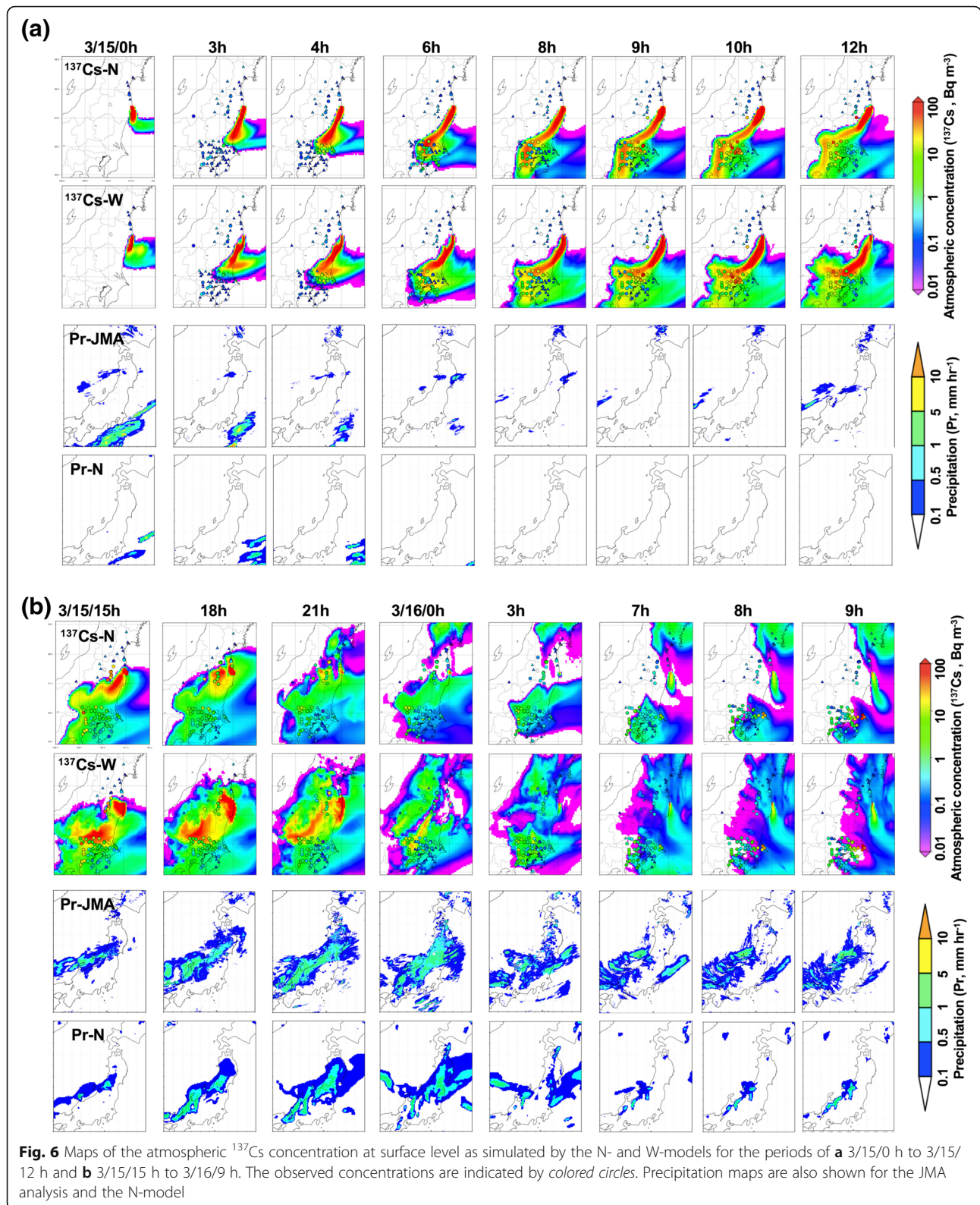


Fig. 5 Comparison of the atmospheric ^{137}Cs (Bq m^{-3}) for events on 15 March, 12:00 and 21 March, 9:00, as estimated by the NICAM-SPRINTARS model (N; **a, c**) and the WRF-CMAQ model (W; **b, d**). Observed values are indicated by *color-coded circles* (Bq m^{-3}); *triangles* indicate data below the detection limit (0.1 Bq m^{-3}) of SPM measurements

