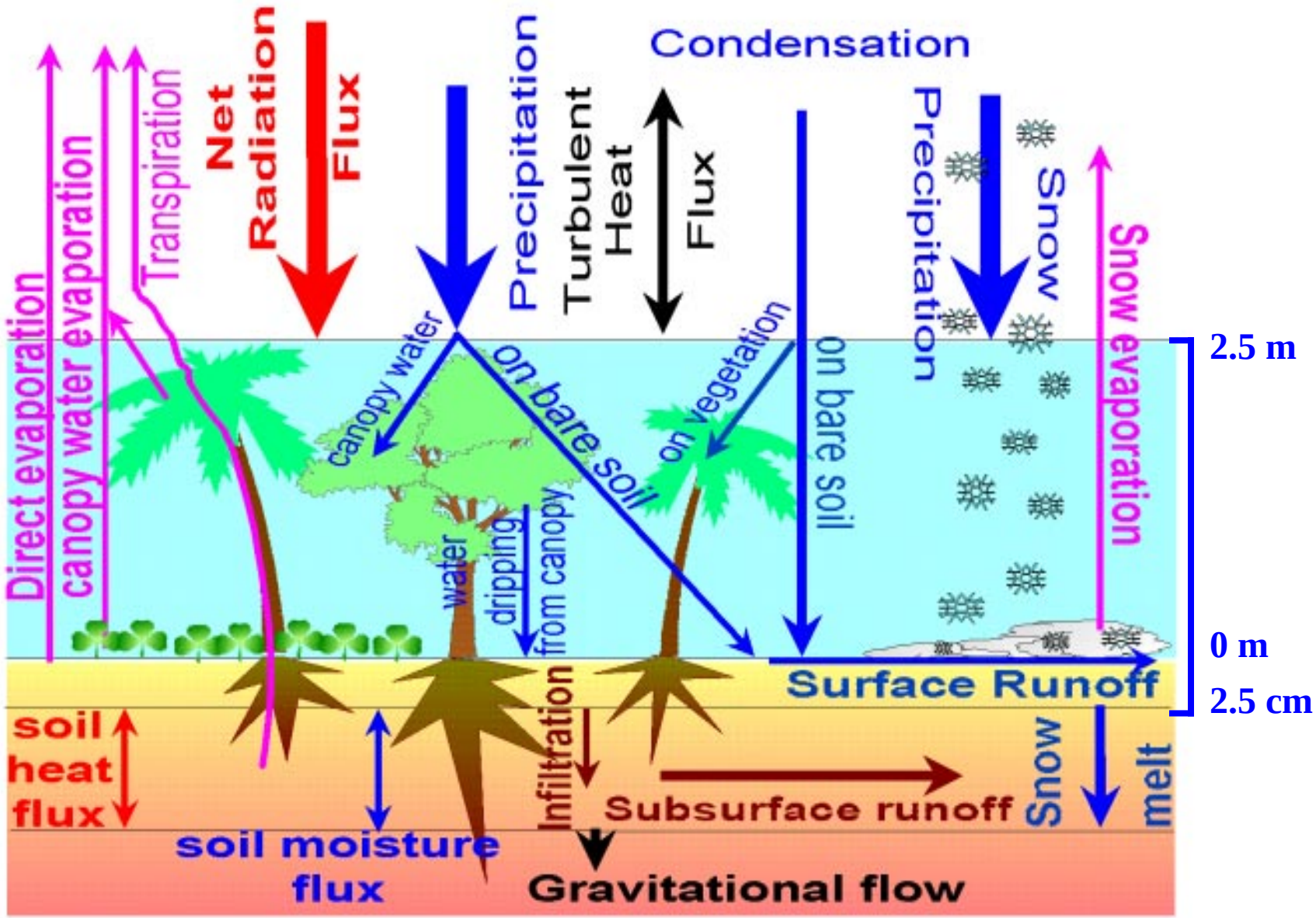


5 levels in soil below surface: 5, 20, 40, 160 and 300 cm

Figure 1. A summary of the processes in the MAPS/RUC soil/snow/vegetation scheme.

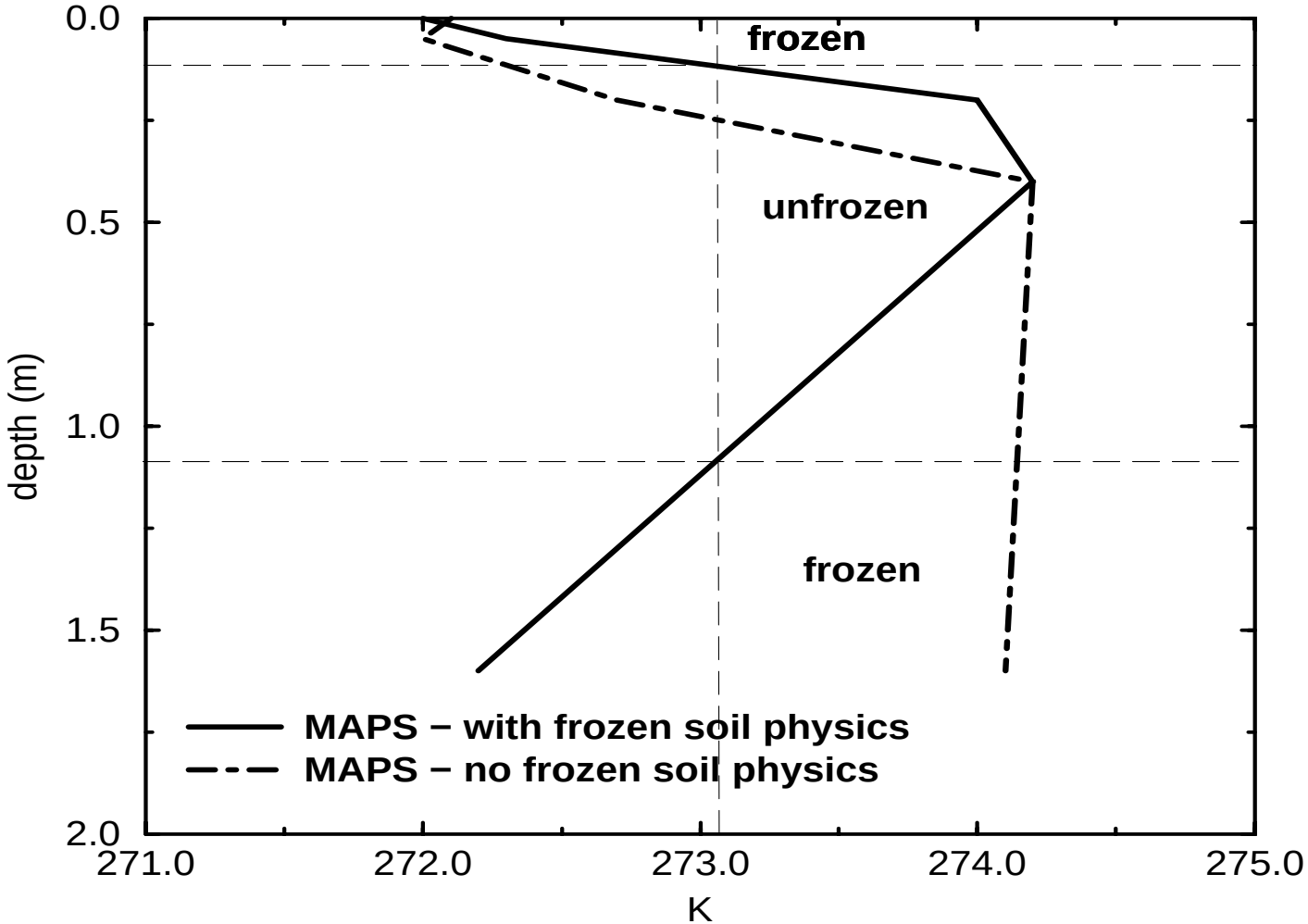
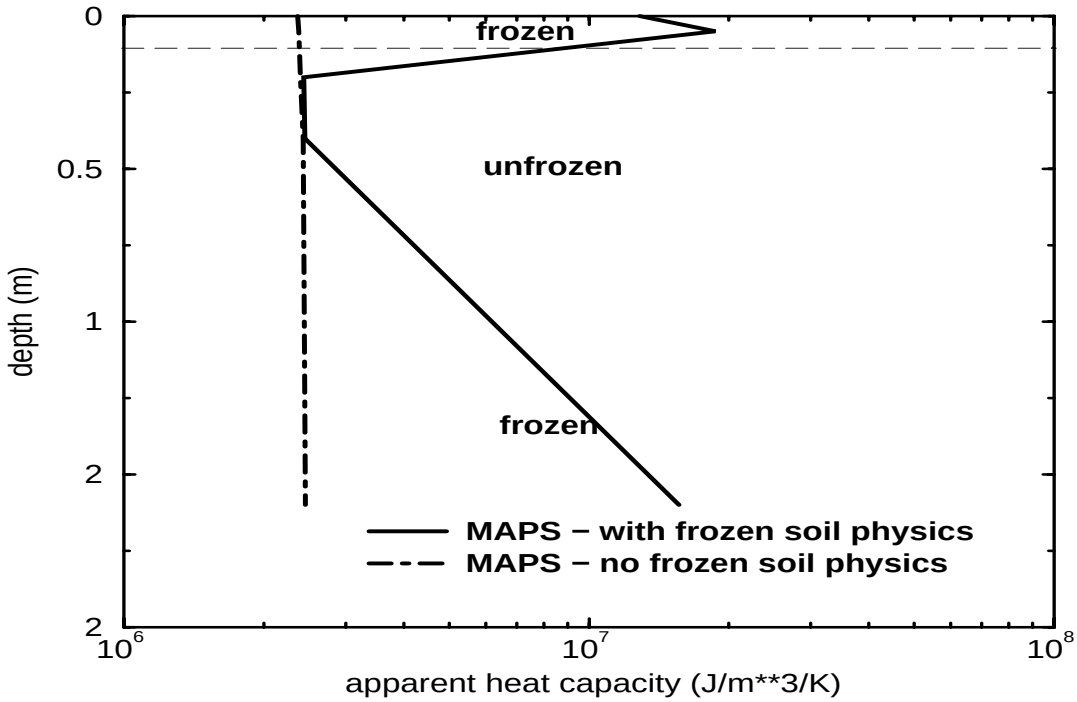


Figure 2. Soil temperature profiles simulated by MAPS with parameterization of frozen soil physics (solid line), and without parameterization of frozen soil physics (dot-dashed line). 15 April 1981, Valdai, Russia.

a



b

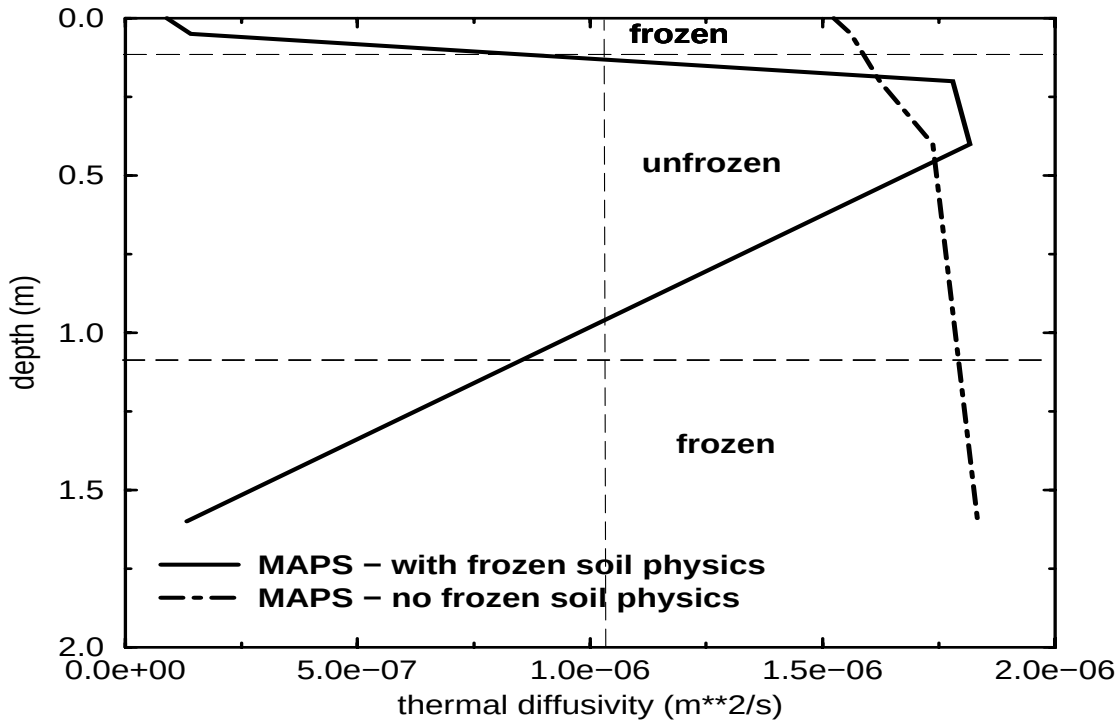


Figure 3. Profiles simulated by MAPS 1-D land-surface model with parameterization of frozen soil physics (solid line) and without (dot-dashed line) for (a) Apparent heat capacity, and (b) thermal diffusivity. 15 April 1981, Valdai, Russia

