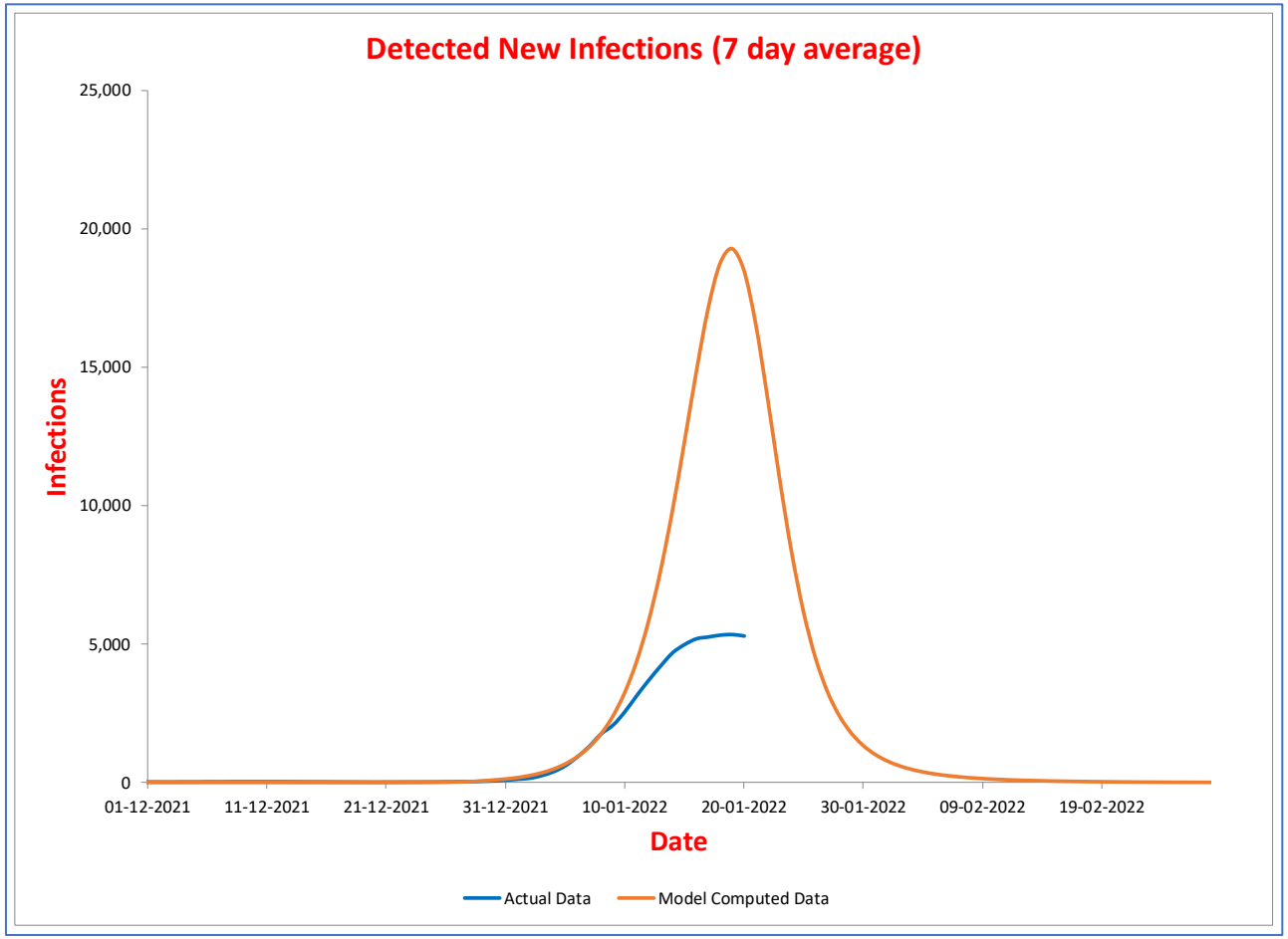
$\rho = 0.98 \pm 0.02$ to 1.04 ± 0.06

Chandigarh



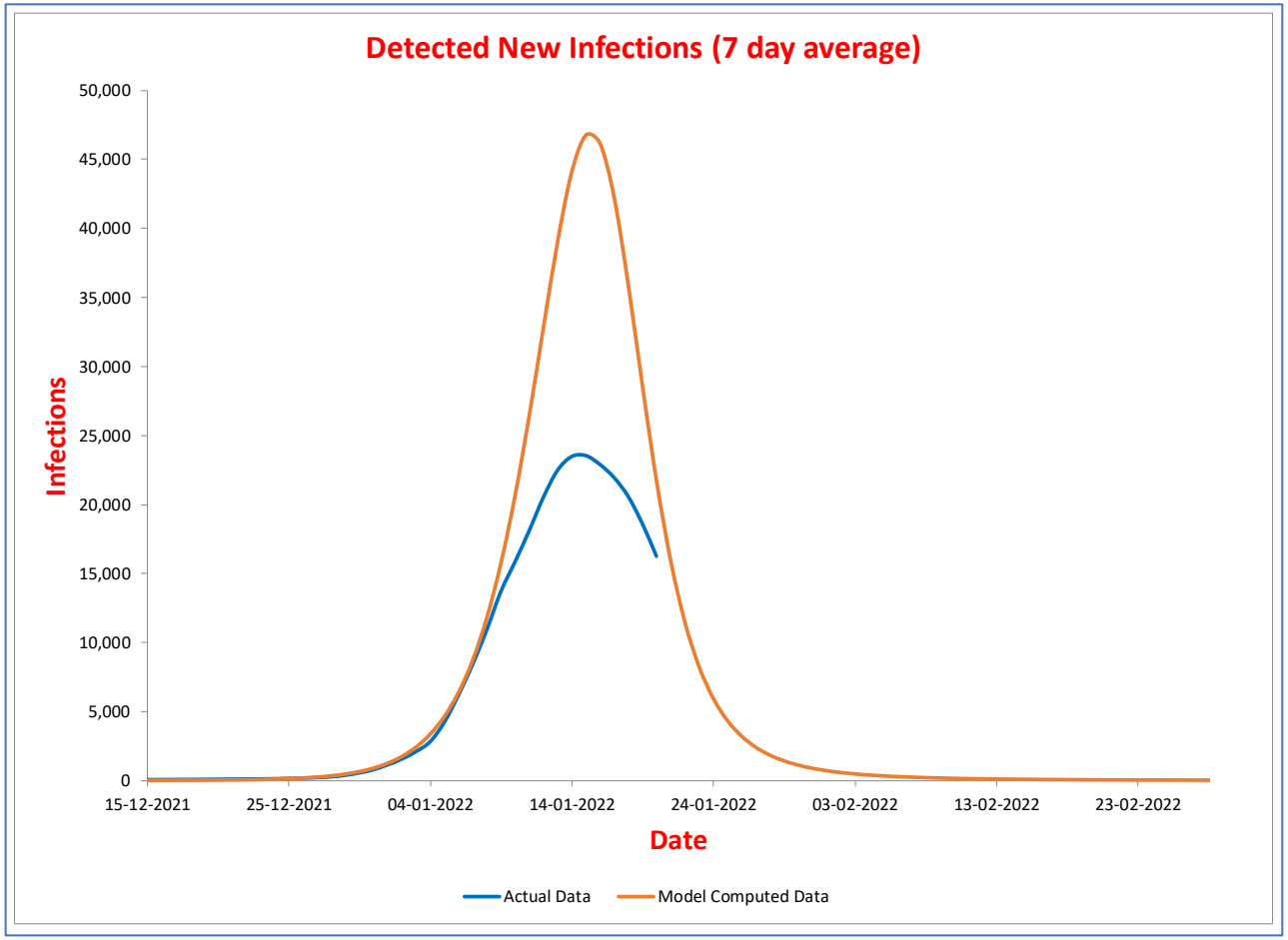
- Peaked? (predicted: 17th Jan)
- Phase change from 9th Jan