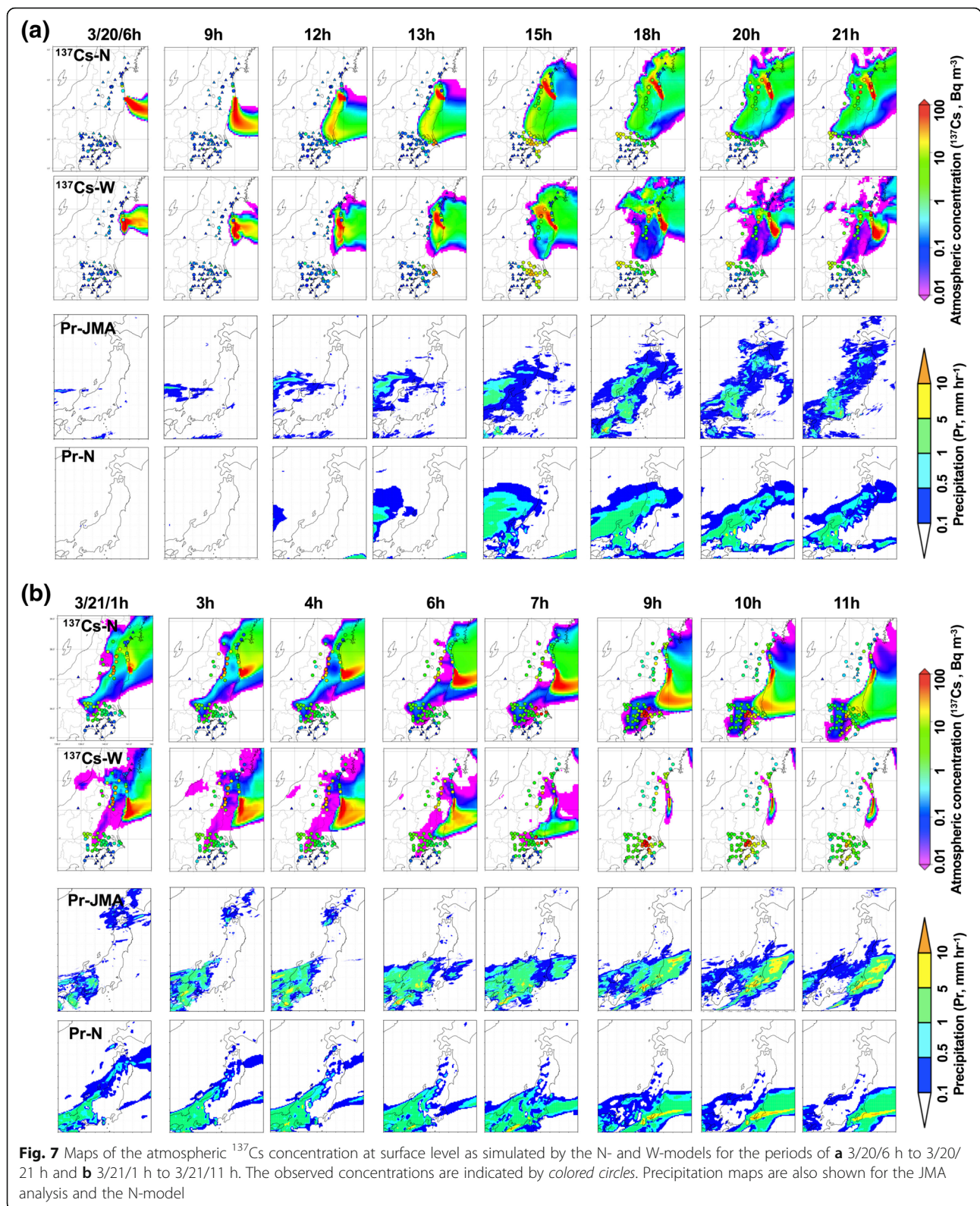
prevailed at the northern edge of the low-pressure system until 9:00, replacing the southwesterly wind associated with the high-pressure system of the previous day (not shown). This northeasterly wind transported radioactive material from the FDNPS southward to form plume P2, departing from the FDNPS at midnight and arriving at the Kantou region around 4:00 (Fig. 6a, panel 4:00), at which point the concentration exceeded

several Bq m^{-3} , according to observations by the SPM network. Figure 6a, panels 0:00 to 4:00, indicates that the arrival time and location of the tongue of simulated plume P2 appear to be consistent with the observed concentrations shown by color-coded circles. The model simulation of plume transportation was relatively easy in this early phase during which there was no precipitation.



Simulation results of the maximum stage of plume P2 in the Kantou region is, however, different from the SPM observations; a thick simulated plume as large as

tens of Bq m⁻³ arrived around 6:00 at the Saitama, Tokyo, and Kanagawa prefectures (Fig. 6a, panels 6:00 to 9:00, and Fig. 9a, b), whereas the observed data did not



show an increase to more than 10 Bq m^{-3} until 9:00, indicating a later arrival. Such a large difference in the arrival time of the plume cannot be explained by model errors,

given that there were relatively simple meteorological conditions with a dry process, and the N- and W-models had similar results, as shown in Fig. 6a, panels 0:00 to 9:00.

