

Model-based Nowcasting

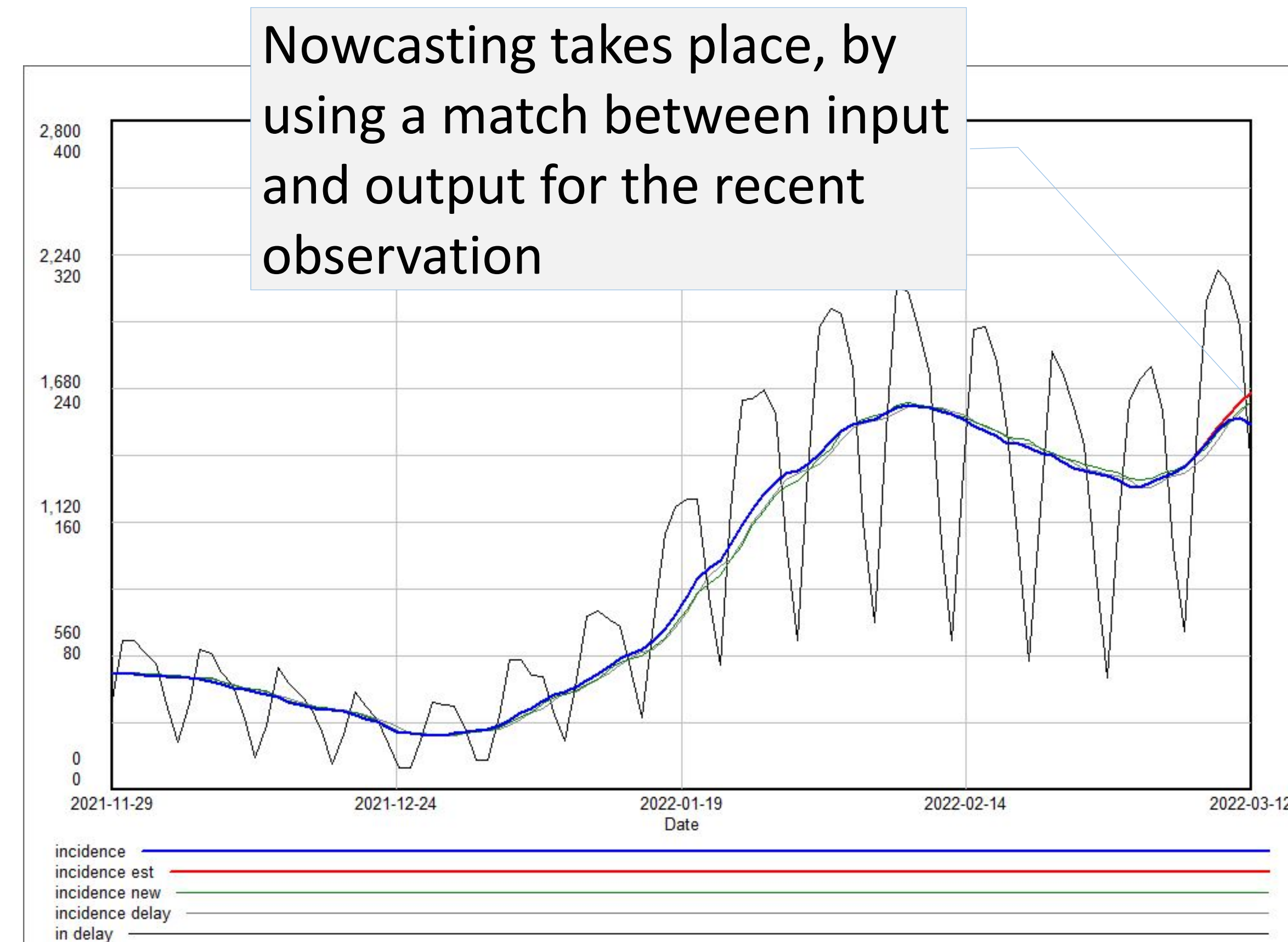
Bo Hu^{1,2}, Michael Woywadt², Holger Krischen²
¹UniBw Munich, D-85577 Neubiberg, Germany, bo.hu@unibw.de
²Horus Advisory Group, D-82211 Herrsching, Germany

Nowcasting

Nowcasting or as Lawless* coined it more precisely, the “adjustments for reporting delays and the prediction of occurred, but yet unreported events”, has gained considerable importance in our fast moving world. We present two of our system dynamics models showing real world nowcasting applications.