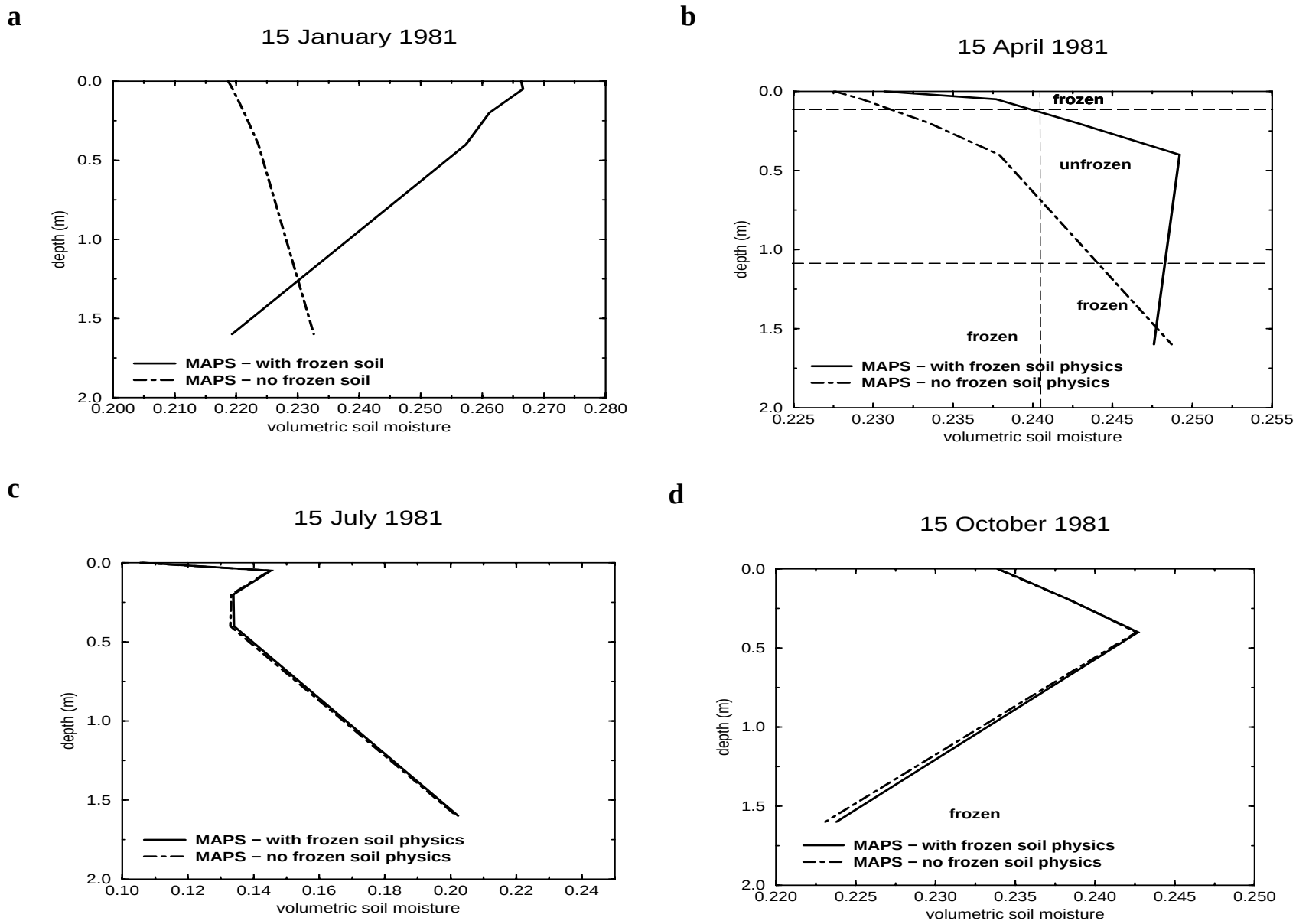
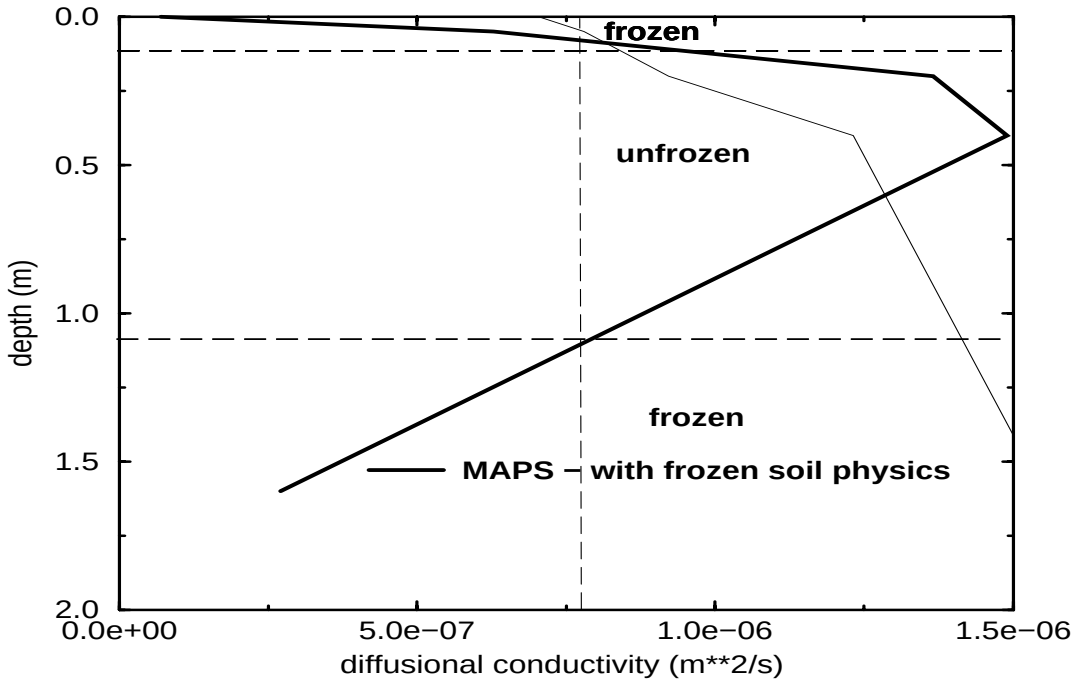


Figure 4. Volumetric soil moisture content profiles simulated by MAPS with parameterization of frozen soil physics 1(solid line) and without (dot-dashed line) for (a) 15 January, (b) 15 April, (c) 15 July, and (d) 15 October for 1981, Valdai, Russia.

a



b

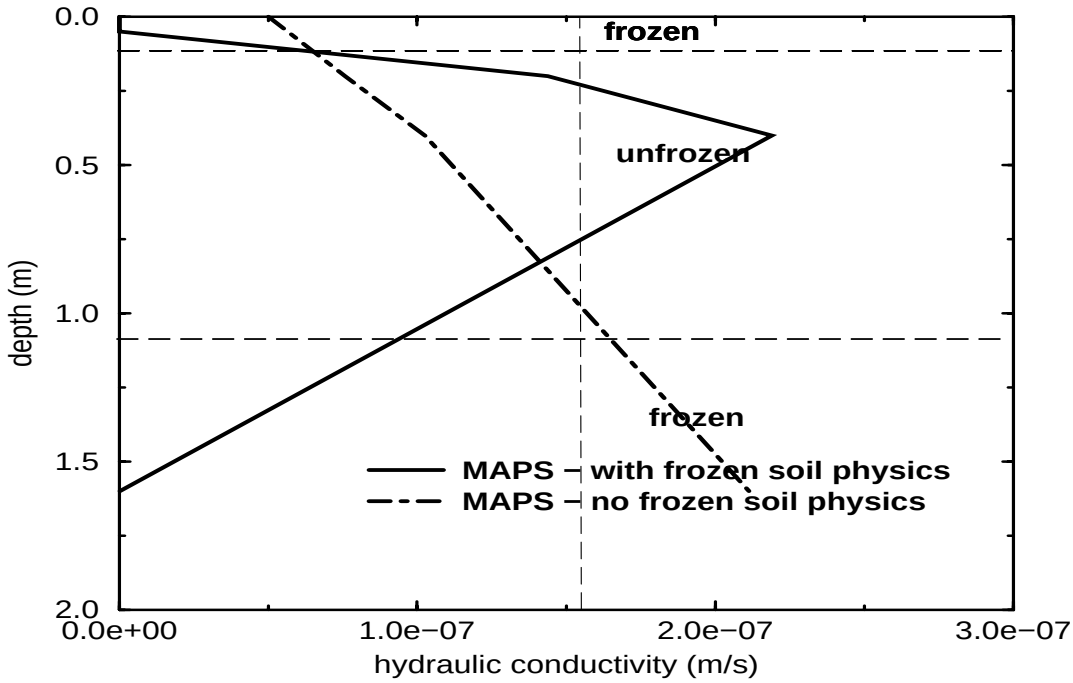


Figure 5. Profiles simulated by MAPS with parameterization of frozen soil physics (soilid line) and without (dot-dashed line) for (a) Diffusional conductivity, and (b) hydraulic conductivity. 15 April 1981, Valdai, Russia

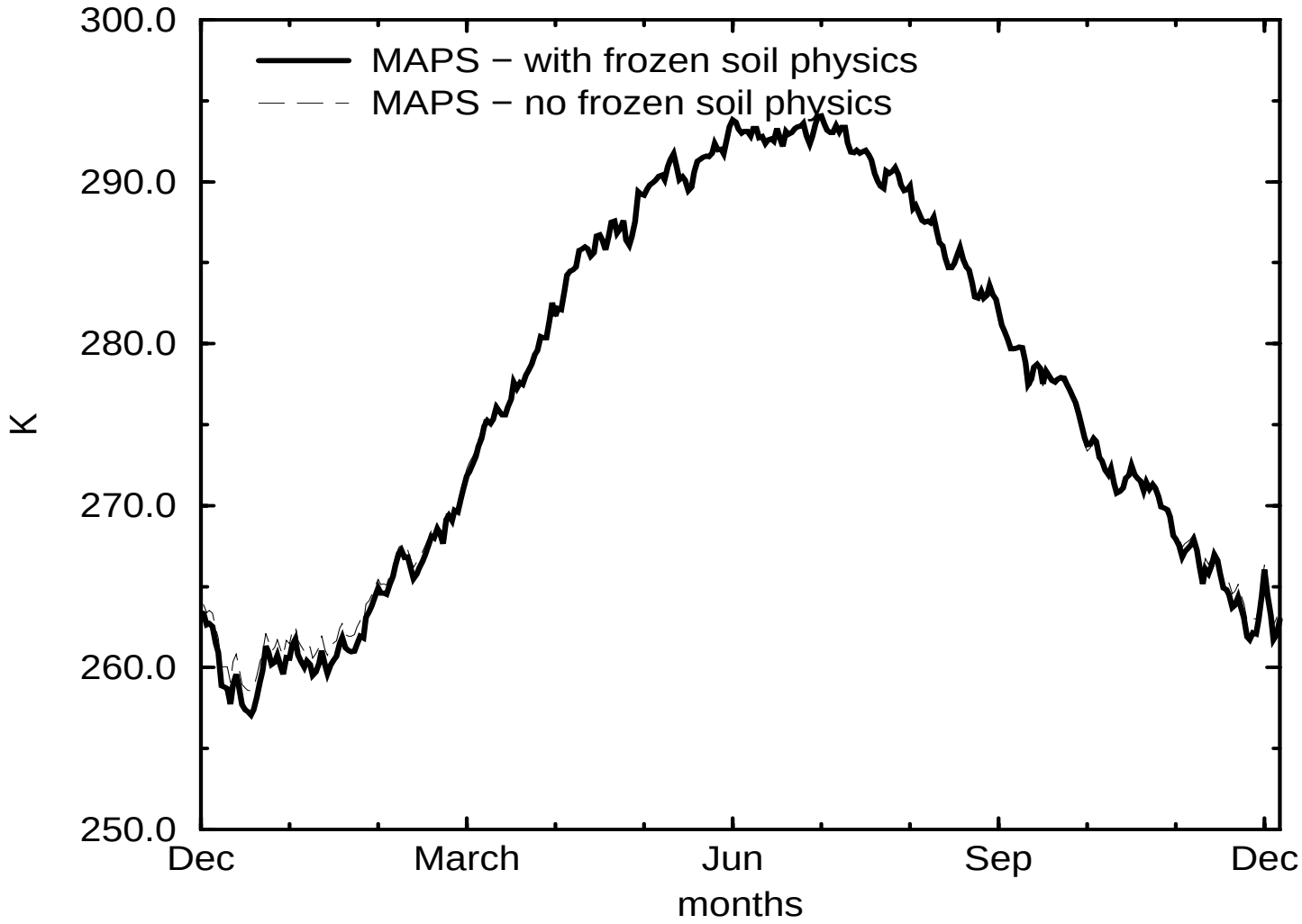


Fig. 6a. Annual variation of variables averaged in MAPS simulations over 18-year period for Valdai, Russia. (a) Skin temperature.

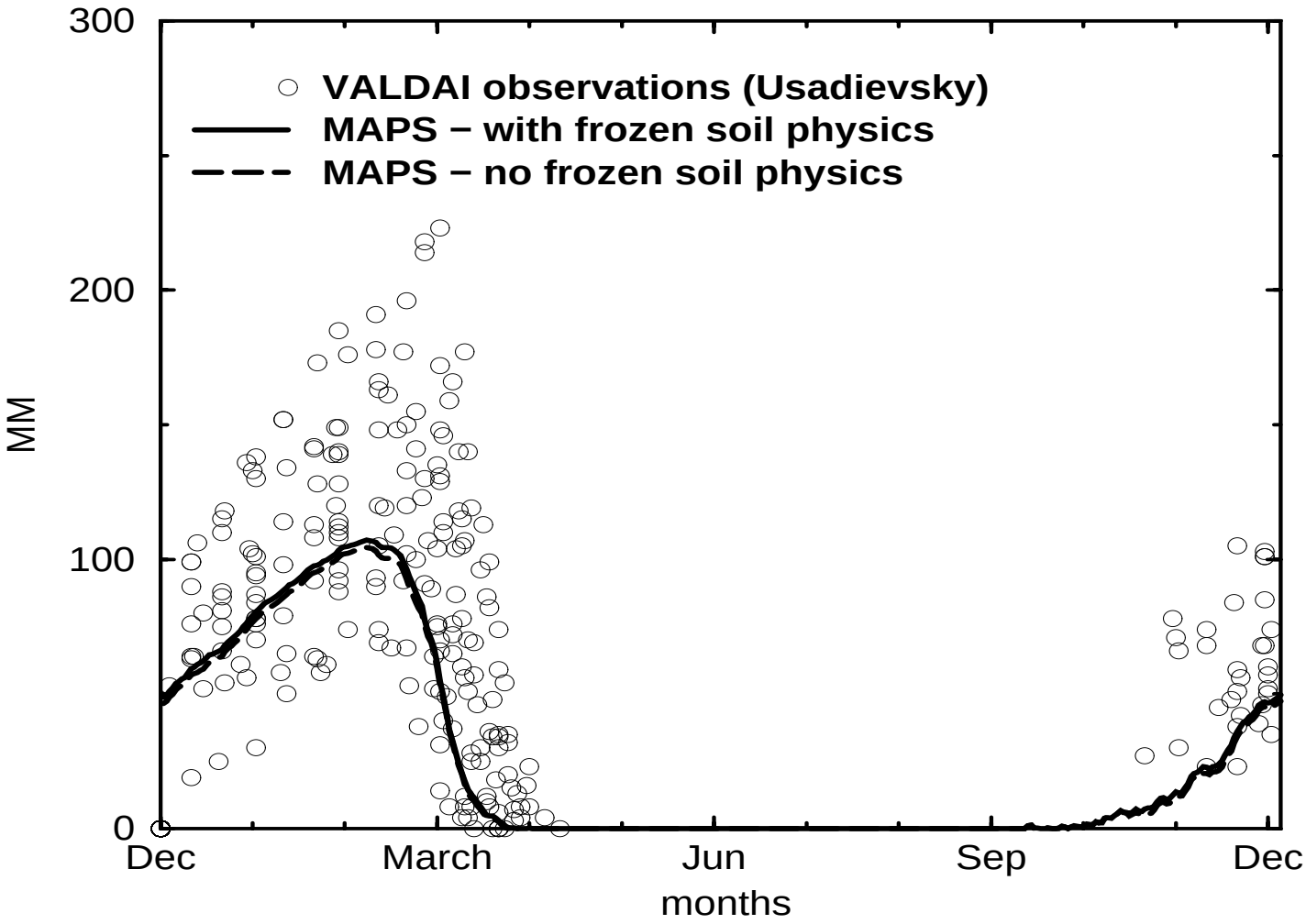


Fig. 6b. Annual variation of variables averaged in MAPS simulations over 18-year period for Valdai, Russia. (b) Snow water equivalent.