Chhattisgarh



- Peaking on 19th Jan
- Phase change from 9th Jan

Delhi

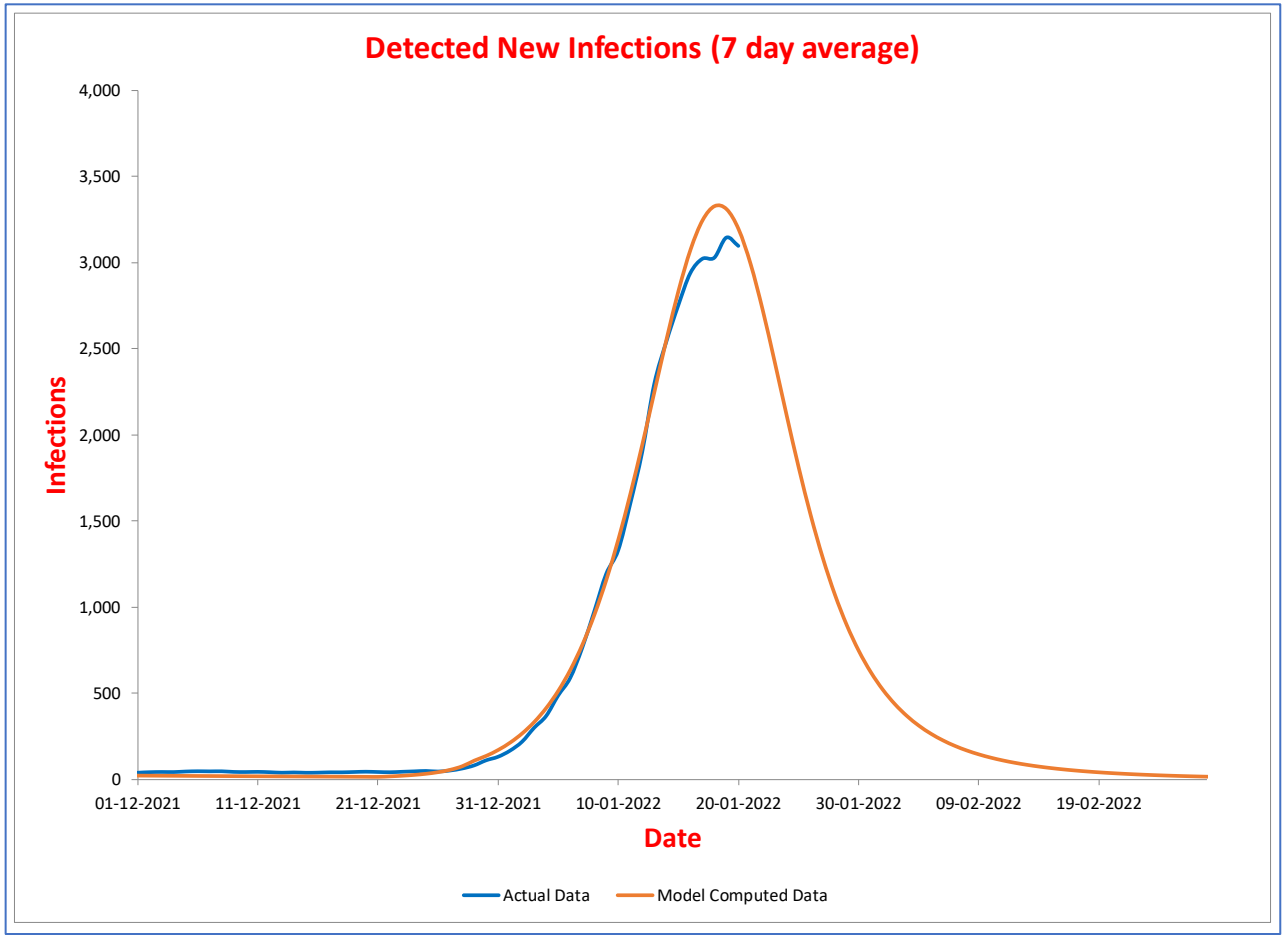


- Peaking on 18^{th} Jan
- No phase change yet

$\beta = 0.60 \pm 0.09$ to 1.69 ± 0.37

$\rho = 1.01 \pm 0.03$ to 1.14 ± 0.06

Goa

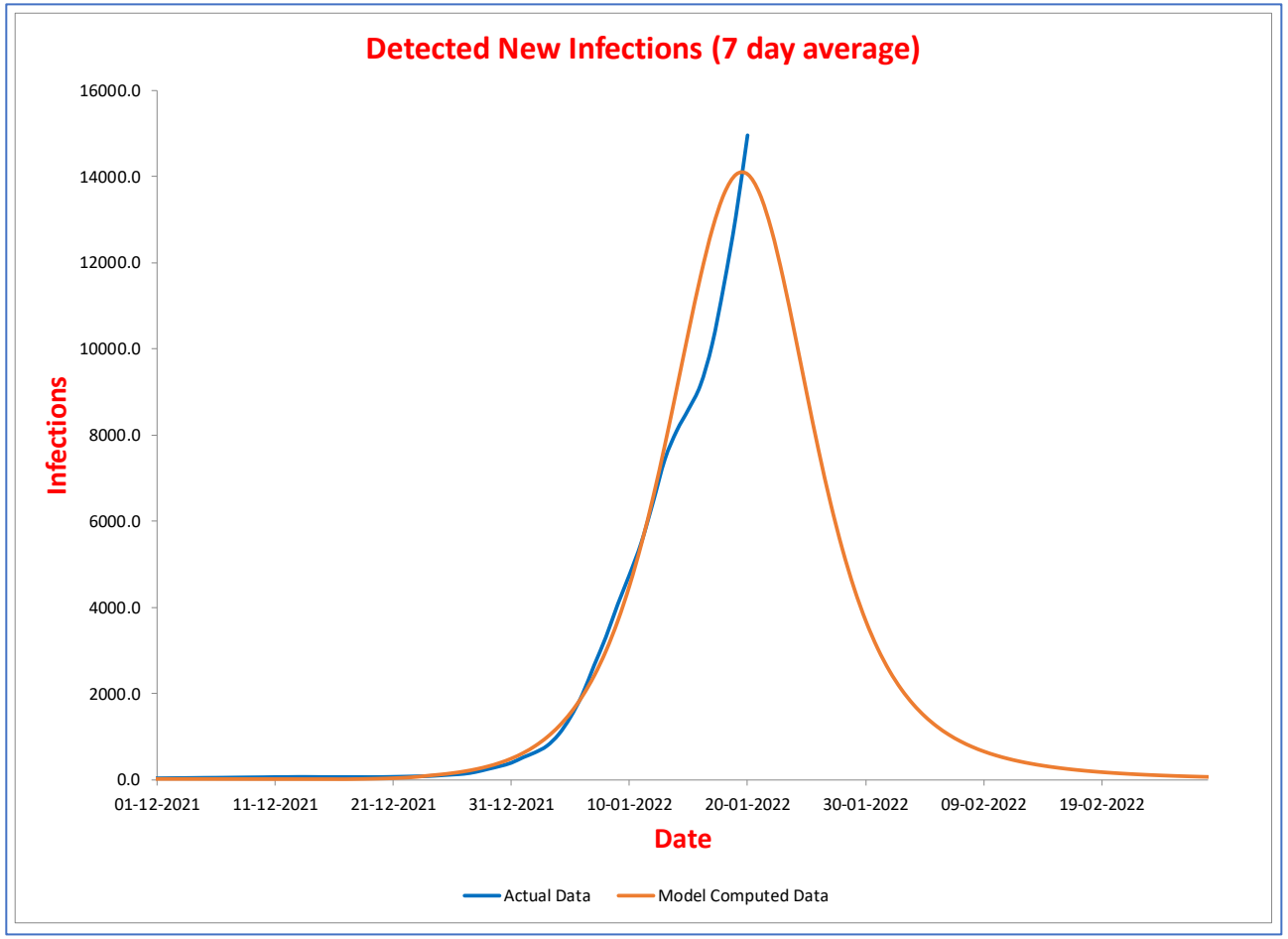


- Peaking on 18^{th} Jan
- No phase change yet

$\beta = 0.60 \pm 0.09$ to 1.69 ± 0.37