One of the key aspects of nowcasting is that the result can often be checked promptly, namely when the delay phase is over. In the applications presented, new data is available daily for the infection statistics and monthly for the construction industry. This is both a challenge and an opportunity: Parameterisations can be carried out promptly, sometimes even automated.

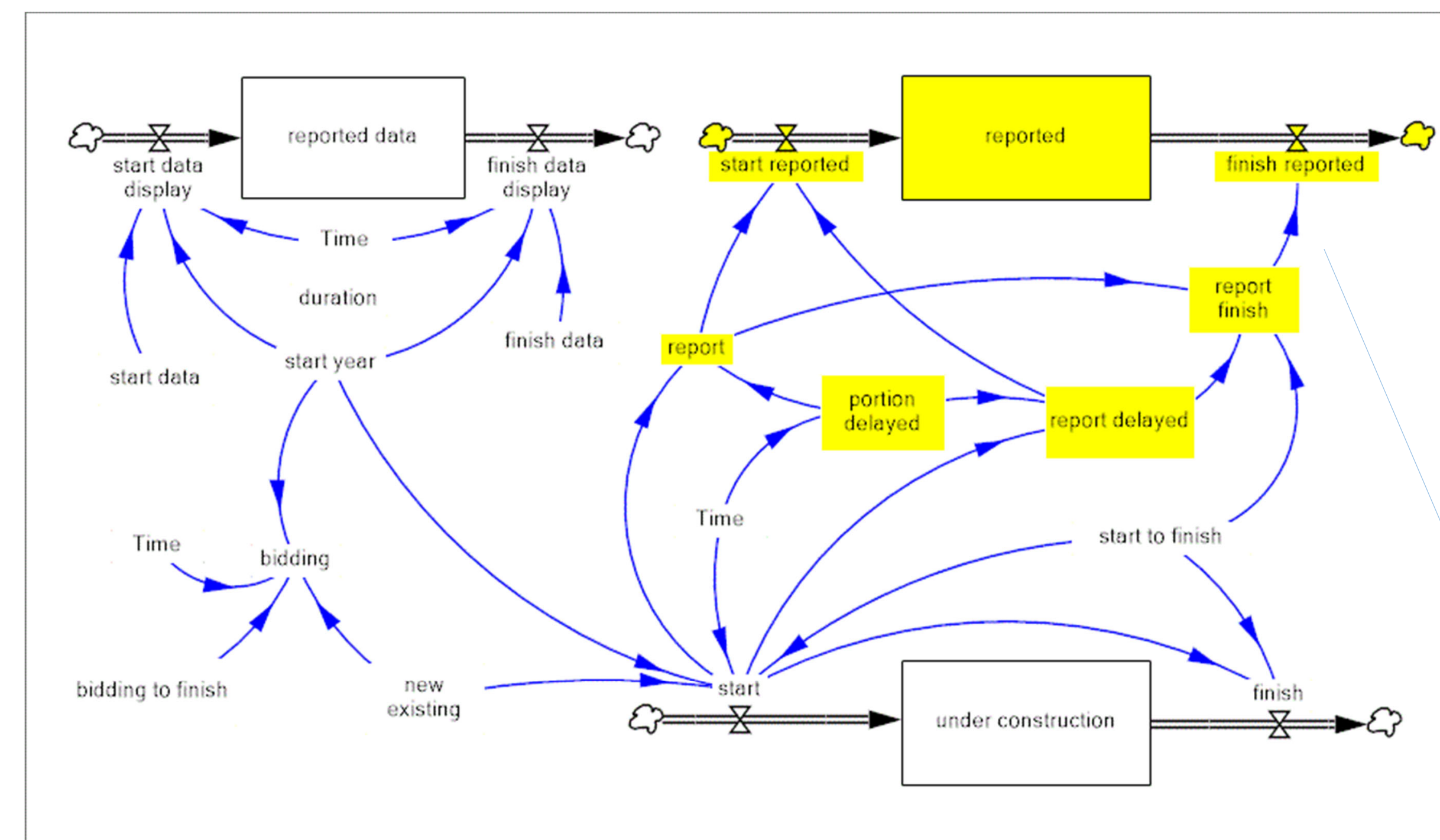
It is also relatively easy to create and further develop nowcasting models of this kind, since the treatment of delays is part of the standard repertoire of system dynamics, where both the methodology and tools are particularly suitable for rapid reactions to new challenges.