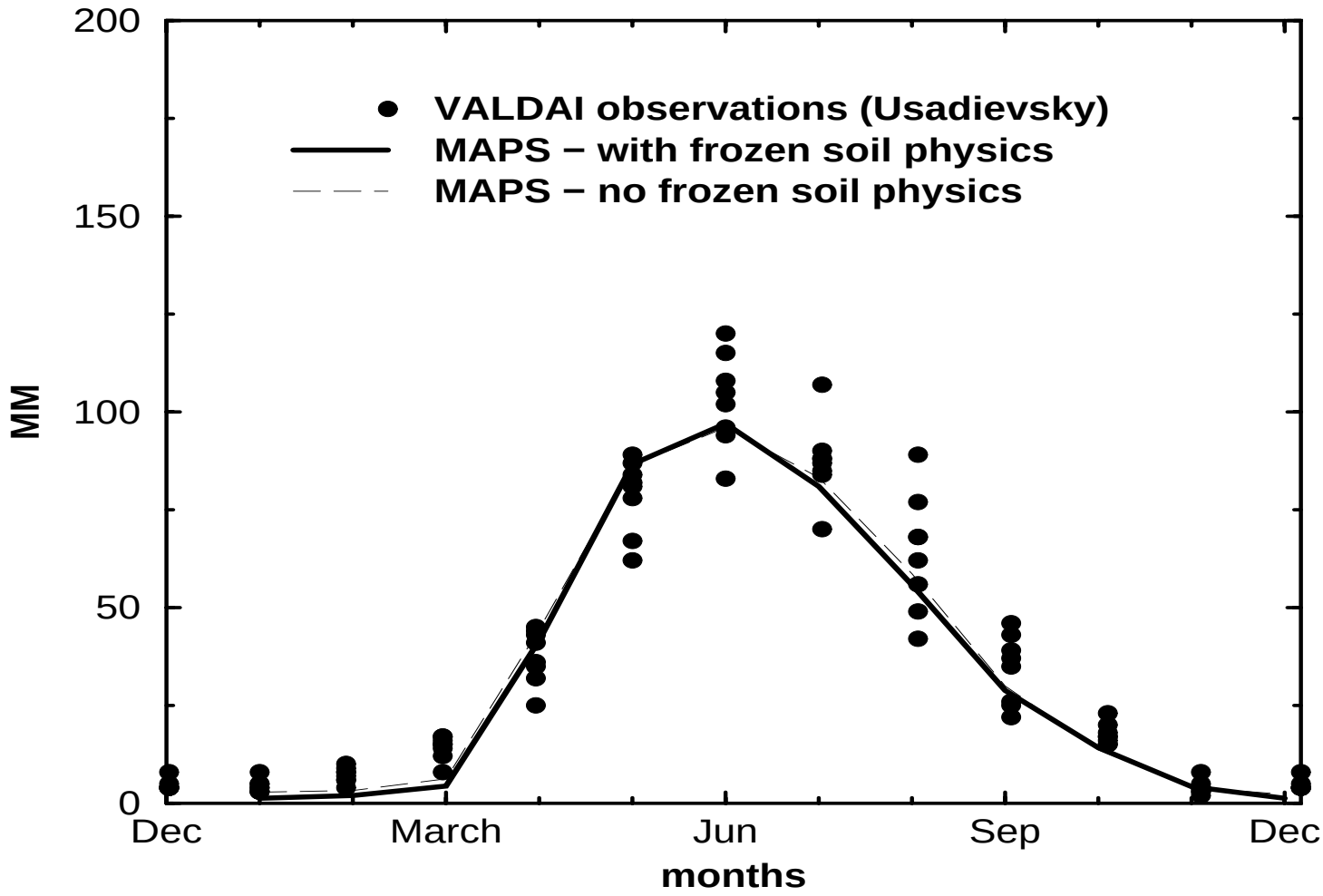


Fig. 6c. Annual variation of variables averaged in MAPS simulations over 18-year period for Valdai, Russia. (c) Monthly accumulated total evaporation.

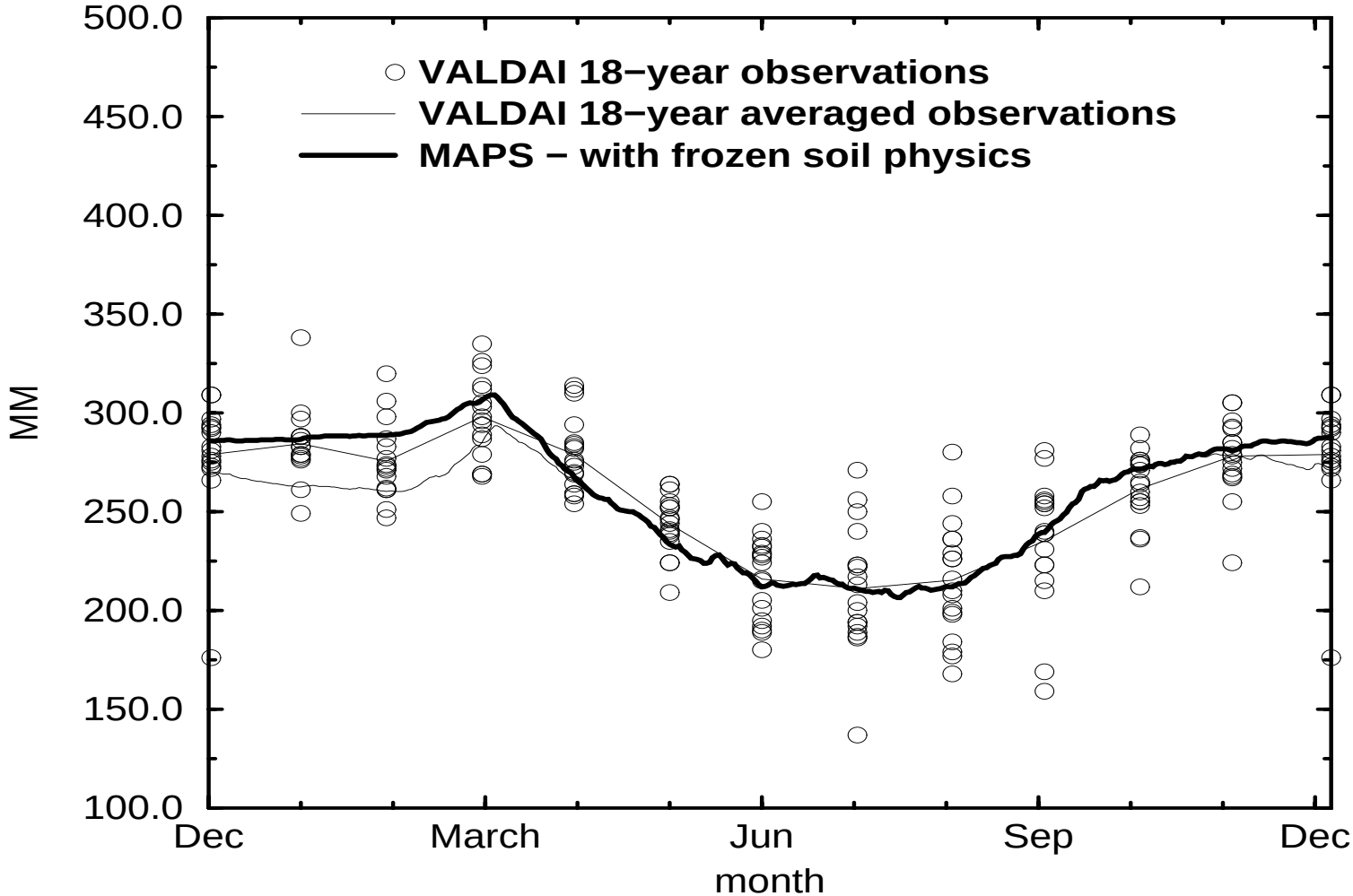


Fig. 6d. Annual variation of variables averaged in MAPS simulations over 18-year period for Valdai, Russia. (d) Soil moisture content in the top 1-m layer.

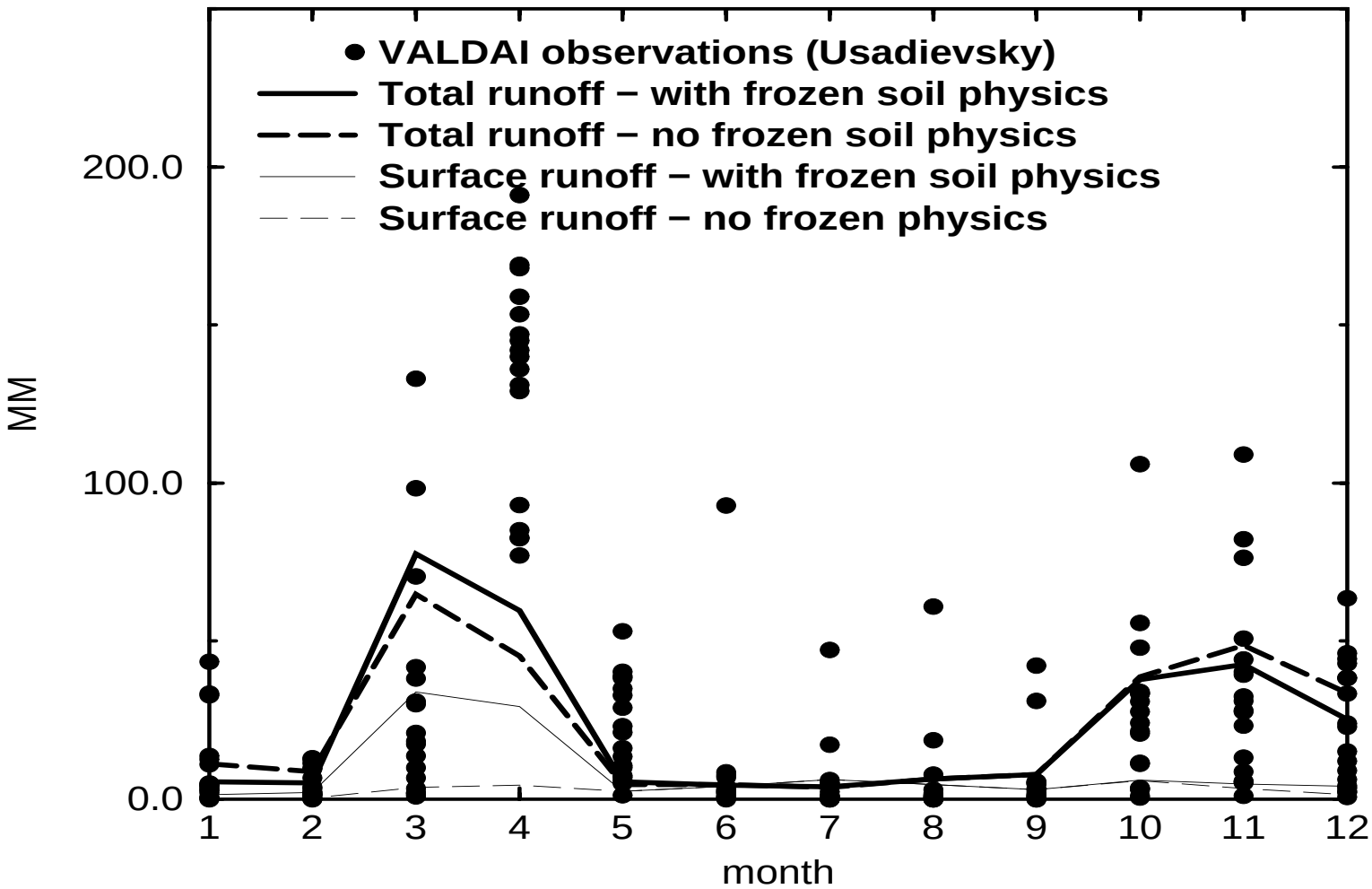


Fig. 6e. Annual variation of variables averaged in MAPS simulations over 18-year period for Valdai, Russia. (e) Total and surface runoff.