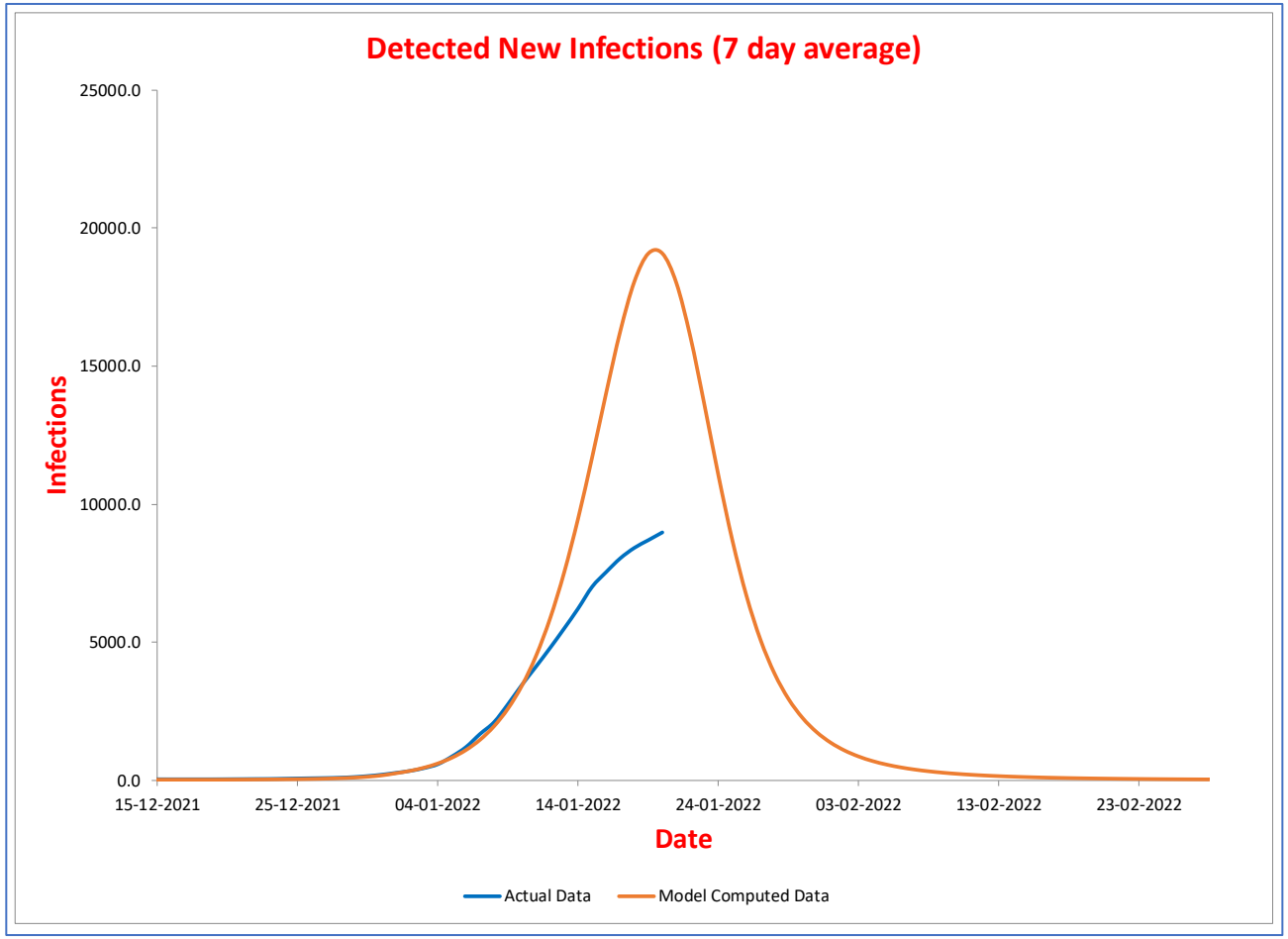
$\rho = 1.01 \pm 0.03$ to 1.14 ± 0.06

Gujarat



- Peaking on 20th Jan
- Phase change from 12th Jan

Haryana

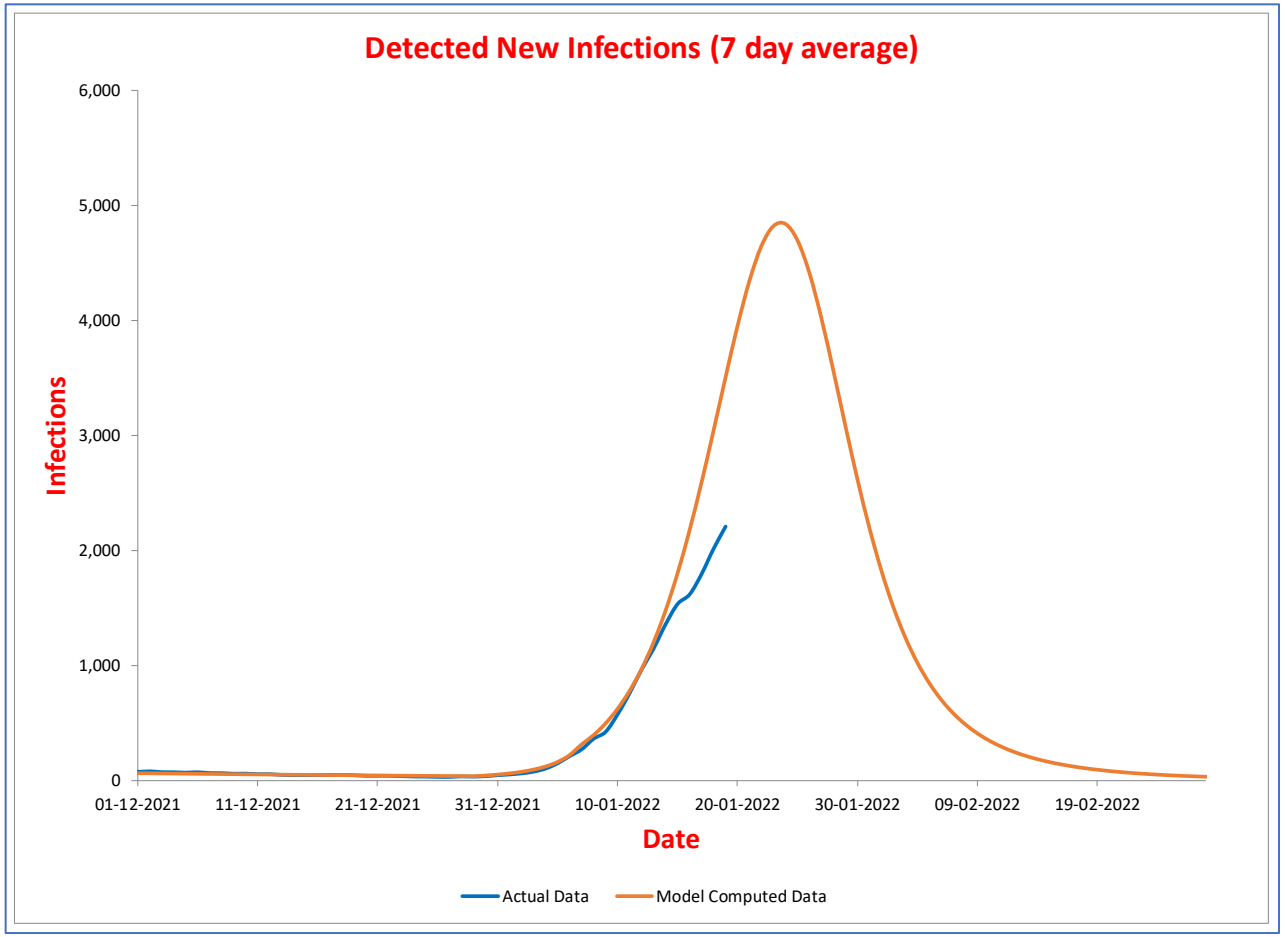


- Peaking on 20^{th} Jan
- Phase change from 10^{th} Jan

$\beta = 0.74 \pm 0.21$ to 1.77 ± 0.22

$\rho = 0.71 \pm 0.02$ to 0.83 ± 0.03

Himachal Pradesh

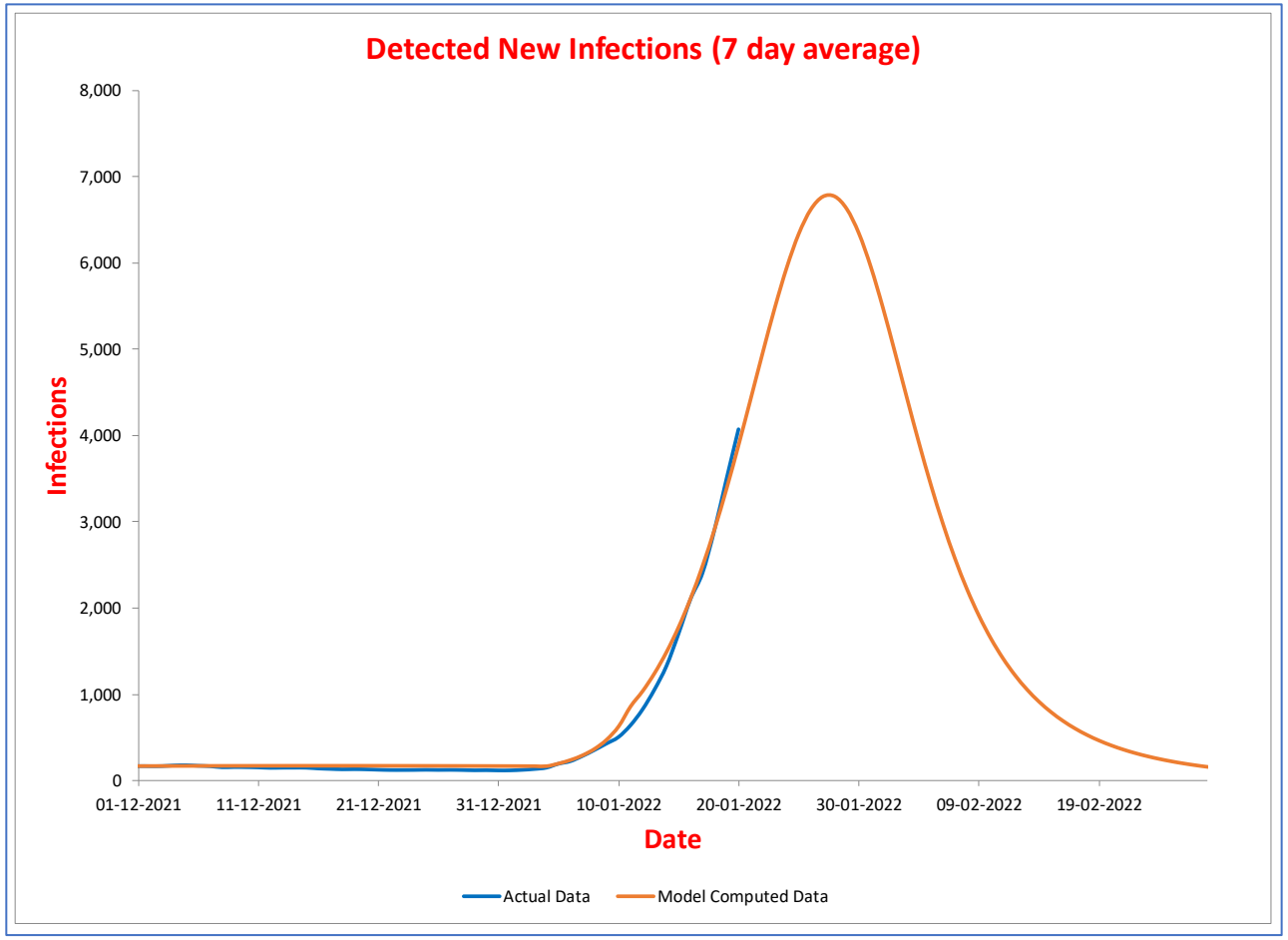