(* See Conference Record for references)

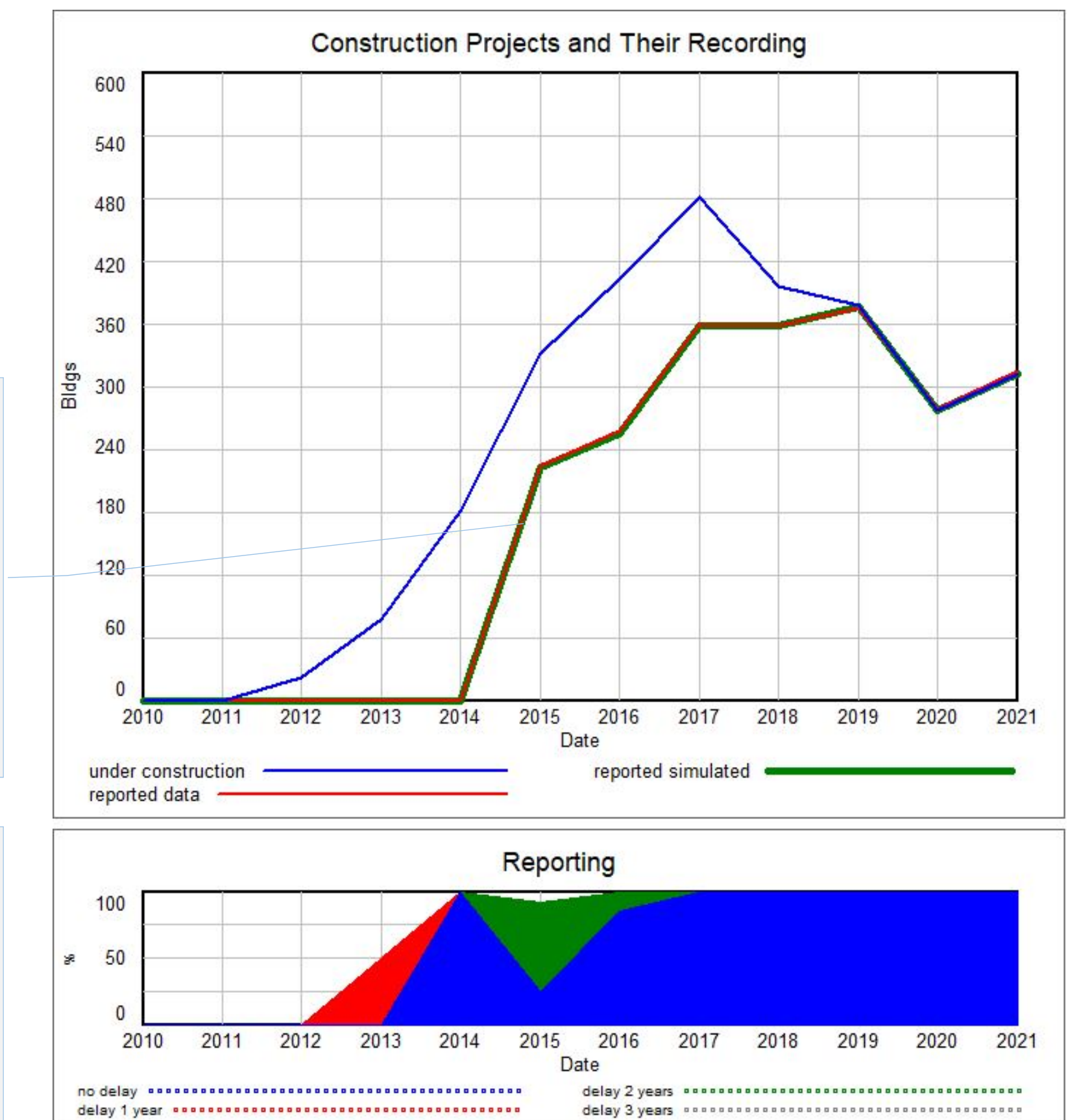
High-Rise Buildings

The 1st model covers the market observation of high-rise buildings. Based upon data of construction projects from *Emporis**, which are partly incomplete or recorded with a delay, the nowcasting model is intended to determine the real number of high-rise projects actually commencing each year.