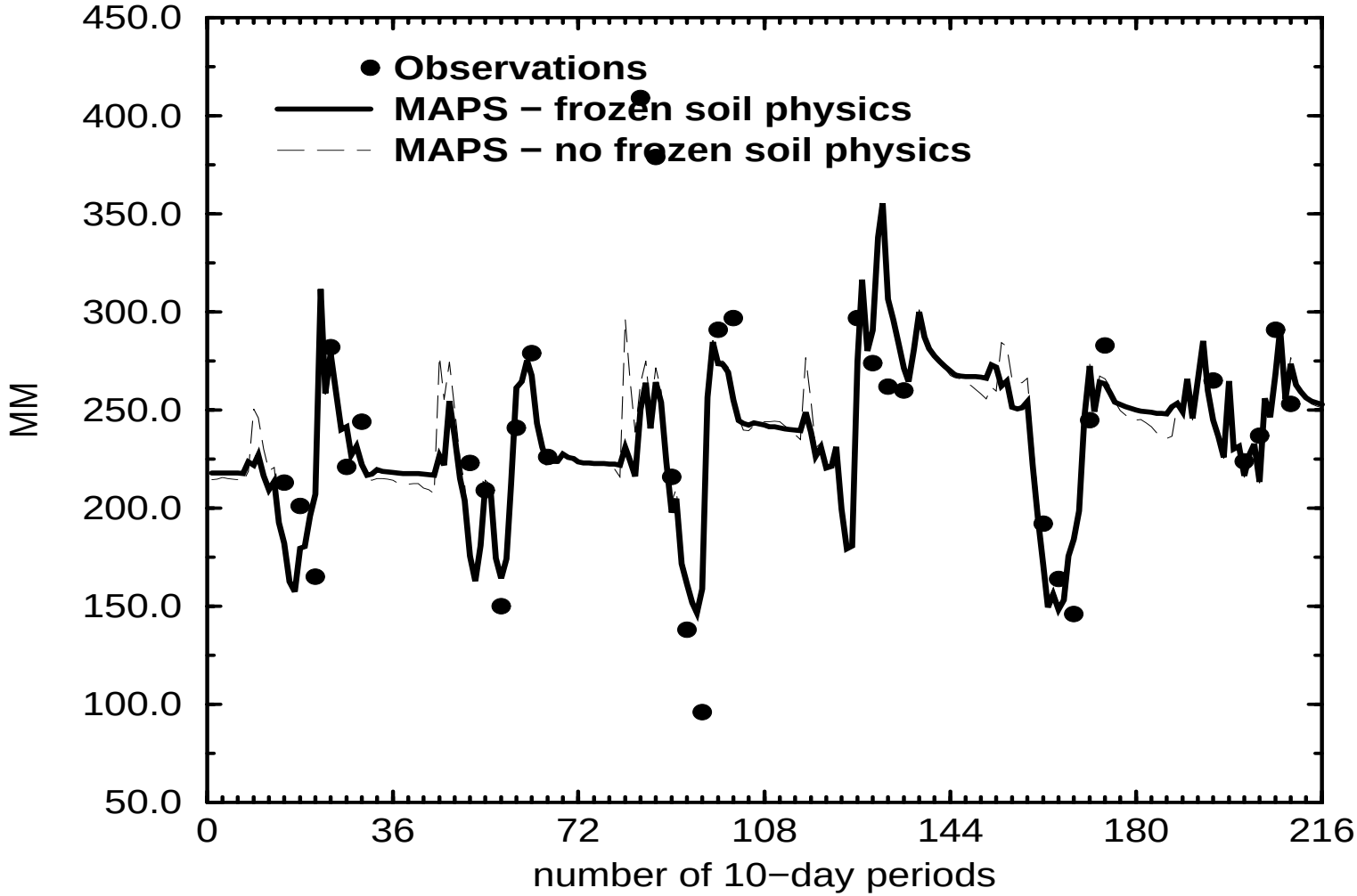


Fig. 7a. Observed and MAPS simulated soil moisture in top 1-m layer of soil (mm) for six stations. (e) Khabarovsk, Russia, 1978-1983.

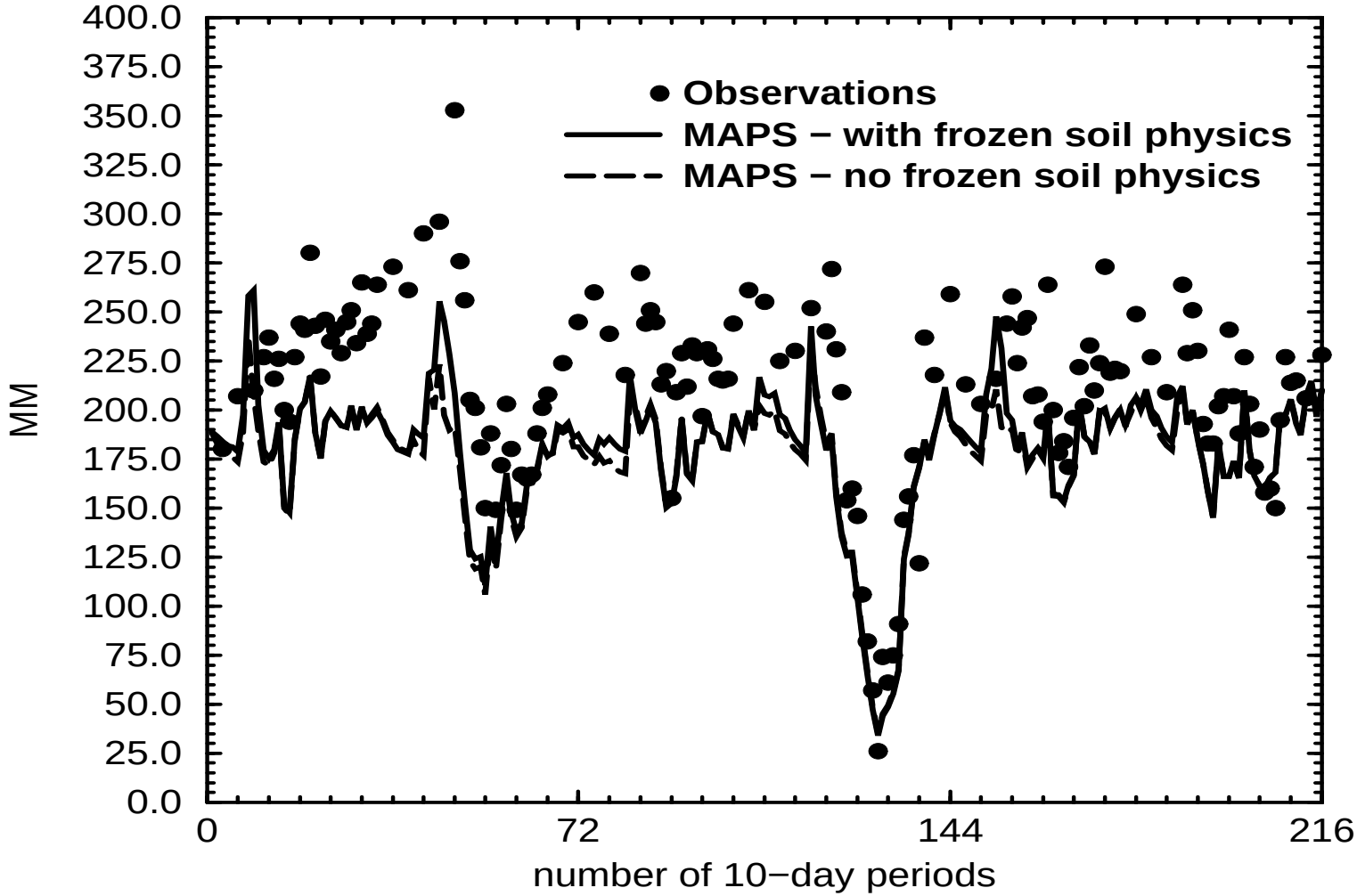


Fig. 7b. Observed and MAPS simulated soil moisture in top 1-m layer of soil (mm) for six stations. (b) Kostroma, Russia, 1978-1983.

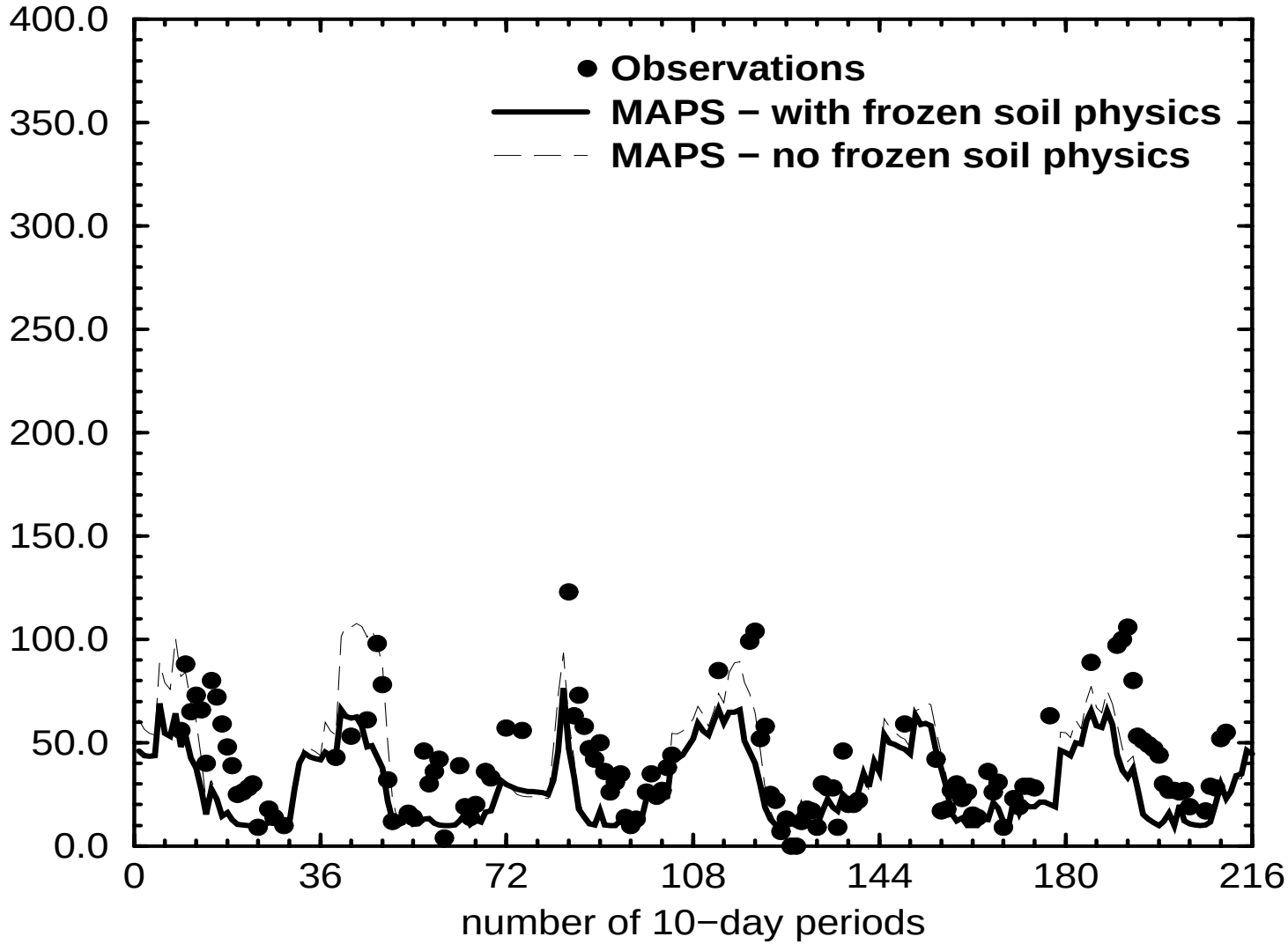


Fig. 7c. Observed and MAPS simulated soil moisture in top 1-m layer of soil (mm) for six stations. (c) Uralsk, Kazakhstan, 1978-1983.

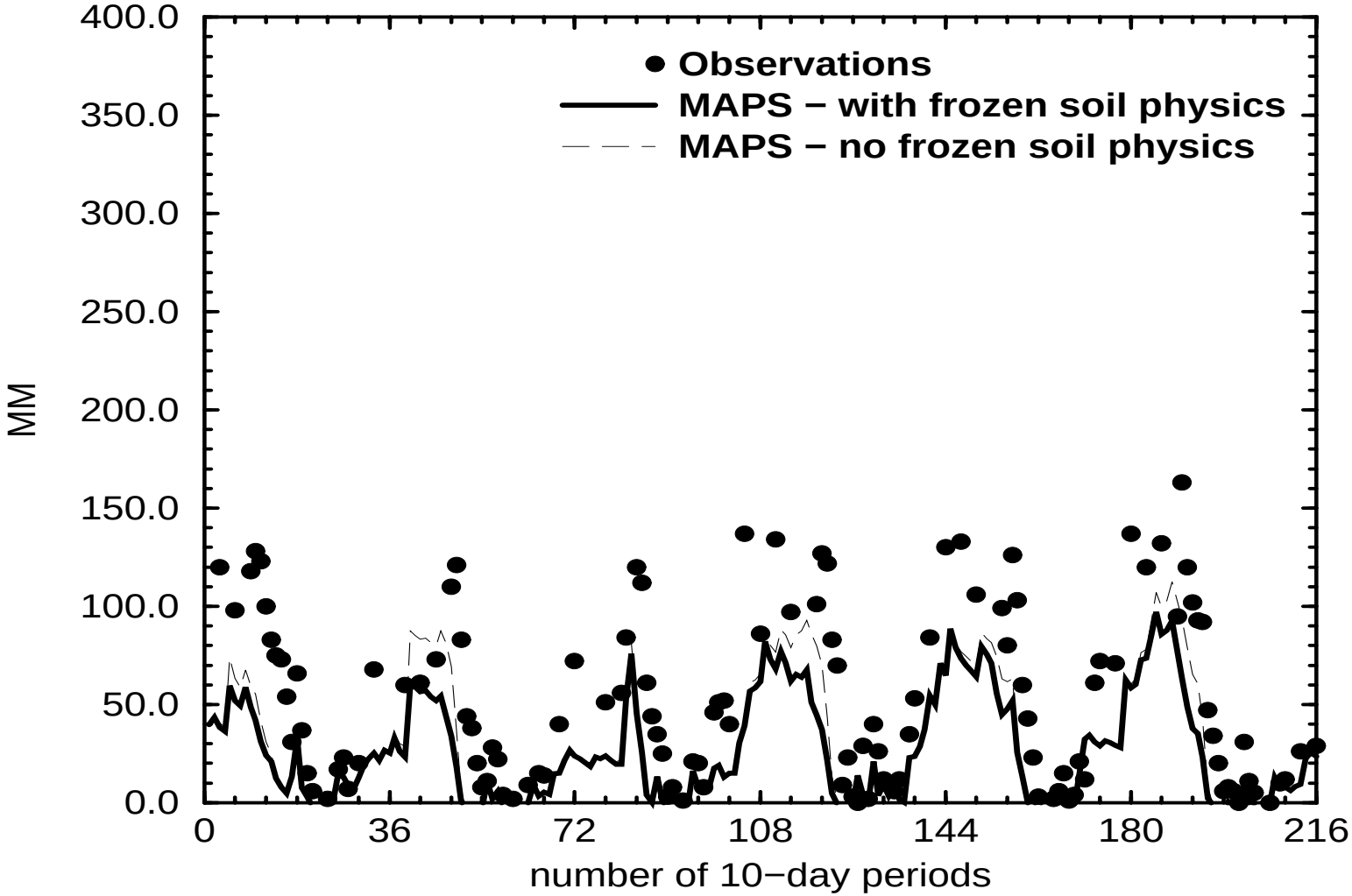


Fig. 7d. Observed and MAPS simulated soil moisture in top 1-m layer of soil (mm) for six stations. (d) Yershov, Russia, 1978-1983.