- Peaking on 24^{th} Jan
- Phase change from 15^{th} Jan

$\beta = 0.44 \pm 0.04$ to 1.46 ± 0.57

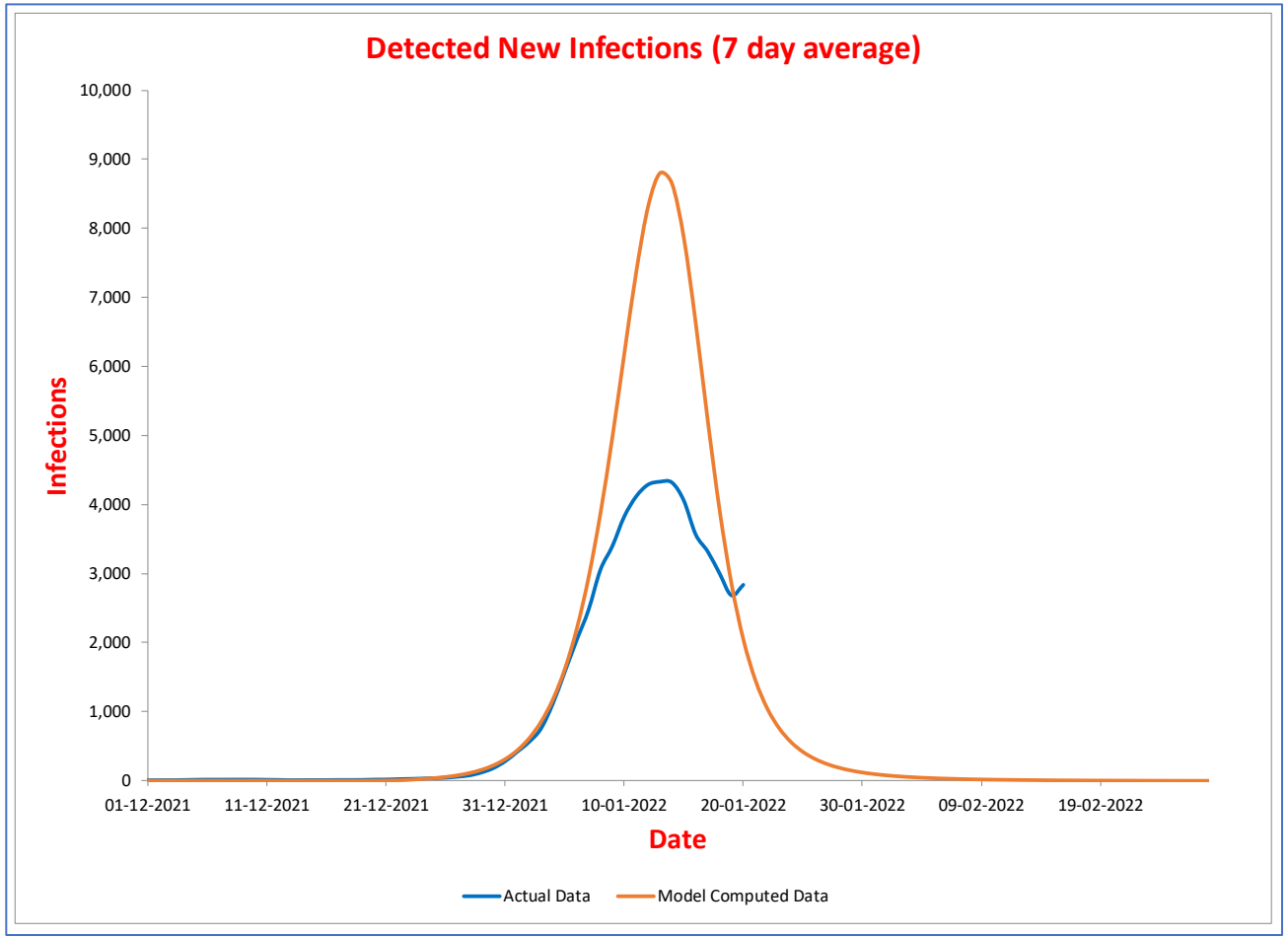
$\rho = 1.03 \pm 0.02$ to 1.14 ± 0.12

Jammu and Kashmir



- Peaking on 28th Jan
- No phase yet

Jharkhand

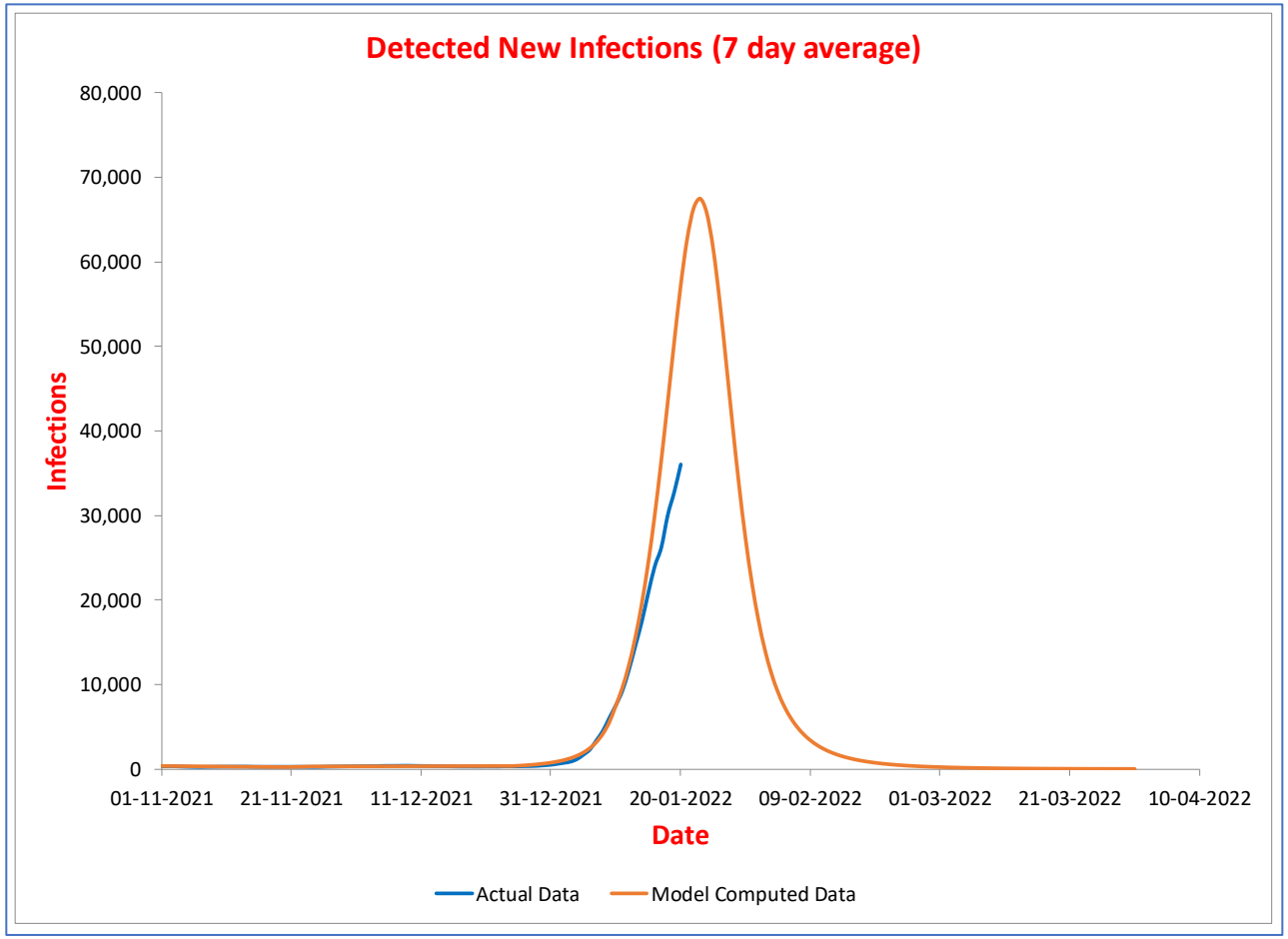


- Peaked 13th Jan (predicted: 13th Jan)
- Phase change from 6th Jan

$\beta = 0.54 \pm 0.22$ to 2.41 ± 1.07