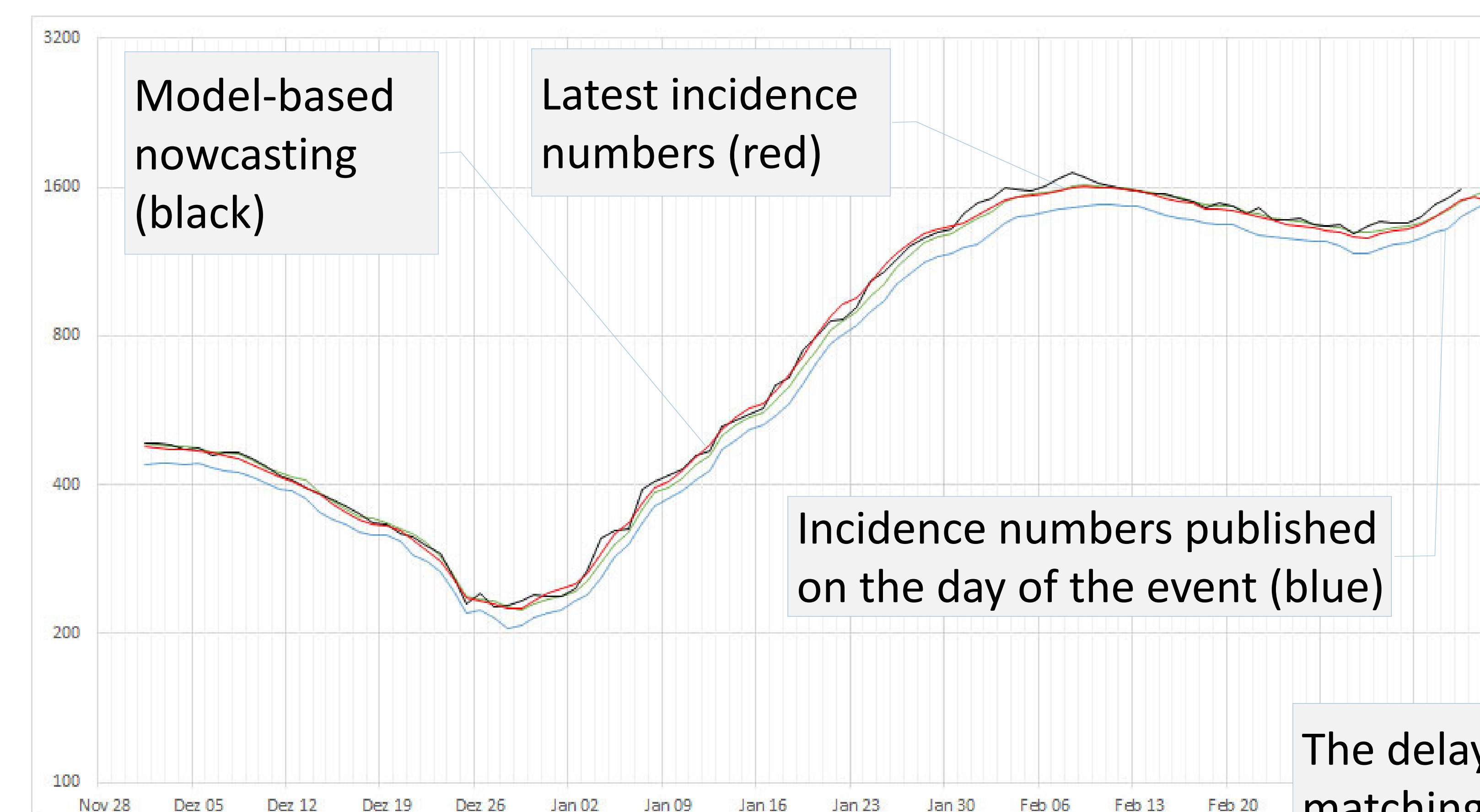
Nowcasting takes place, by using a match of input and output for the recent observation

The delay in reporting is modeled and parameterized, by matching the input and output of the delaying processes from a more distant past

