



*Supplement of*

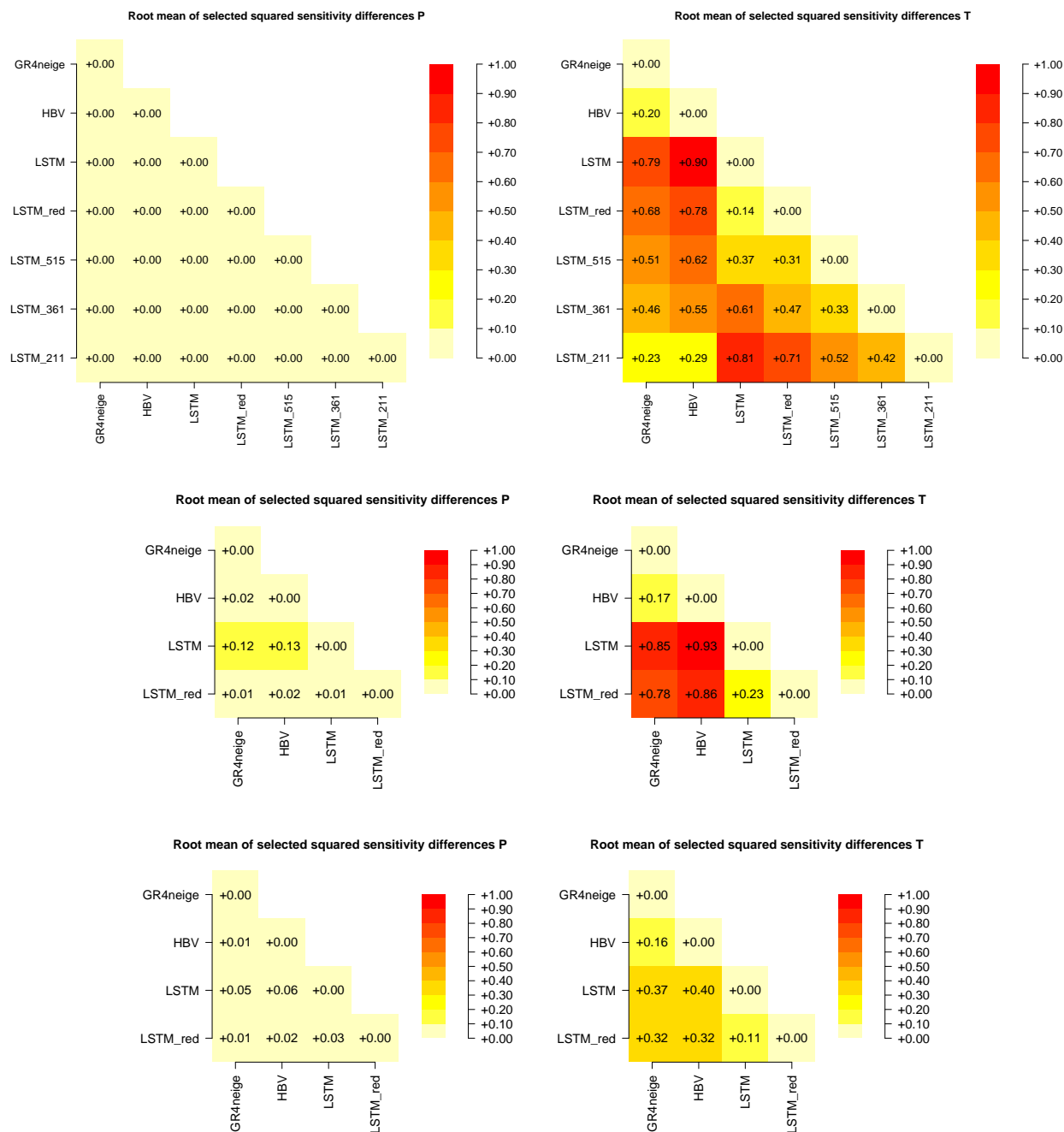
## **Metamorphic testing of machine learning and conceptual hydrologic models**