$\rho = 0.77 \pm 0.04$ to 0.83 ± 0.07

Karnataka

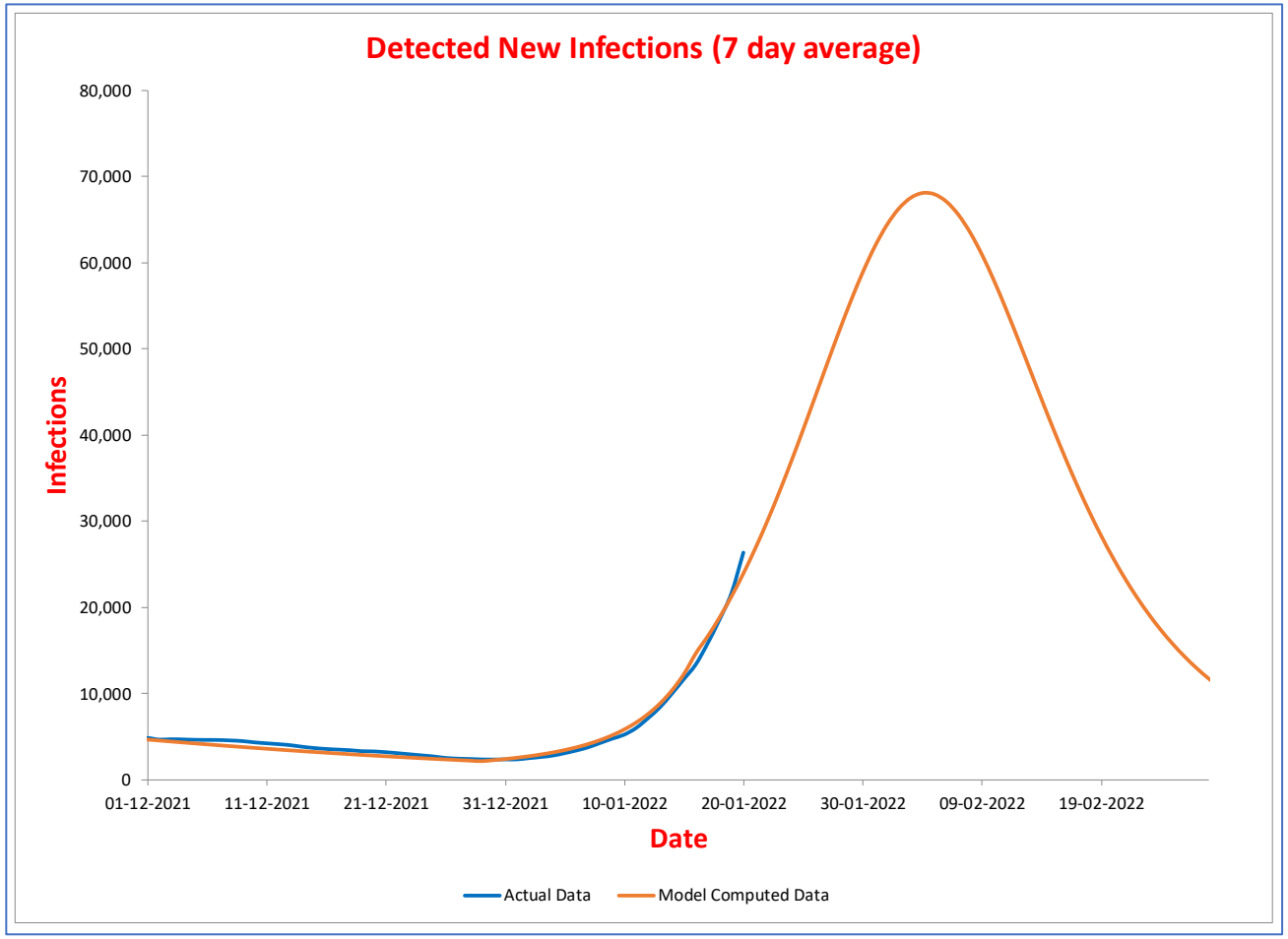


- Peaking on 23^{th} Jan
- Phase change from 14^{th} Jan

$\beta = 0.81 \pm 0.53$ to 1.71 ± 1.09

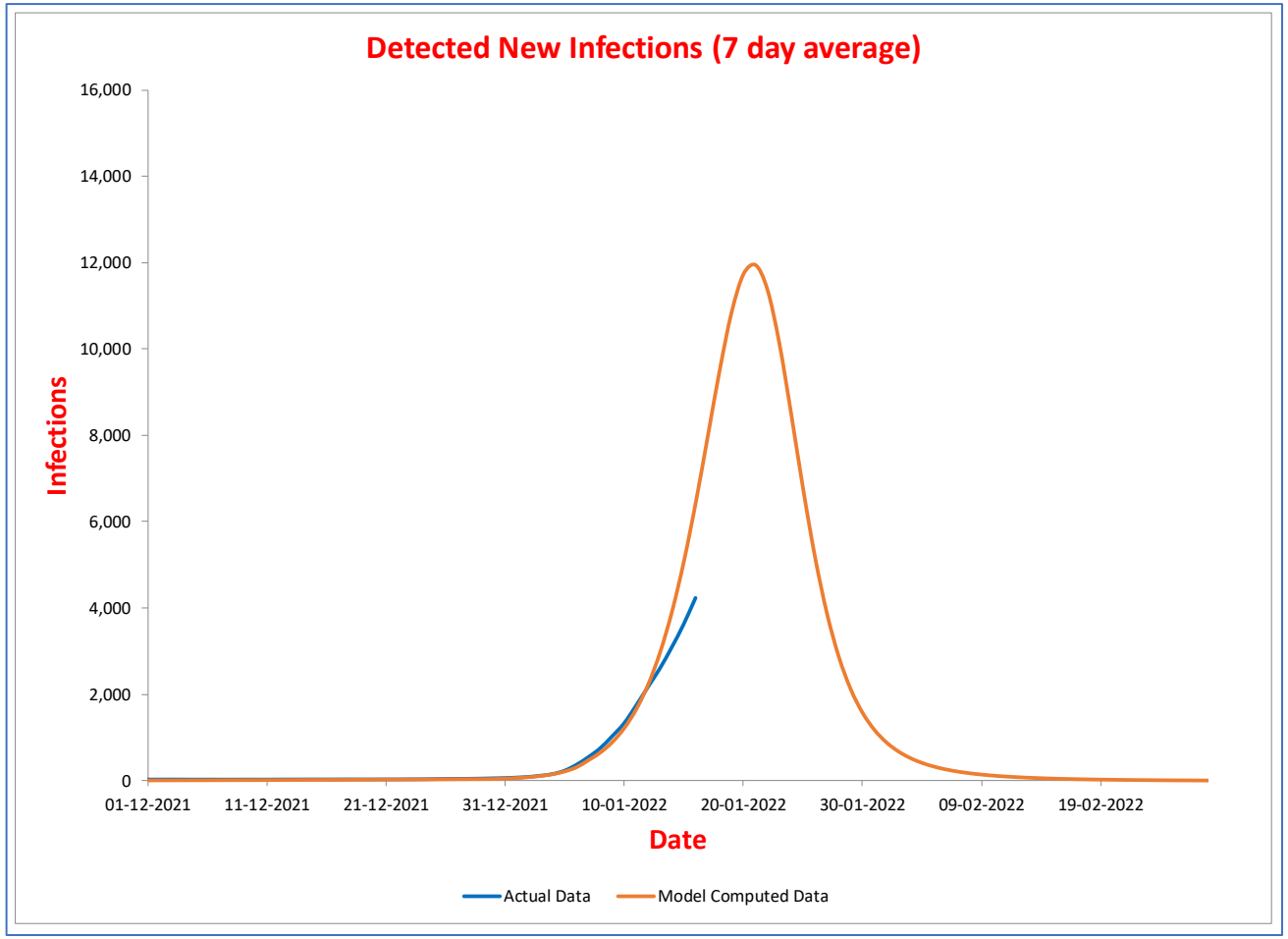
$\rho = 0.90 \pm 0.06$ to 1.04 ± 0.02

Kerala



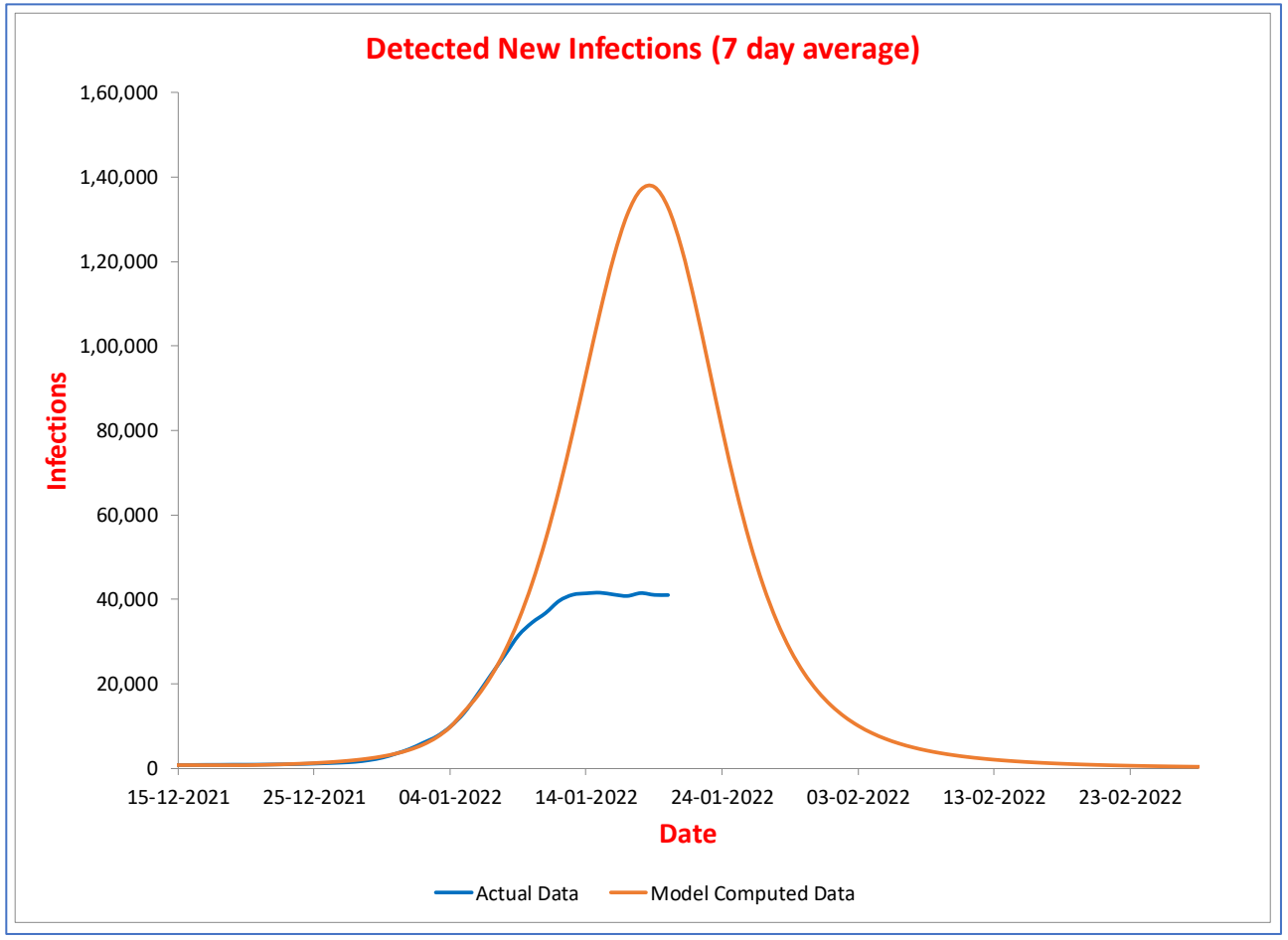
- Peaking on 5th Feb
- No phase change yet