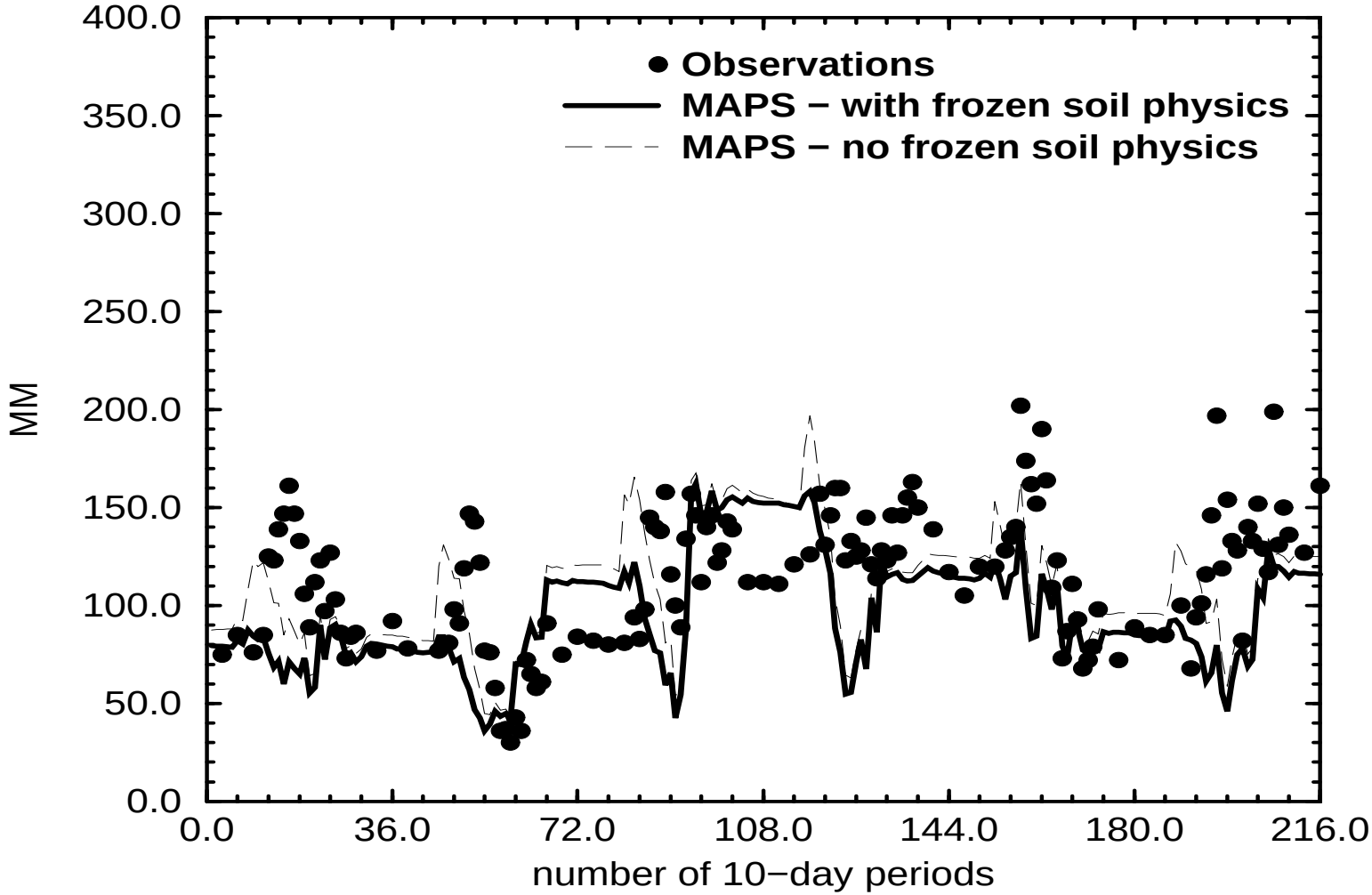


Fig. 7e. Observed and MAPS simulated soil moisture in top 1-m layer of soil (mm) for six stations. (e) Tulun, Russia, 1978-1983.

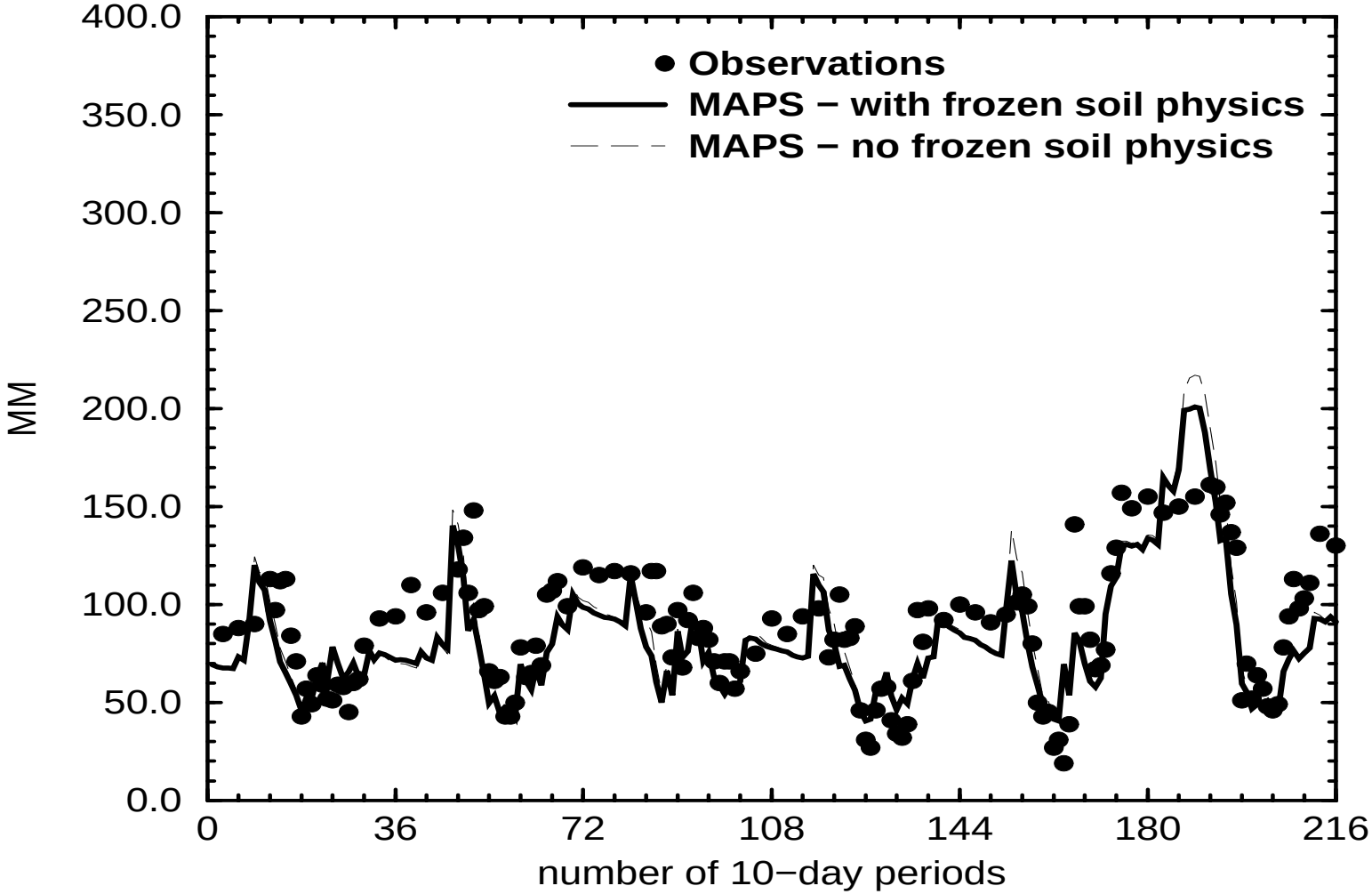


Fig. 7f. Observed and MAPS simulated soil moisture in top 1-m layer of soil (mm) for six stations. (f) Ogurtsovo, Russia, 1978-1983.

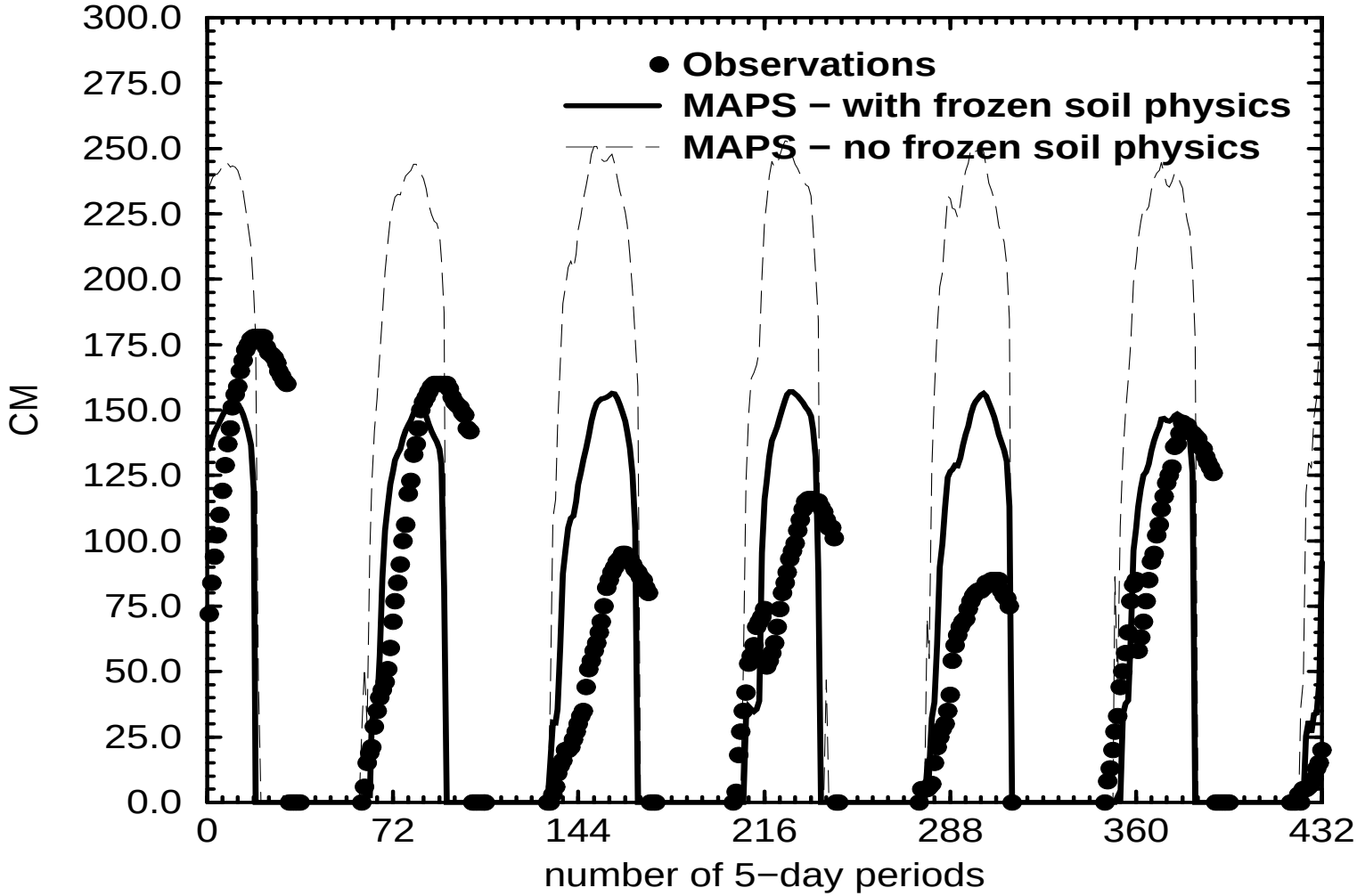


Fig. 8a. Observed and MAPS simulations of freezing depth in soil (cm) for same stations as in Figure 7. (a) Khabarovsk, Russia, 1978-1983.

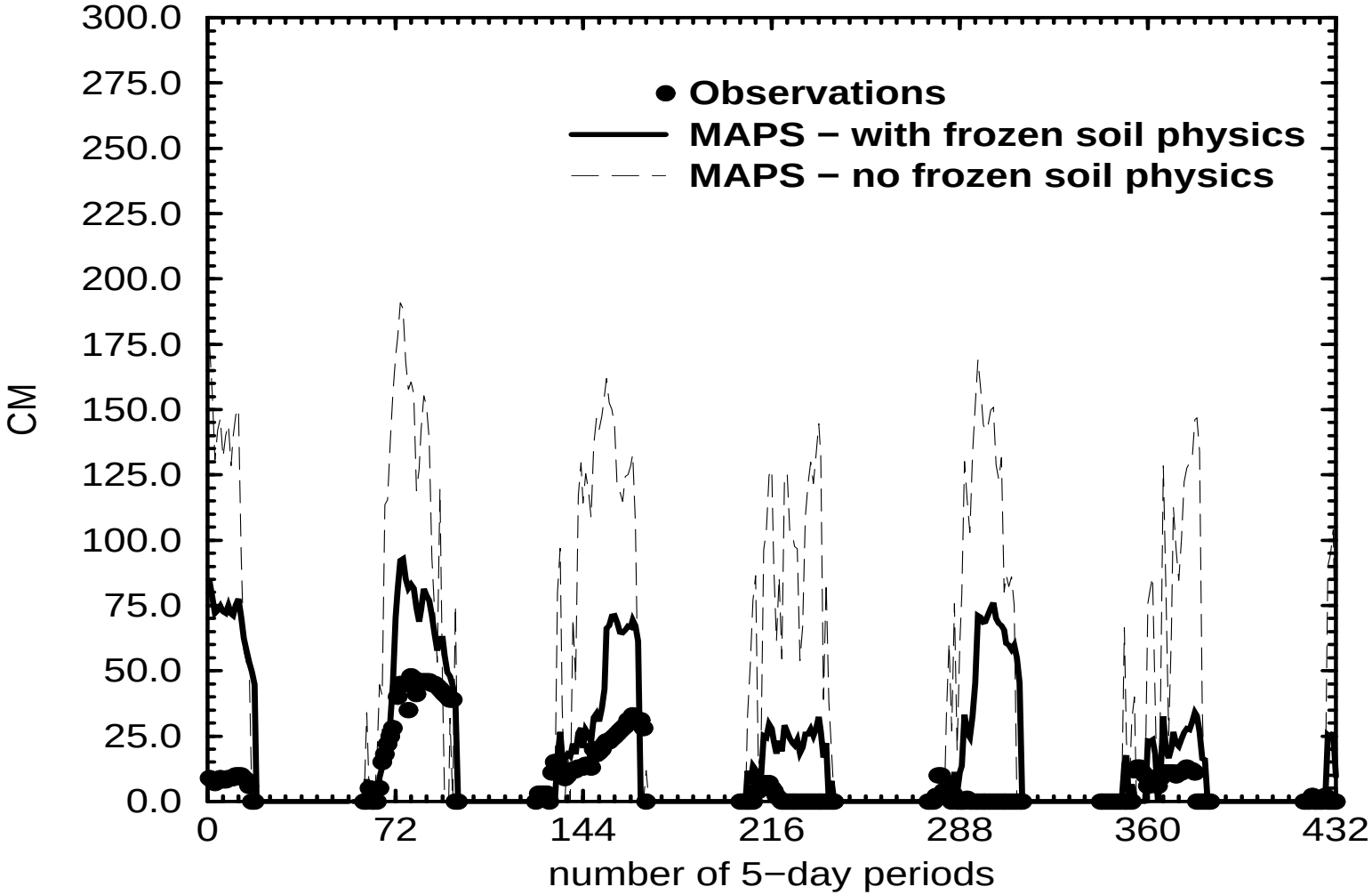


Fig. 8b. Observed and MAPS simulations of freezing depth in soil (cm) for same stations as in Figure 7. (b) Kostroma, Russia, 1978-1983.