**Peter Reichert et al.**

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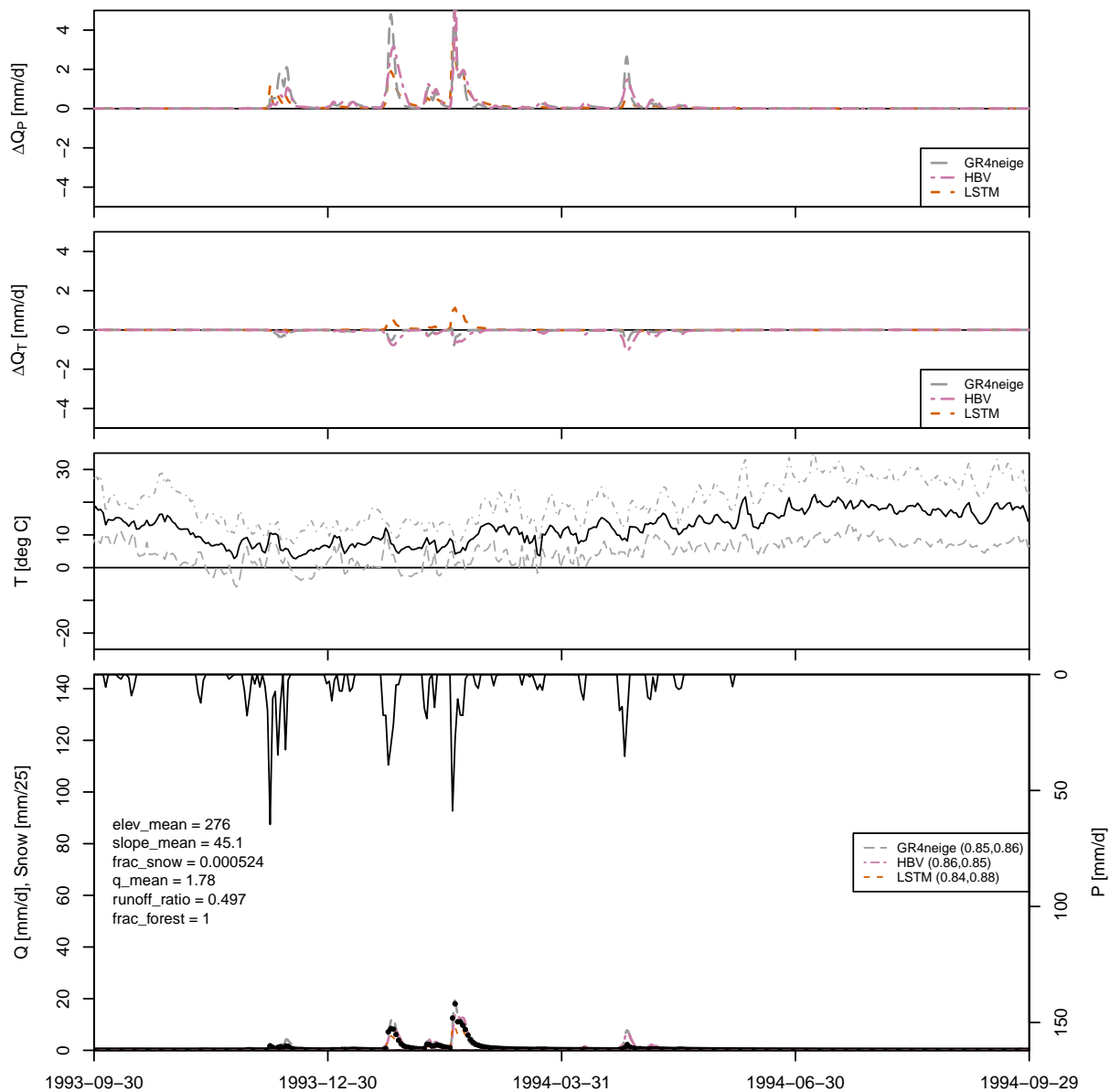
## S1 Summary of Sensitivity Deviations