Madhya Pradesh



- Peaking on 21th Jan
- Phase change from 13th Jan

Maharashtra

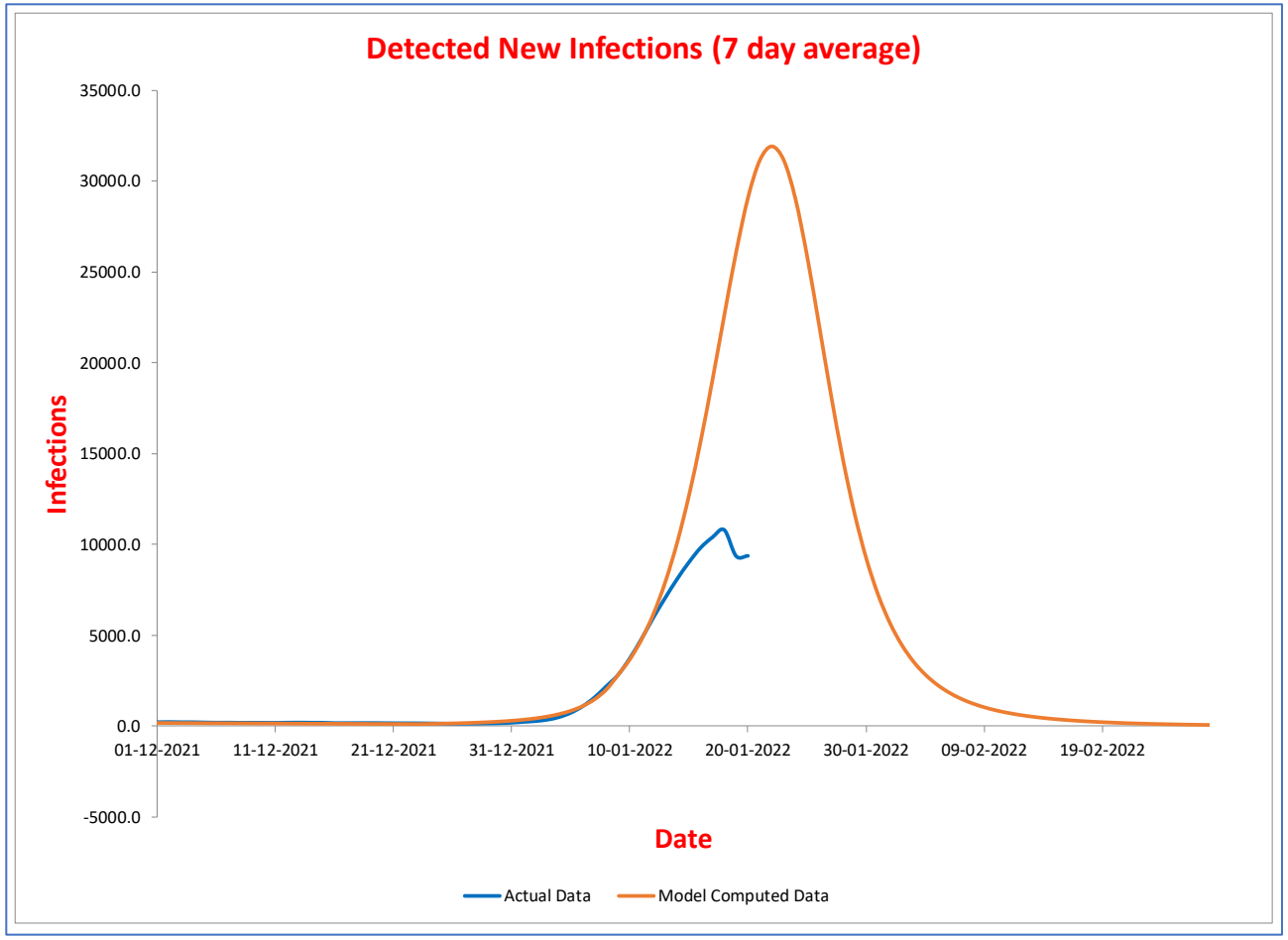


- Peaking on 19th Jan
- Phase change from 9th Jan

$\beta = 0.61 \pm 0.13$ to 1.57 ± 0.34

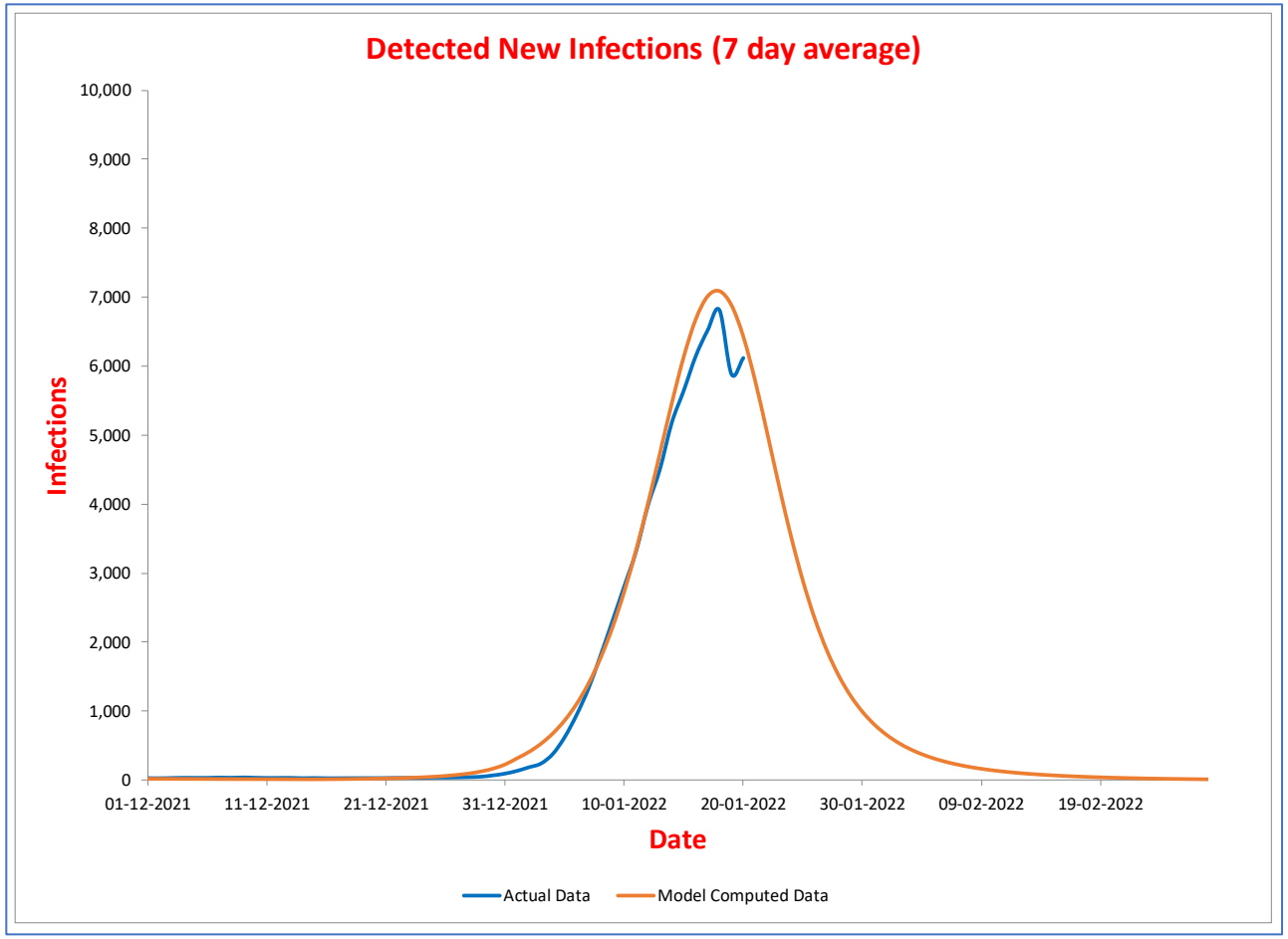
$\rho = 0.73 \pm 0.03$ to 0.83 ± 0.06

Odisha



- Peaking on 22th Jan
- Phase change from 14th Jan

Punjab

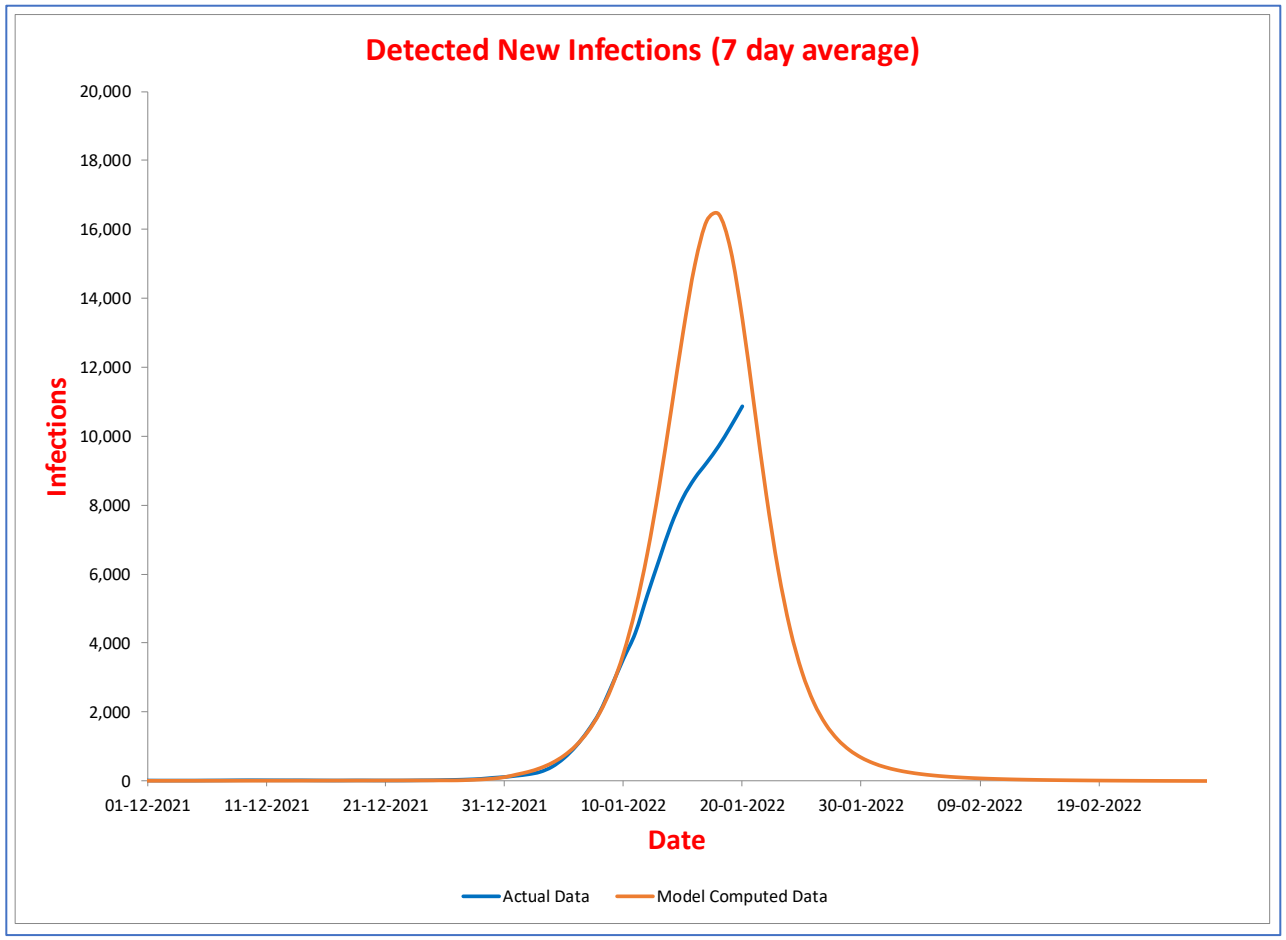


- Peaking on 18^{th} Jan
- Phase change from 12^{th} Jan

$\beta = 0.61 \pm 0.13$ to 2.77 ± 1.40