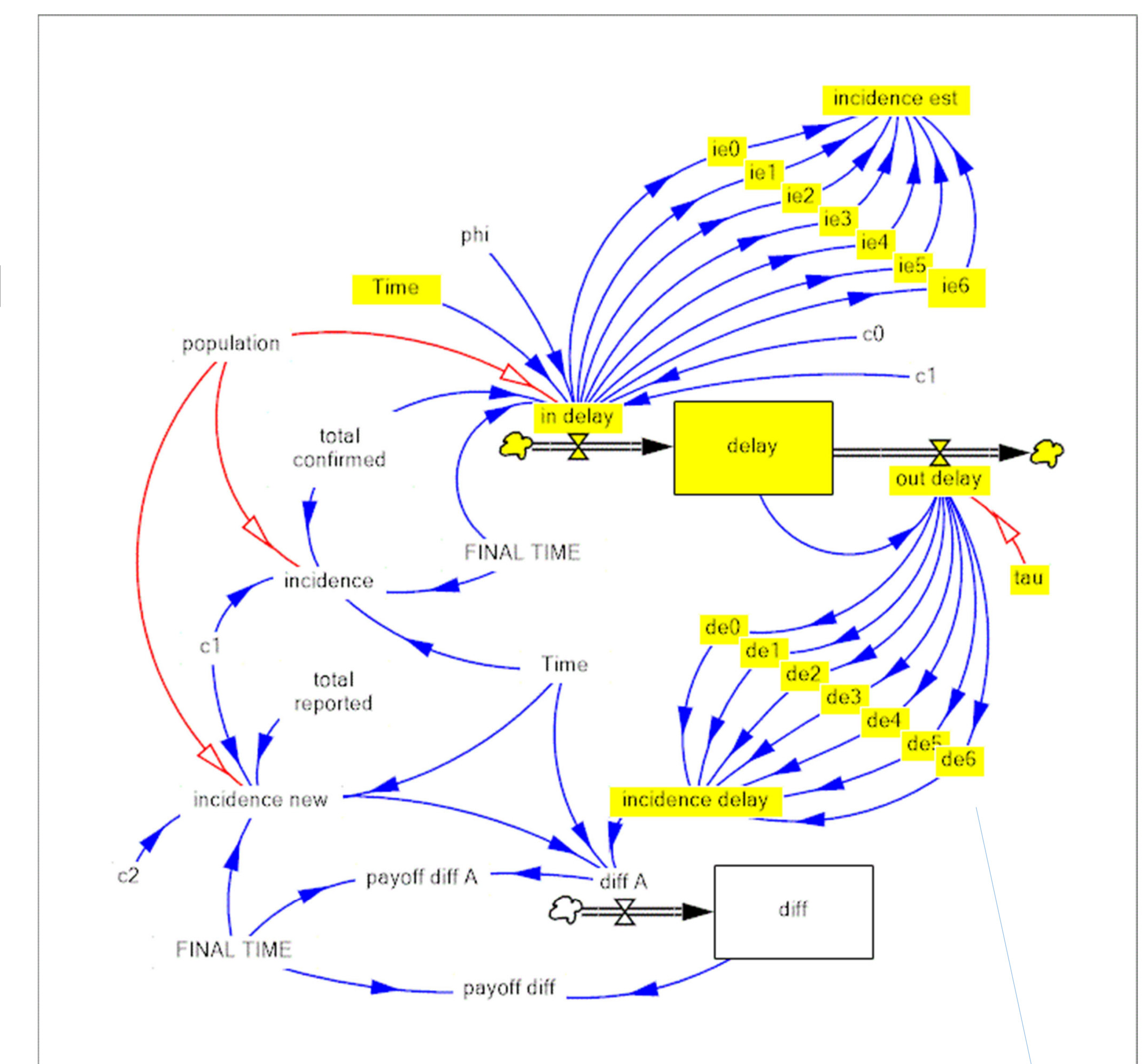


RKI Report

As of March 2020, the *Robert Koch Institute* has been publishing precise statistics* on the COVID-19 pandemic on a daily basis. Calculated 7-day-incidence numbers are also provided for Germany and for each German region, which are systematically too low on the day of the event, caused by the delay in reporting. The 2nd model aims to remedy this problem.



The delay in reporting is modeled and parameterised by matching the input and output of the delaying processes from a more distant past