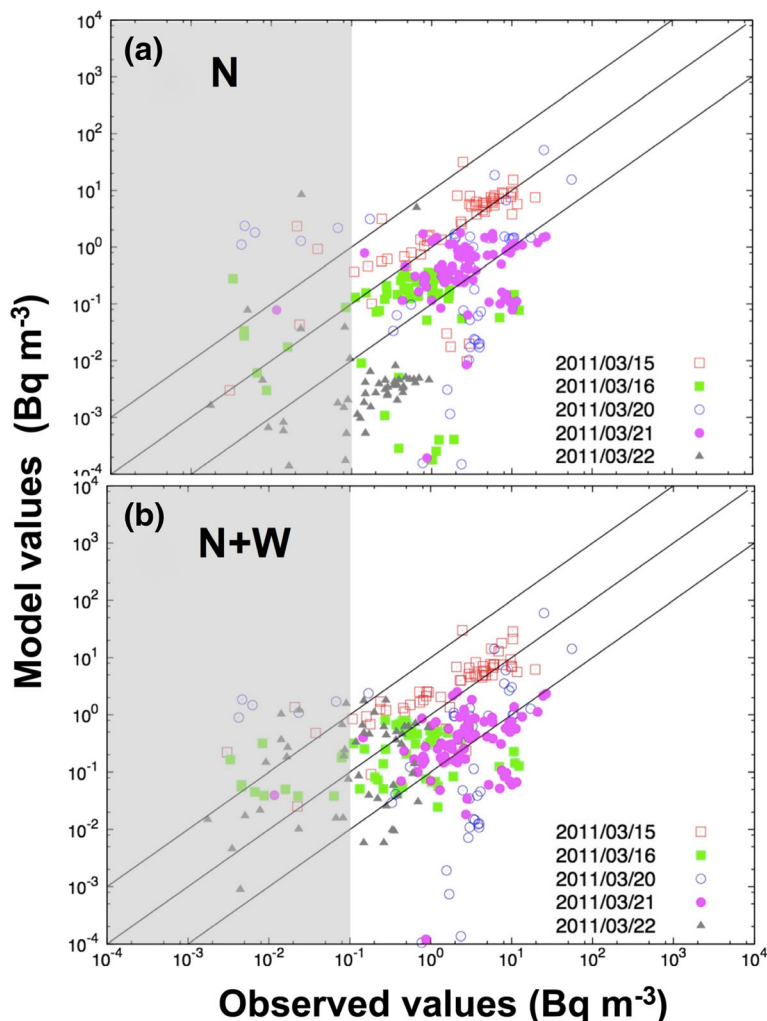


Fig. 8 Scatter plots of the observed atmospheric ^{137}Cs concentration (Bq m^{-3}) and the values obtained by the N-model and the two-model ensemble mean (**a, b**). The area in which the data was below the detection limit (0.1 Bq m^{-3}) is shaded

One possible cause of this is the large emission from FDNSP around 22:00 on 14 March, in the emission scenario of Terada et al. (2012). Figure 1 shows that the updated scenario of Katata et al. (2015), on the other hand, suggests a large emission occurred later, around 1:00 on 15 March. To investigate this possibility, Fig. 10 shows the simulation results of the N-model for the scenario of Terada et al. (2012) and that of Katata et al.

(2015). It can be seen in the figure that with the scenario of Katata et al. (2015), the high-concentration area in the Kantou region, becomes smaller and is more consistent with the observations.

Table 1 Daily correlation coefficients between observed and simulated ^{137}Cs concentrations based on N-model, W-model, and two-model ensemble (N + W) results for ^{137}Cs

Day (JST)	N	W	N + W
2011/3/15	0.51	0.52	0.55
2011/3/20	0.57	0.50	0.55
2011/3/21	0.36	0.37	0.44
Average	0.48	0.46	0.51

The observed high-concentration area of plume P2 gradually spread from 9:00 to 12:00 in the Central Tokyo area, which is similar to simulations that show that the plume slightly shifted to the east, as shown in Fig. 6a, panels 9:00 to 12:00. Figure 9c shows that the ensemble model cannot account for this shift of the high-concentration area, but the emission scenario of Katata et al. (2015) gives a better result (Fig. 10). The SPM data suggest that dissipation of the P3 plume occurred during the evening of 15 March through the morning of 16 March, as shown in Fig. 6, panels 3/15/15:00 to 3/16/7:00, and Fig. 9d, e. The N-model adequately simulated the timing and distribution of the plume dissipation following a reduction in the transport of radioactive