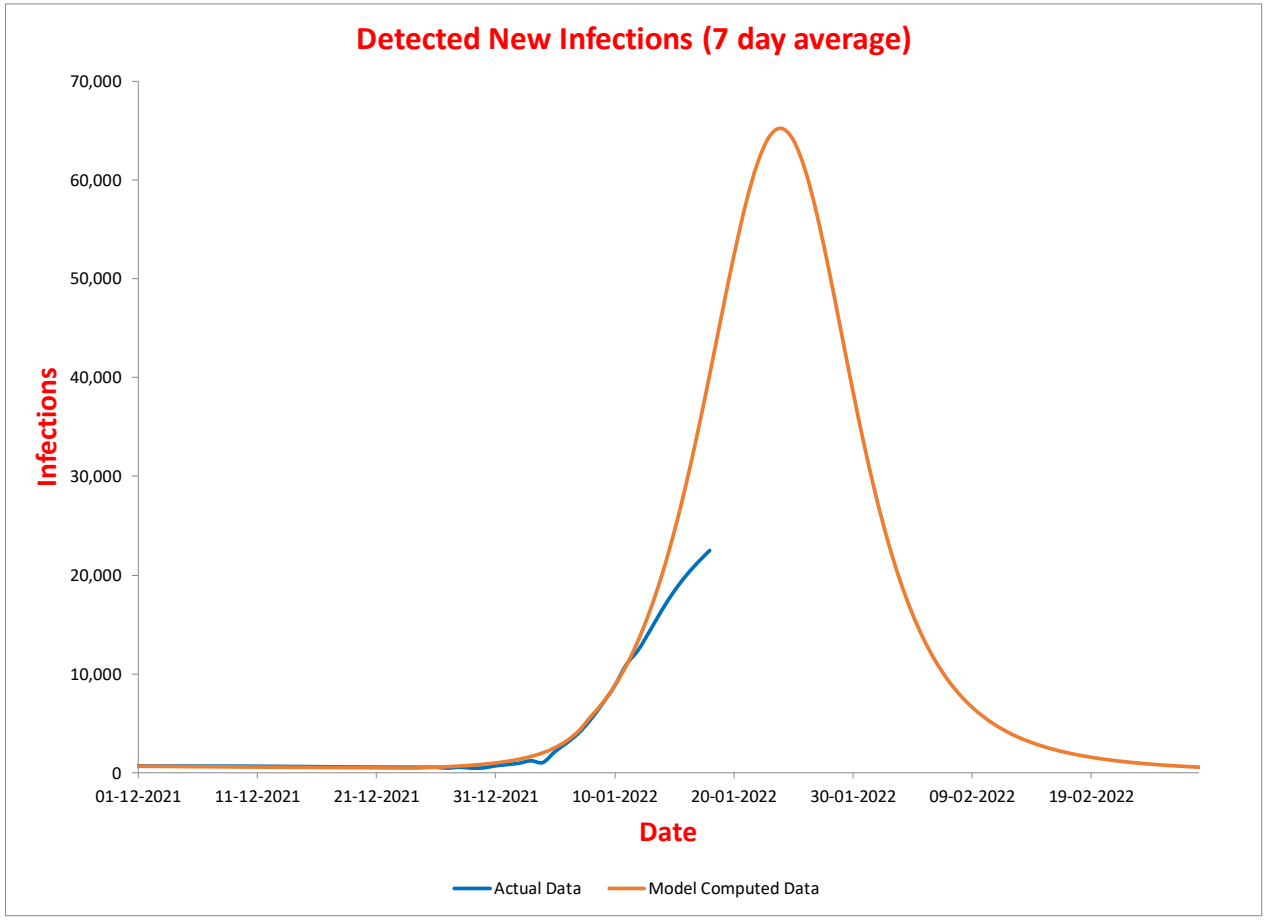
$\rho = 0.94 \pm 0.03$ to 0.96 ± 0.07

Rajasthan



- Peaking on 18th Jan
- Phase change from 12th Jan

Tamil Nadu

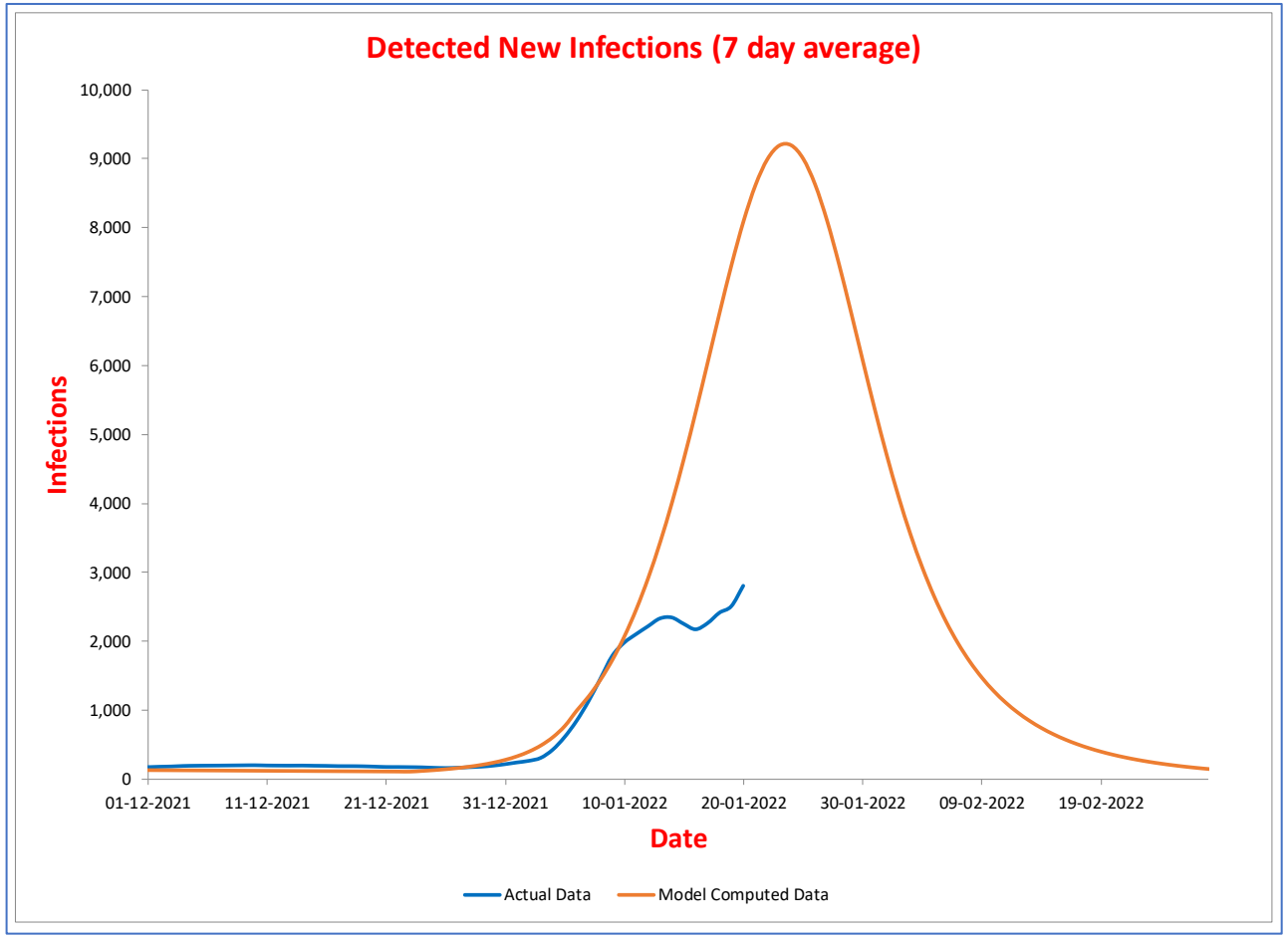


- Peaking on 24^{th} Jan
- Phase change from 14^{th} Jan

$\beta = 0.34 \pm 0.02$ to 1.30 ± 0.15

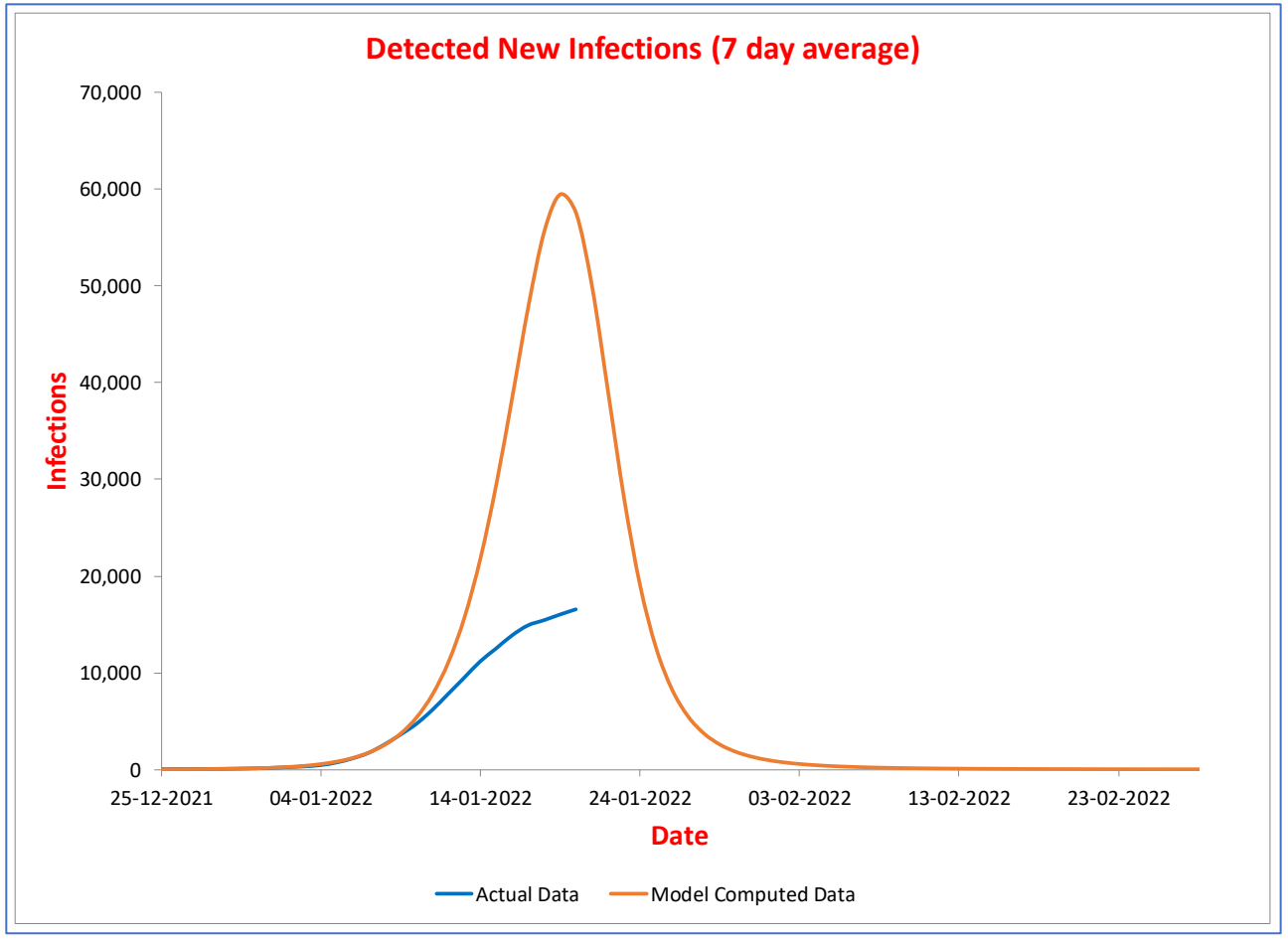
$\rho = 0.94 \pm 0.02$ to 0.98 ± 0.04

Telangana



- Peaking on 24th Jan
- Phase change from 11th Jan

UP

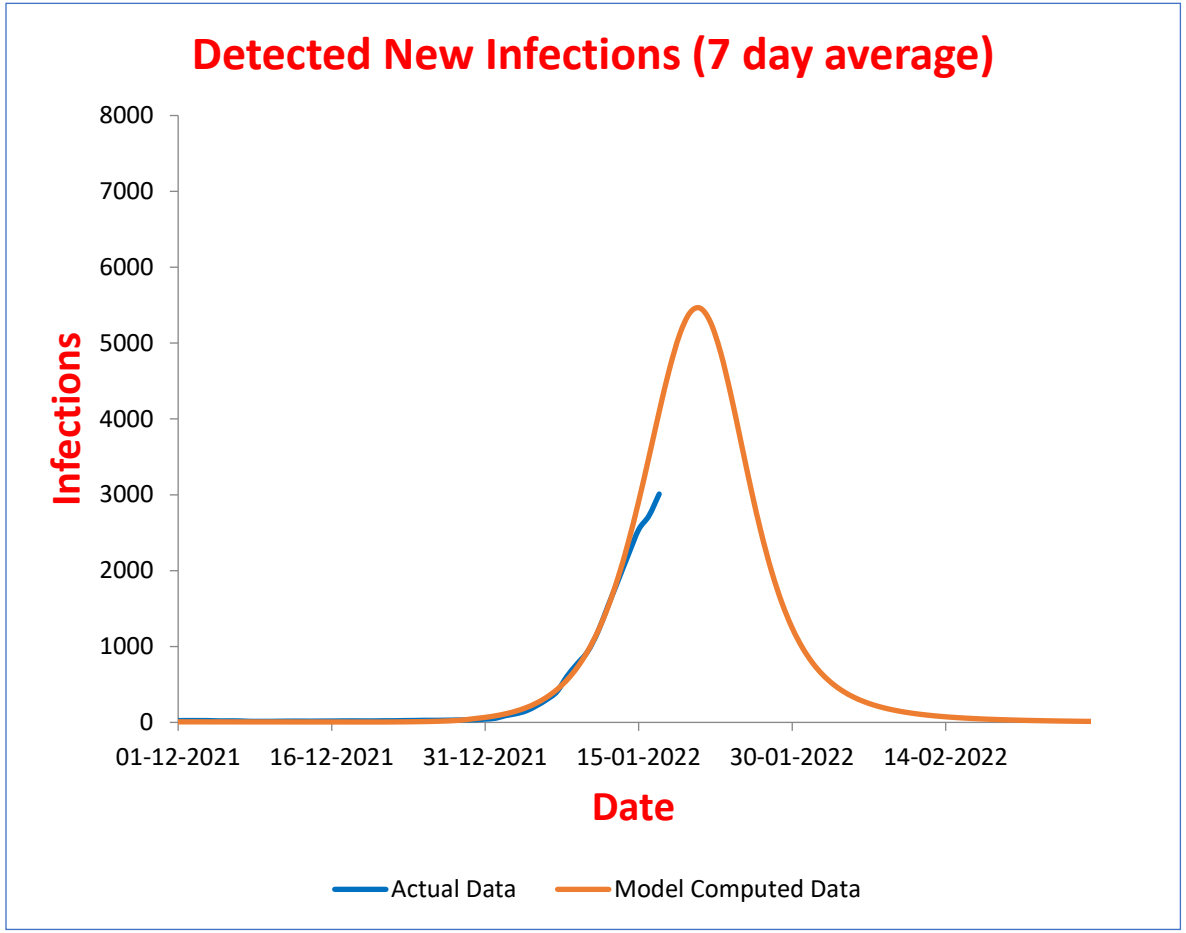