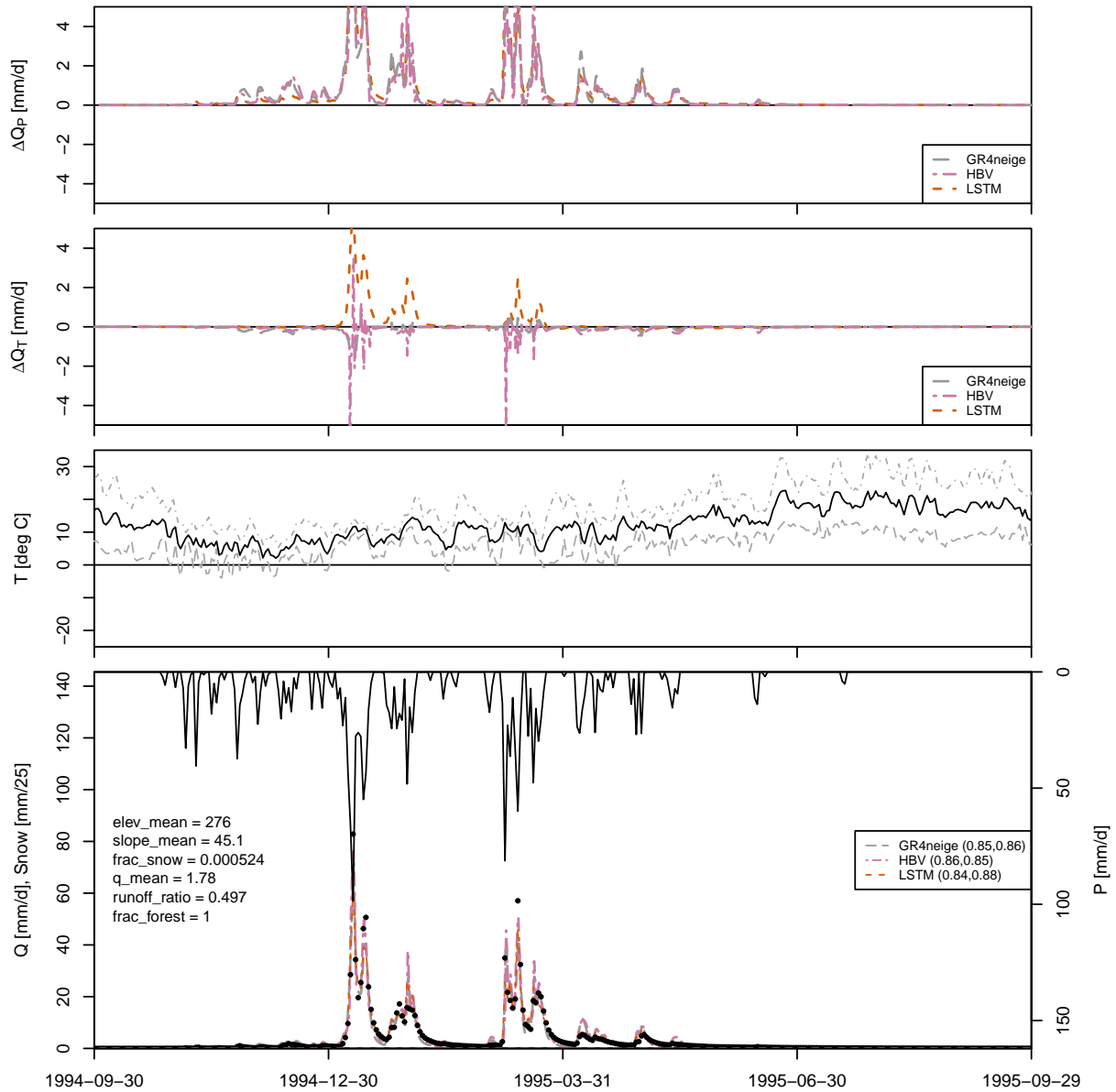
**Figure S1.** Summary of deviations (see section 3.3 in the main paper for the definition) of precipitation (left column) and temperature (right column) sensitivities (mm/d) for low altitude (top), intermediate altitude (middle) and very high altitude (bottom) catchments.