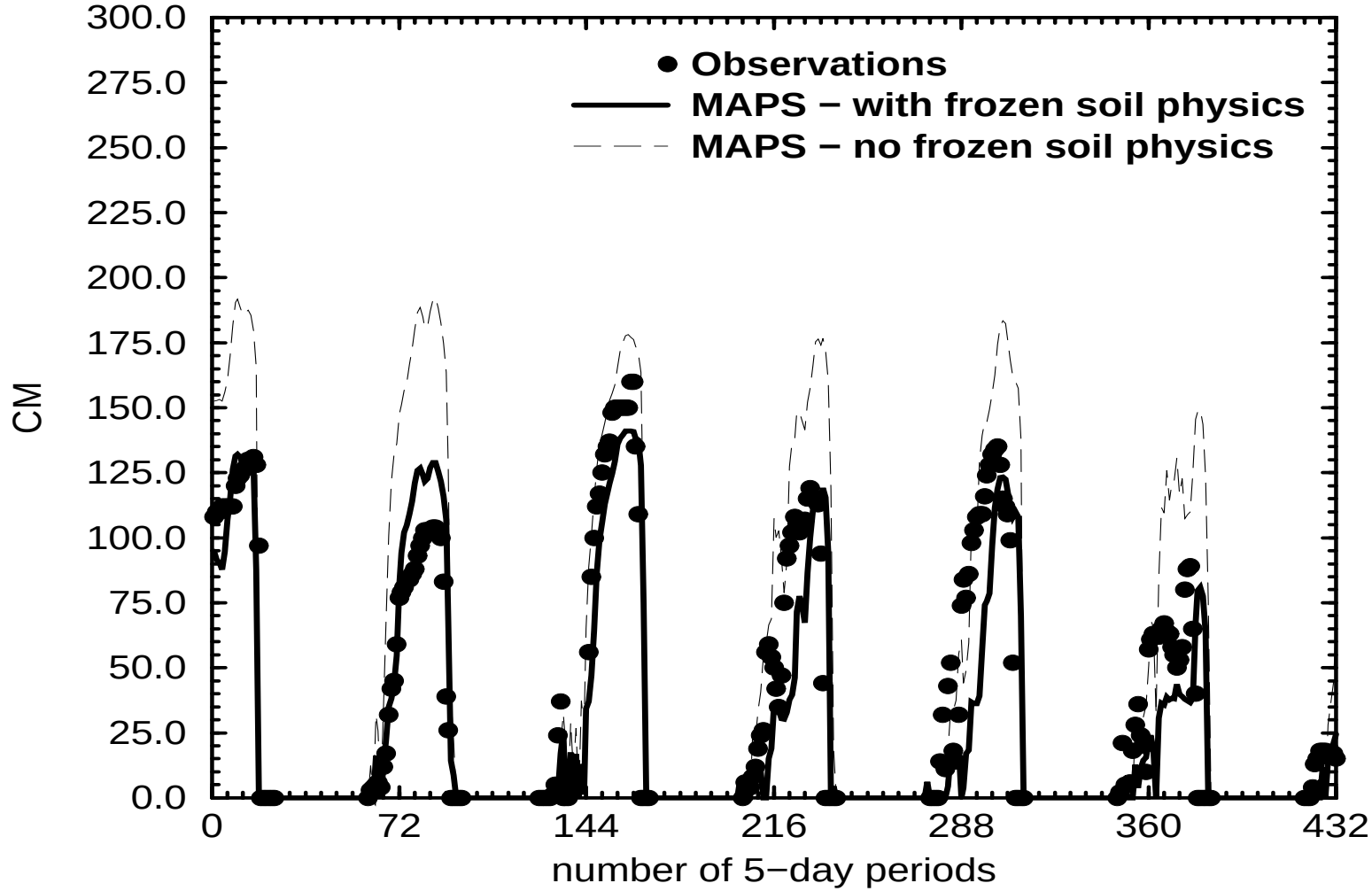


Fig. 8c. Observed and MAPS simulations of freezing depth in soil (cm) for same stations as in Figure 7. (c) Uralsk, Kazakhstan, 1978-1983.

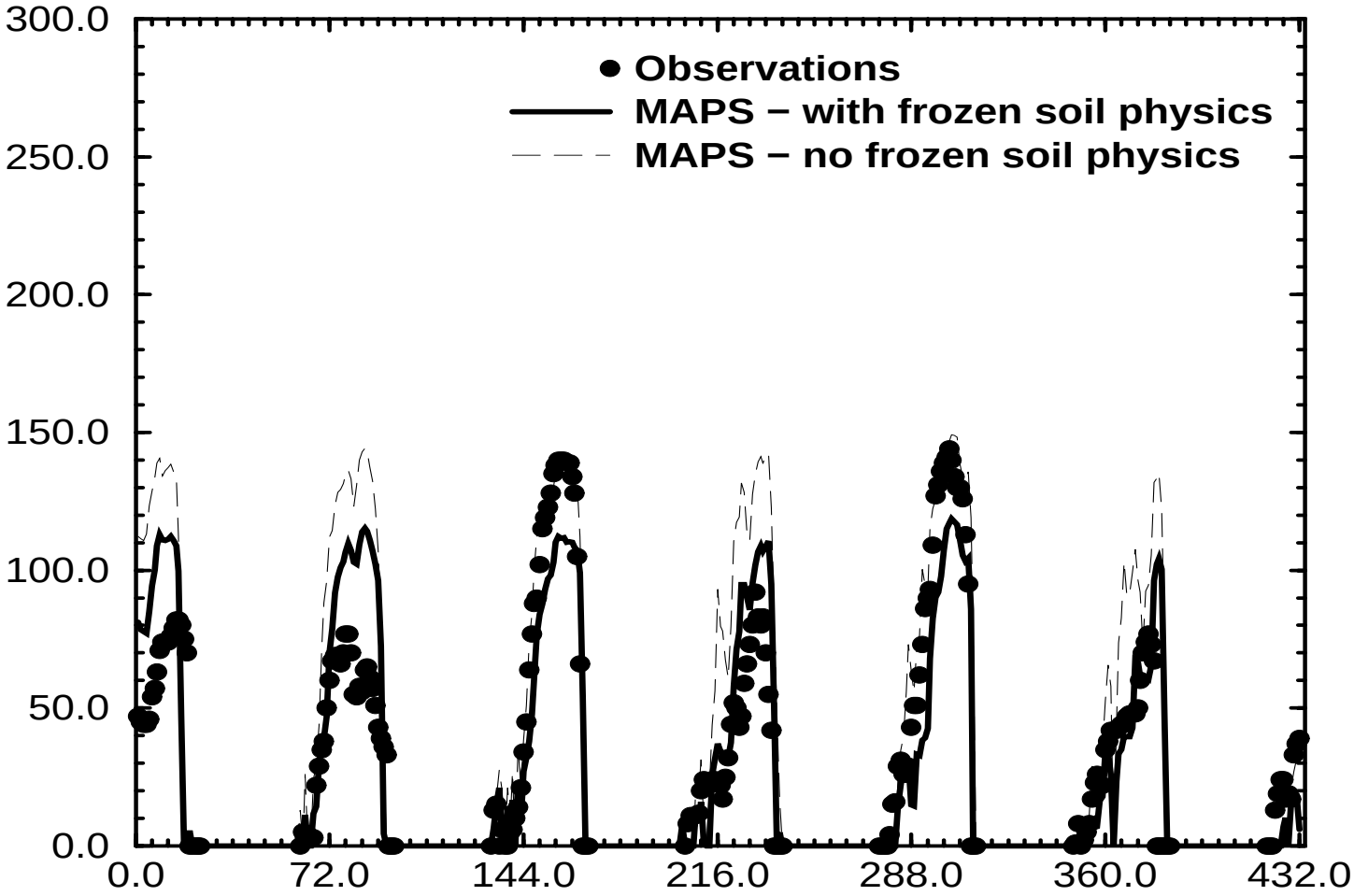


Fig. 8d. Observed and MAPS simulations of freezing depth in soil (cm) for same stations as in Figure 7. (d) Yershov, Russia, 1978-1983.

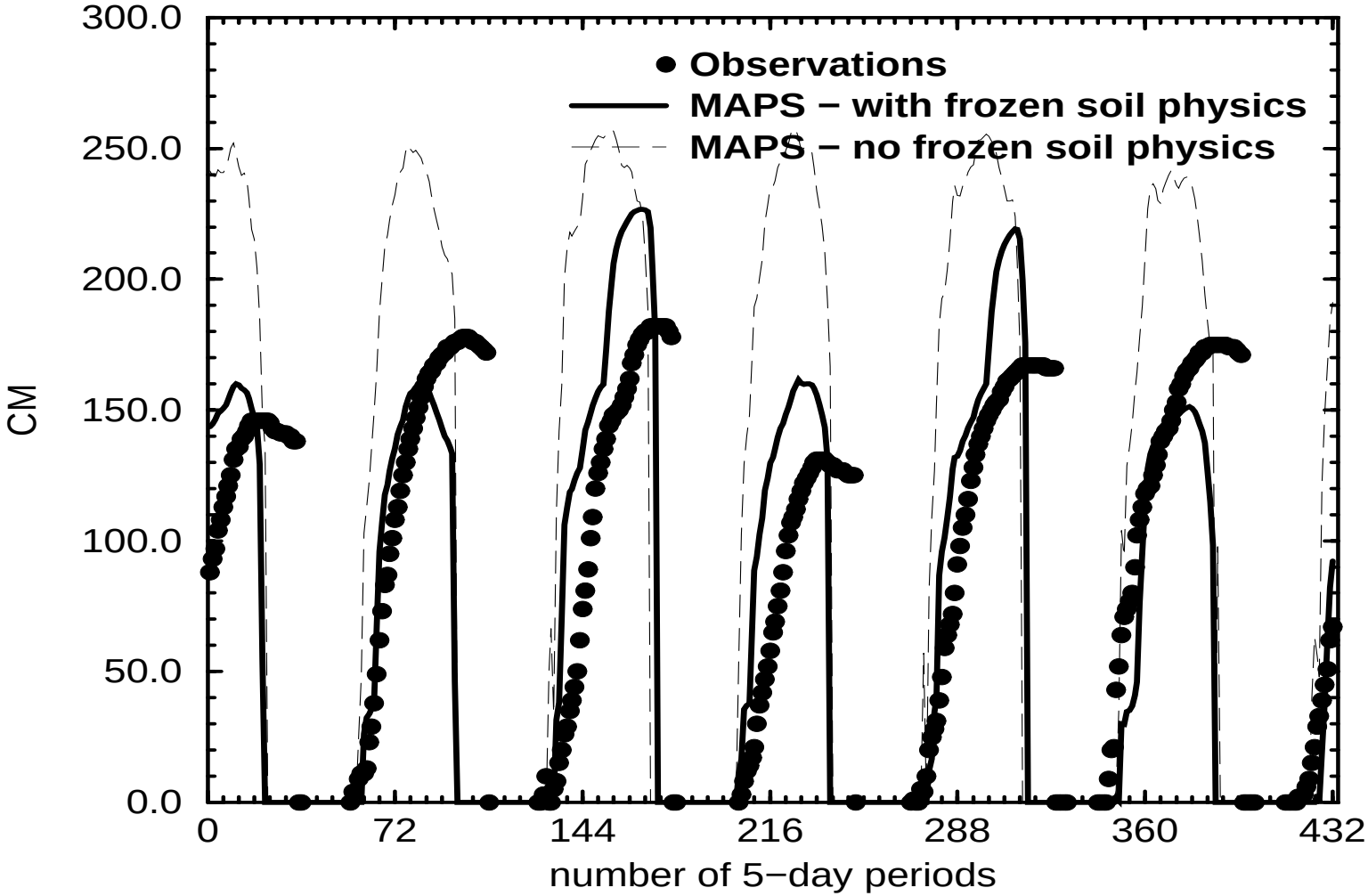


Fig. 8e. Observed and MAPS simulations of freezing depth in soil (cm) for same stations as in Figure 7. (e) Tulun, Russia, 1978-1983.