- Peaking on 19^{th} Jan
- Phase change from 10^{th} Jan

$\beta = 0.54 \pm 0.02$ to 2.40 ± 0.25

$\rho = 0.91 \pm 0.00$ to 1.16 ± 0.04

Uttarakhand

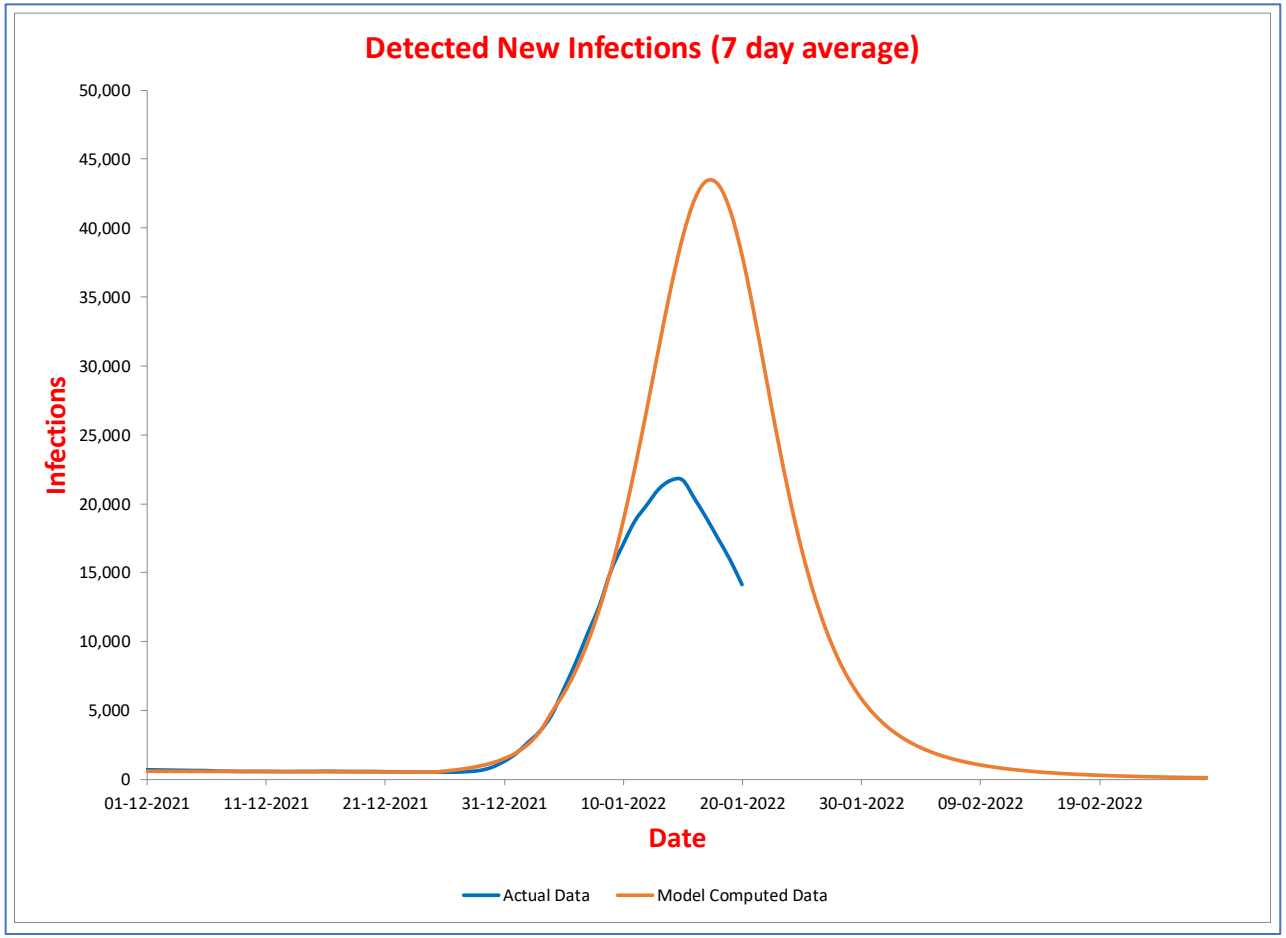


- Peak on 21st Jan
- Phase change from 12th Jan

$\beta = 0.69 \pm 0.19$ to 2.37 ± 1.28

$\rho = 0.84 \pm 0.03$ to 0.90 ± 0.08

West Bengal



- Peaked 15^{th} Jan (predicted: 17^{th} Jan)
- Phase change from 10^{th} Jan

$\beta = 0.31 \pm 0.01$ to 1.37 ± 0.44

$\rho = 0.96 \pm 0.01$ to 0.94 ± 0.10