References

- [1] Pierfrancesco Alaimo Di Loro, Fabio Divino, Alessio Farcomeni, Giovanna Jona Lasinio, Gianfranco Lovison, Antonello Maruotti, Marco Mingione: Nowcasting COVID-19 incidence indicators during the Italian first outbreak. *Statistics in Medicine*, John Wiley & Sons, Inc, 2021-05-06
- [2] Alexander, M., Polimis, K. & Zagheni, E.: Combining Social Media and Survey Data to Nowcast Migrant Stocks in the United States. *Popul Res Policy Rev*, 18 August 2020
- [3] Matthias an der Heiden, Osamah Hamouda: Schätzung der aktuellen Entwicklung der SARS-CoV-2- Epidemie in Deutschland – Nowcasting. *Epidemiologisches Bulletin*, Robert Koch-Institut, 23. April 2020
- [4] D’Agostino, Antonello & Giannone, Domenico & Lenza, Michele & Modugno, Michele: Nowcasting Business Cycles: a Bayesian Approach to Dynamic Heterogeneous Factor Models. *Finance and Economics Discussion Series*, 1-25, 2015
- [5] Diercke, Michaela; Claus, Hermann; Grabenhenrich, Linus; Wuensche, Hannes: SARS-CoV-2 Infektionen in Deutschland. DOI:10.5281/zenodo.4681153, Robert Koch-Institut, Berlin, 2021, https://github.com/robert-koch-institut/SARS-CoV-2_Infektionen_in_Deutschland (20.02.2022)
- [6] Duarte, P., Süßmuth, B.: Implementing an Approximate Dynamic Factor Model to Nowcast GDP Using Sensitivity Analysis. *J Bus Cycle Res*, 14: 127–141, 2018
- [7] EMPORIS - Provider of international skyscraper and high-rise building data. *emporis.com*, 2020, <https://www.emporis.com/> (2014-2020)
- [8] Giannone, Domenico ; Reichlin, Lucrezia ; Small, David: Nowcasting: The real-time informational content of macroeconomic data. *Journal of monetary economics*, Vol.55 (4): 665-676, ISSN 0304-3932, Elsevier B.V, 2008
- [9] Felix Günther, Andreas Bender, Katharina Katz, Helmut Küchenhoff, Michael Höhle: Nowcasting the COVID-19 pandemic in Bavaria. *Biometrical Journal*, Vol.63 (3): 490, ISSN 0323-3847, John Wiley & Sons, Inc, 2020-12-01
- [10] Hu B, Dehmer M, Emmert-Streib F, Zhang B: Analysis of the real number of infected people by COVID-19: A system dynamics approach. *PLoS ONE*, 16(3): e0245728, 18.03.2021
- [11] Hutter, C.: A new indicator for nowcasting employment subject to social security contributions in Germany. *J Labour Market Res*, 54.4, 30 June 2020
- [12] Knotek, Edward S ; Zaman, Saeed: Nowcasting U.S. Headline and Core Inflation. *Journal of money, credit and banking*, Vol.49 (5): 931-968, ISSN 0022-2879, Wiley Subscription Services, Inc, 2017-08
- [13] Lawless, J.F: Adjustments for reporting delays and the prediction of occurred but not reported events. *Canadian journal of statistics*, Vol.22 (1): 15-31, ISSN 0319-5724, 1994-03
- [14] Navicke, J., Rastrigina, O. & Sutherland, H.: Nowcasting Indicators of Poverty Risk in the European Union: A Microsimulation Approach. *Soc Indic Res*, 119: 101–119, 31 October 2013
- [15] Angela Noufaily, Yonas Ghebremichael-Weldeselassie, Doyo Gagn Enki, Paul Garthwaite, Nick Andrews, André Charlett and Paddy Farrington: Modelling reporting delays for outbreak detection in infectious disease data. *Journal of the Royal Statistical*

Society. Series A (Statistics in Society), Vol. 178, No. 1: 205-222, Wiley for the Royal Statistical Society, January 2015

- [16] COVID-19-Dashboard. *experience.arcgis.com*, Robert Koch-Institut, 2021, <https://experience.arcgis.com/experience/478220a4c454480e823b17327b2bf1d4> (2021-2022)
- [17] Siliverstovs, B.: Assessing nowcast accuracy of US GDP growth in real time: the role of booms and busts. *Empir Econ*, 58: 7–27, 2020
- [18] Thaduri, A.: Nowcast models for train delays based on the railway network status. *Int J Syst Assur Eng Manag*, 11: 184–195, 2020
- [19] Vensim's optimizer. *vensim.com*, Ventana Systems, Inc., 2015, <https://vensim.com/optimization/> (04.03.2022)
- [20] Joseph T Wu, Kathy Leung, Gabriel M Leung: Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study. *The Lancet*, 31.01.2020
- [21] Zhao, Y., Xu, Q., Chen, Y., Tsui, K.: Using Baidu index to nowcast hand-foot-mouth disease in China: a meta learning approach. *BMC Infect Dis*, 18: 398, 2018/08/13