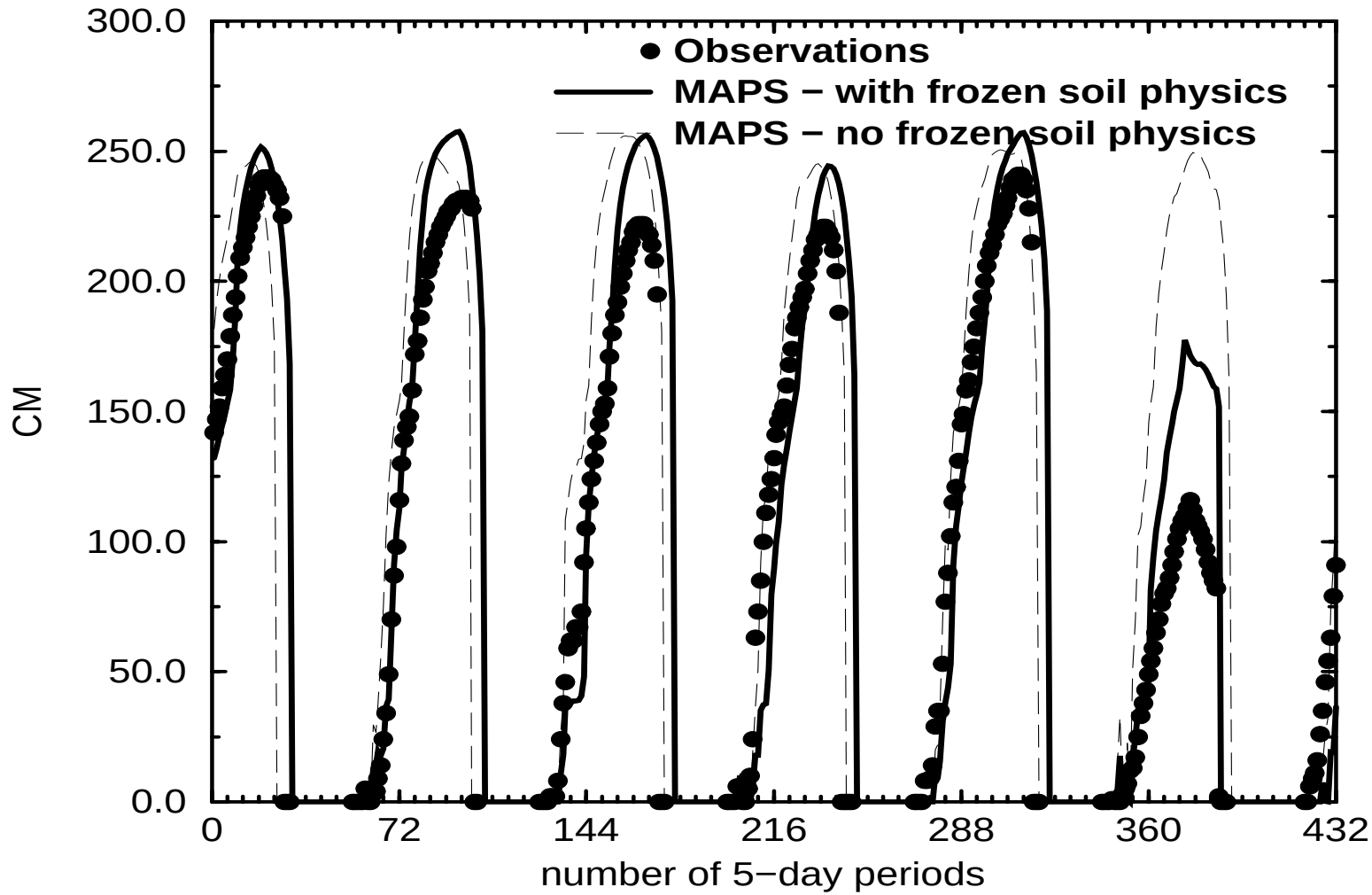


Fig. 8f. Observed and MAPS simulations of freezing depth in soil (cm) for same stations as in Figure 7. (f) Ogurtsovo, Russia, 1978-1983.

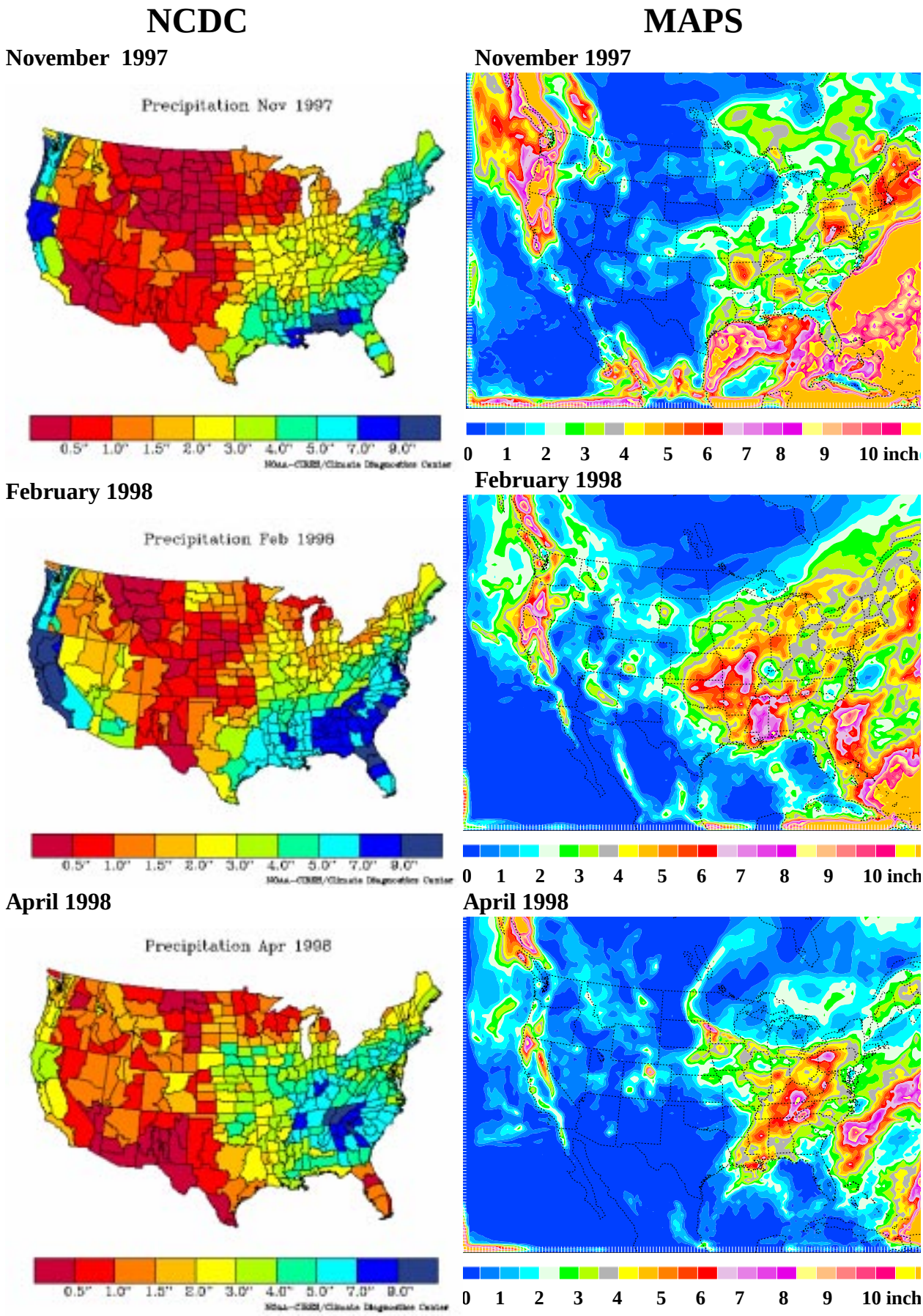
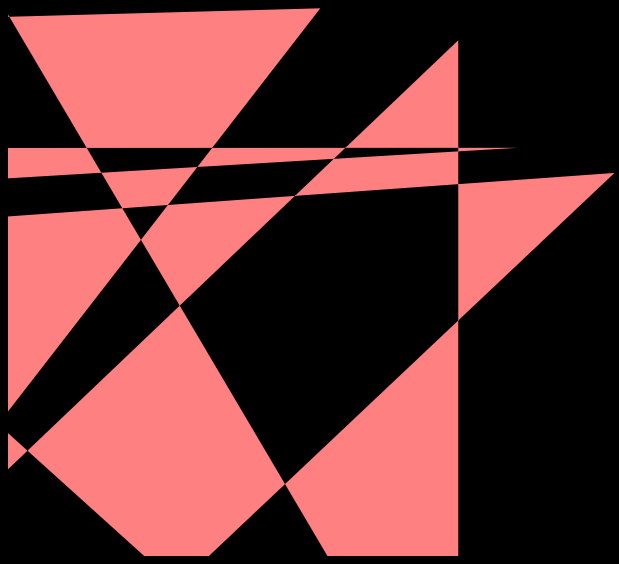
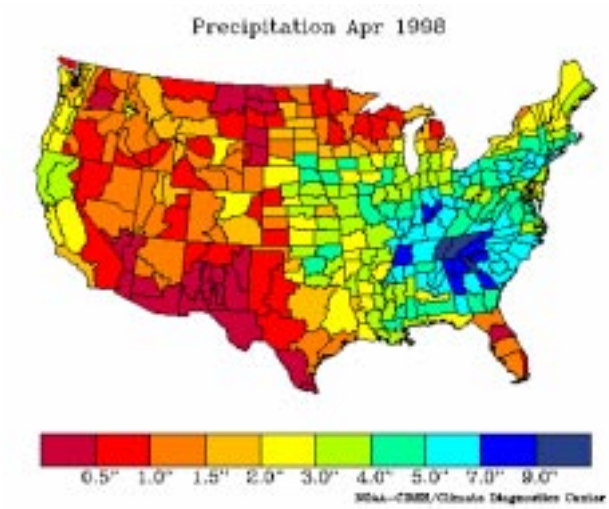


Figure 9. Monthly accumulated precipitation from NCDC analyses and series of MAPS 6-9 h forecasts for November 1997, February 1998, and April 1998.

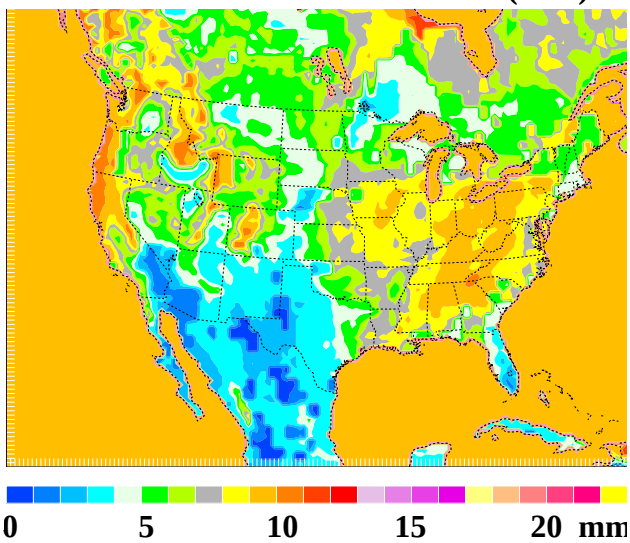


NCDC **MAPS**

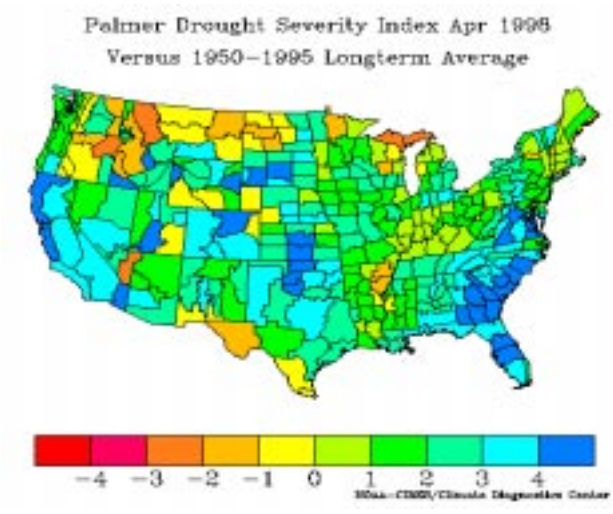
PRECIPITATION



TOP LAYER SOIL MOISTURE (MM)



PALMER DROUGHT SEVERITY INDEX



TOTAL SOIL MOISTURE (MM)

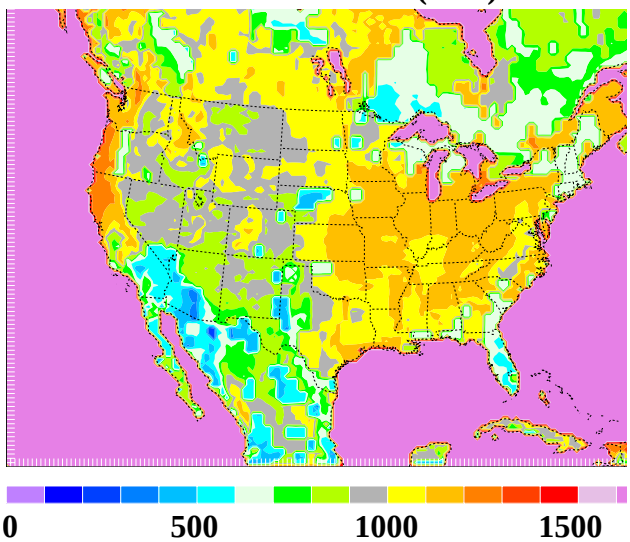
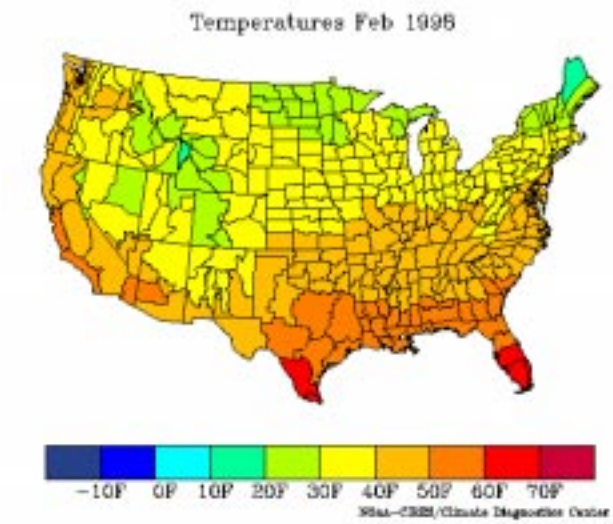


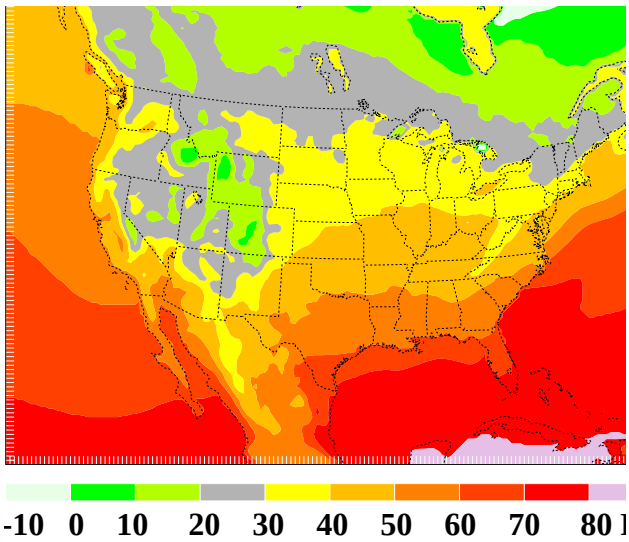
Figure 11. Mean soil moisture from MAPS for April 1998 compared with NCDC precipitation analysis and Palmer Drought Severity Index for same month.