## S2 Comprehensive Results for Low Altitude Warm Basins

850 The Figures S2 to S5 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 11468500.

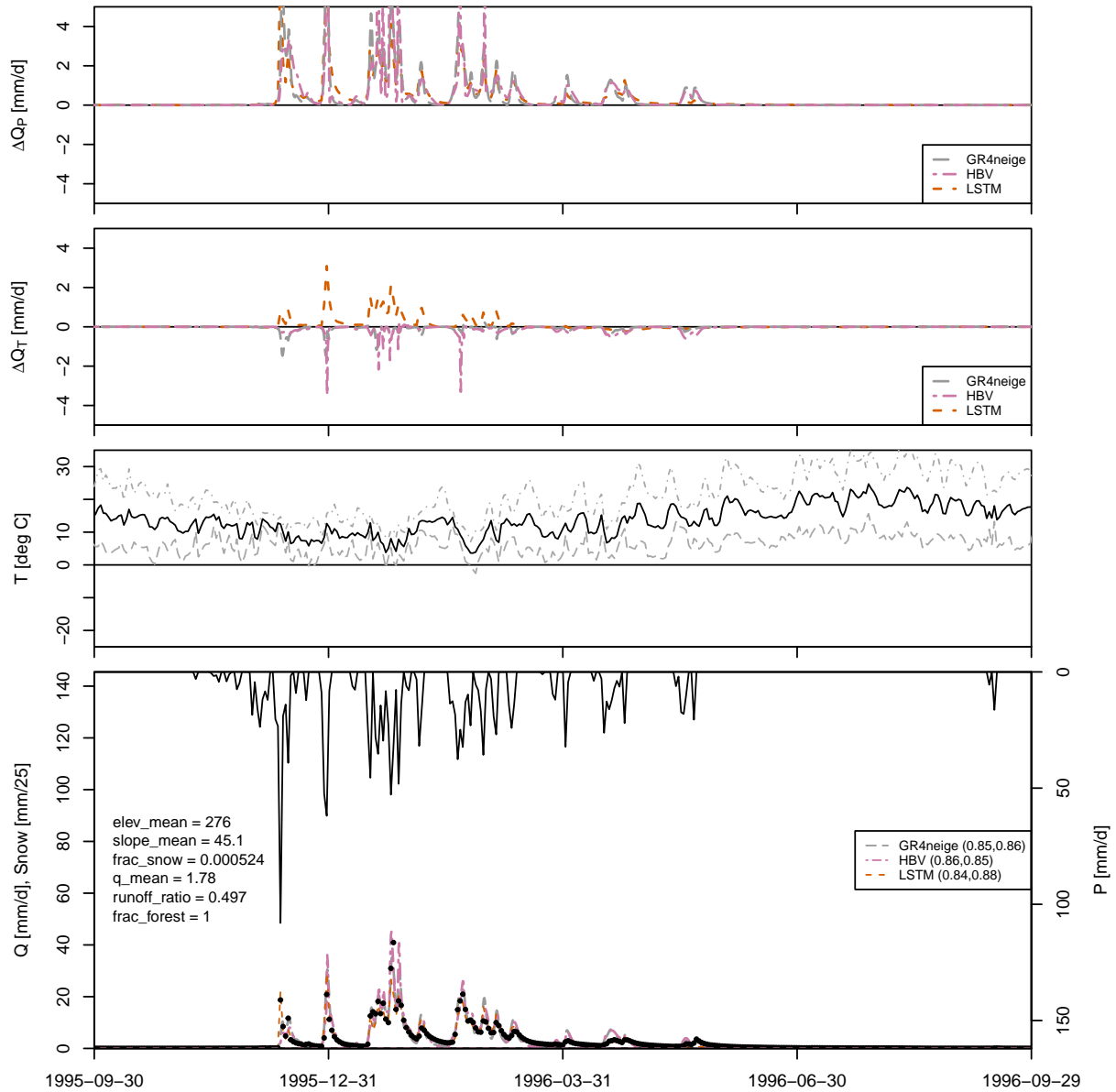


**Figure S2.** Results for basin 11468500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.