NCDC **MAPS**

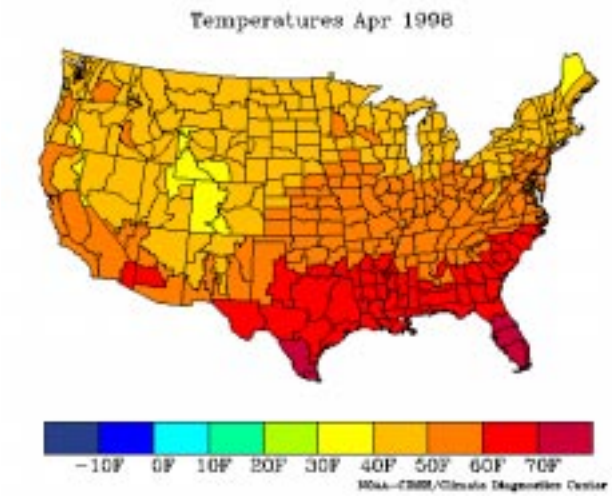
FEBRUARY 1998



FEBRUARY 1998



APRIL 1998



APRIL 1998

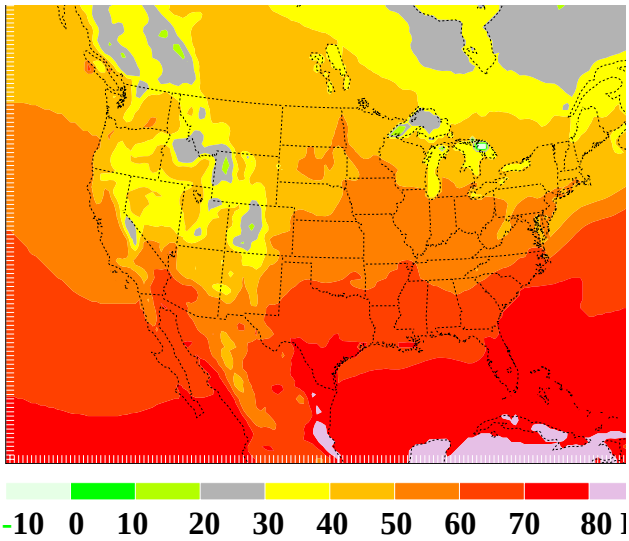


Figure 12. Mean surface temperature from NCDC analyses and MAPS for February 1998 and April 1998.

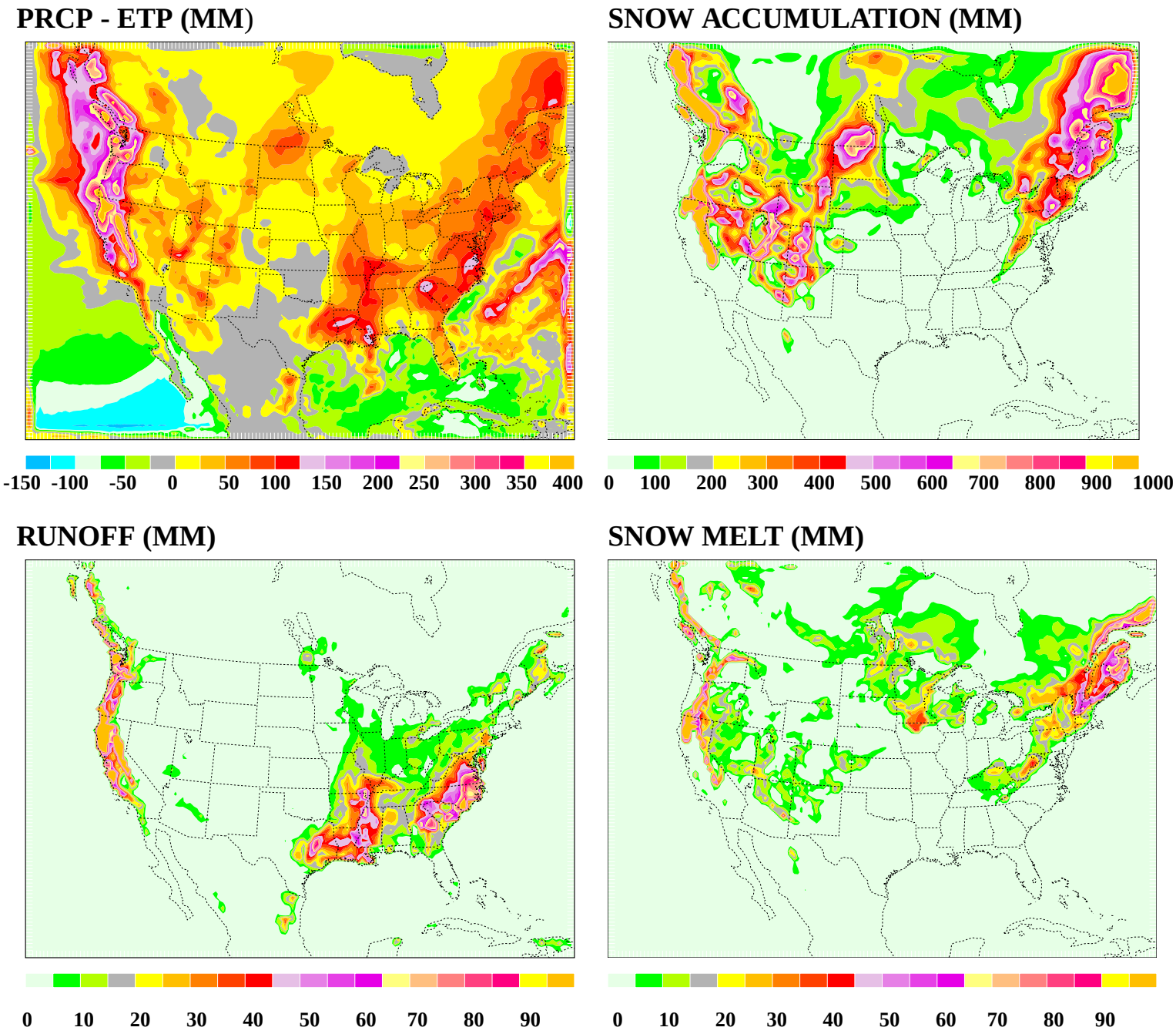


Figure 13a. Hydrological cycle components from MAPS 6-9 h forecasts for February 1998.

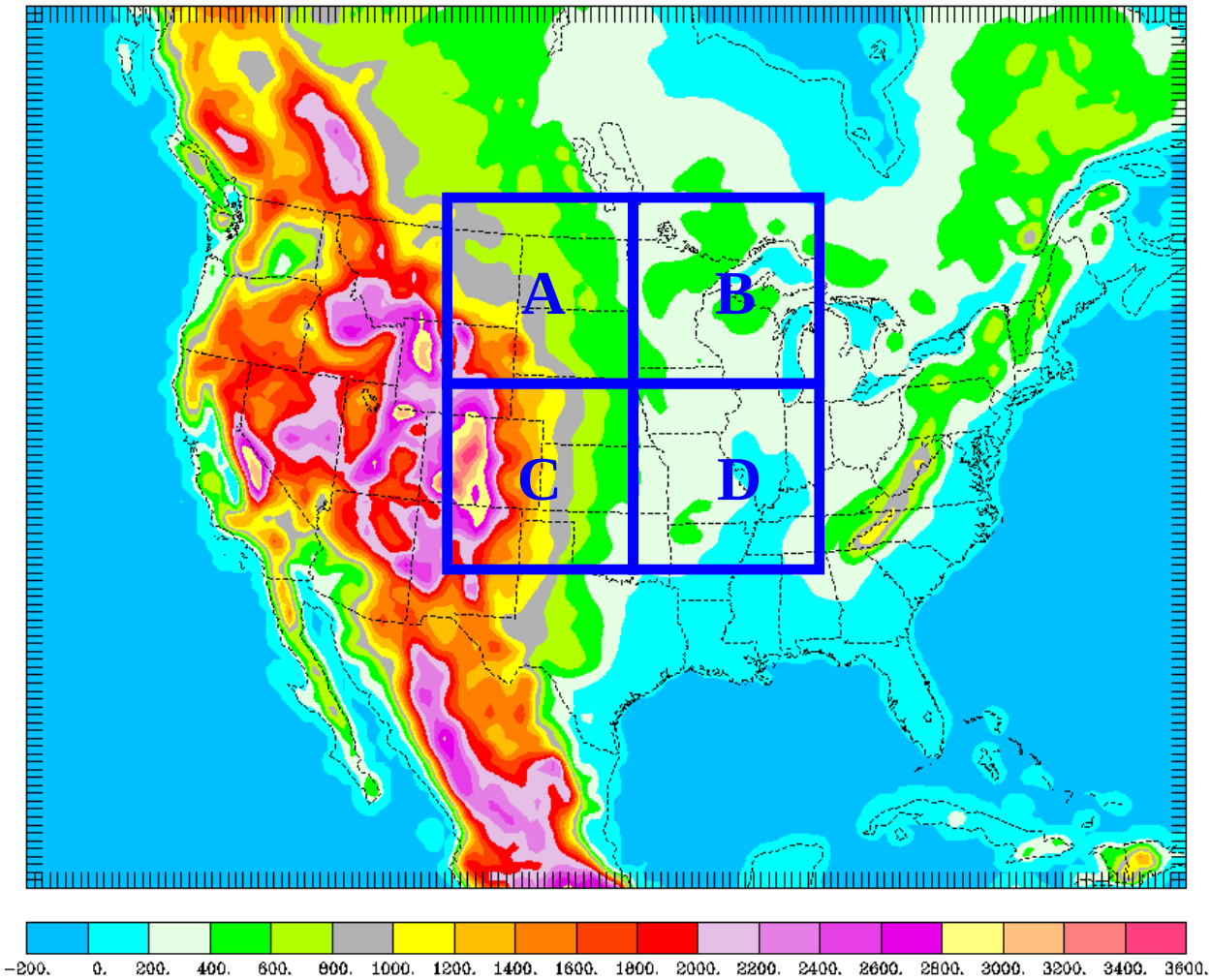


Figure 14a. Map of four areas (A,B,C,D) for area-averaged hydrological cycle components from MAPS.

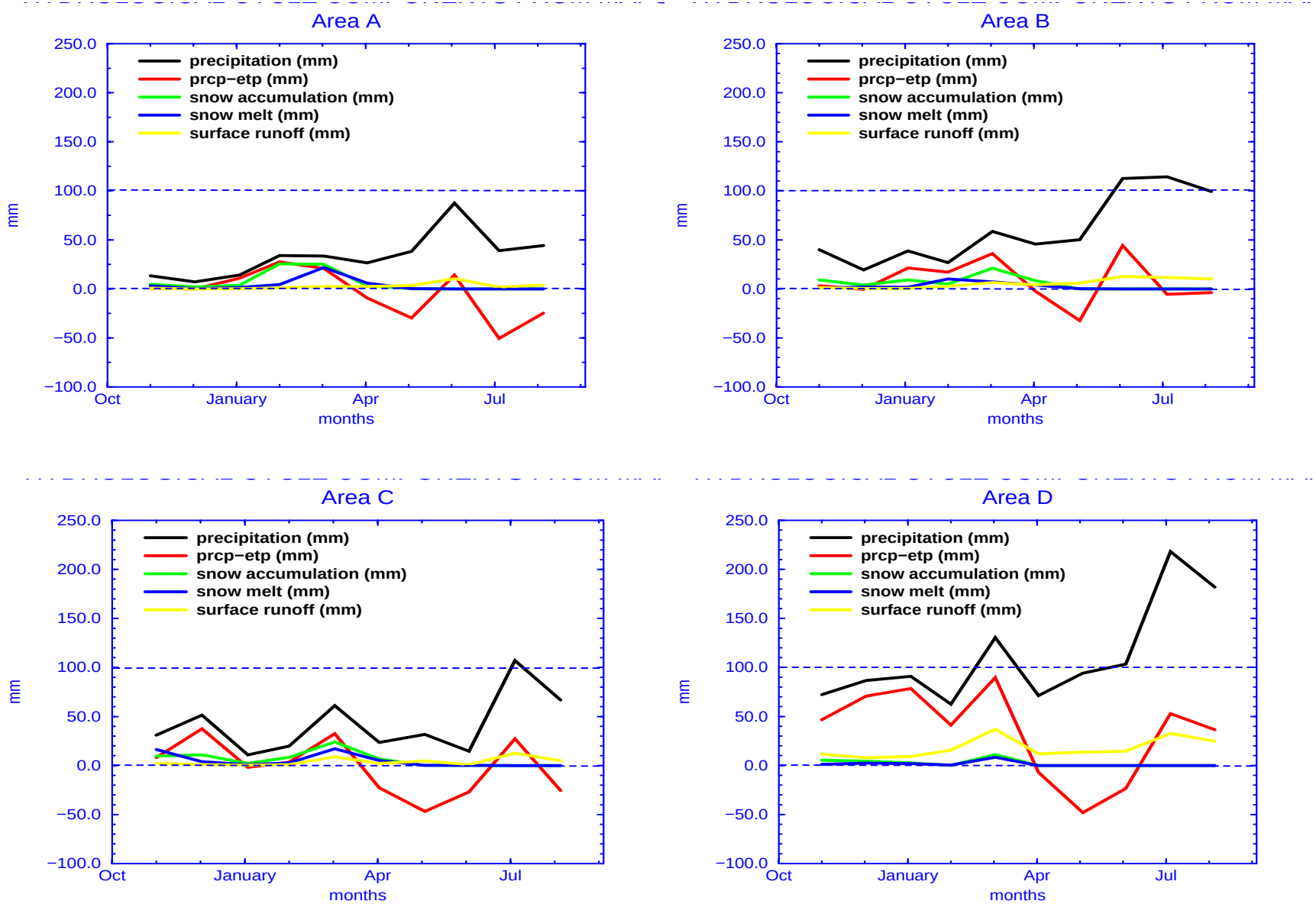


Figure 14 (b)-(e). Monthly values of area-averaged hydrological cycle components from MAPS for four geographical areas shown in Fig. 14a.