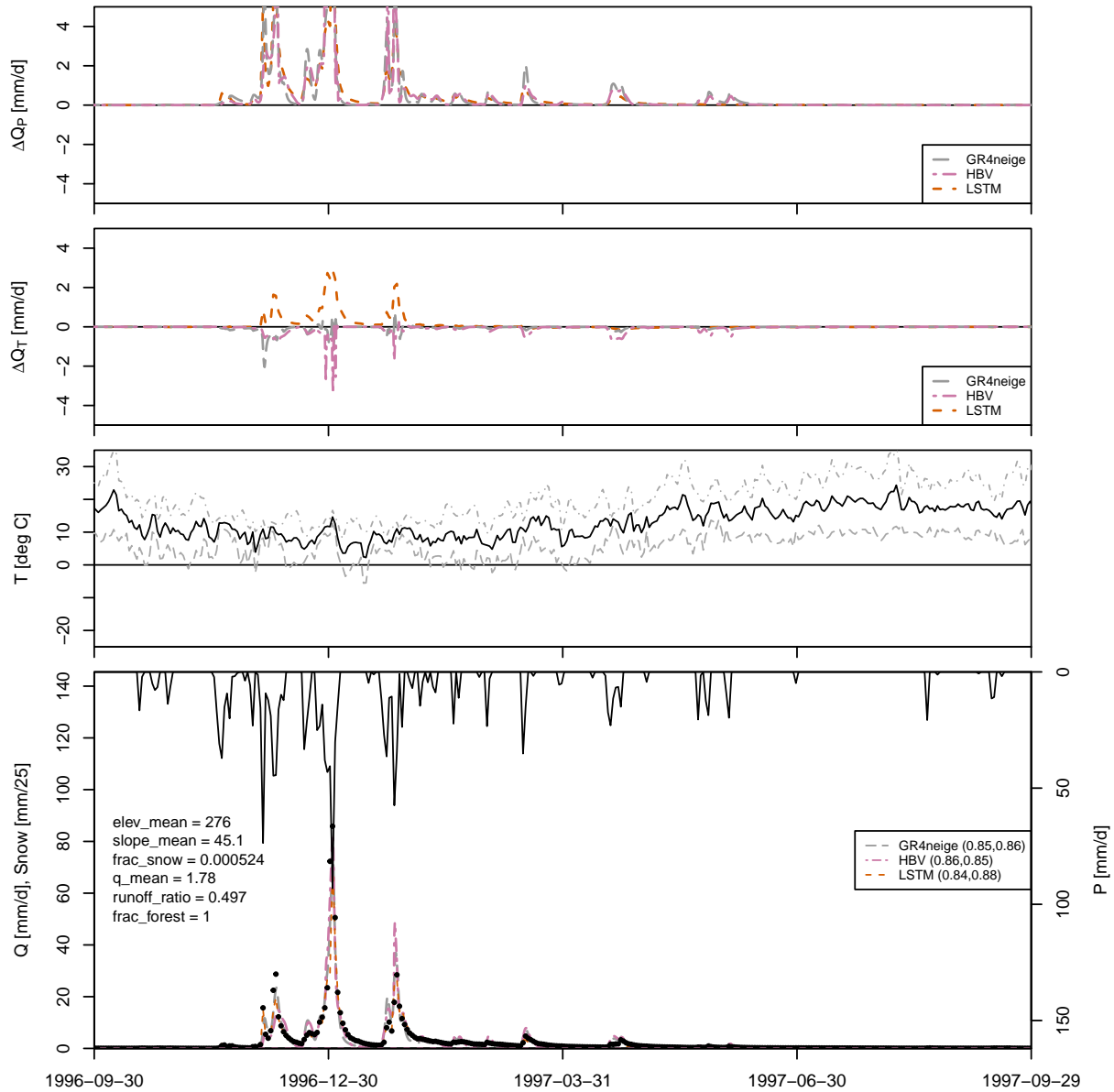
**Figure S3.** Results for basin 11468500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.

The Figures S6 to S9 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 08014500.



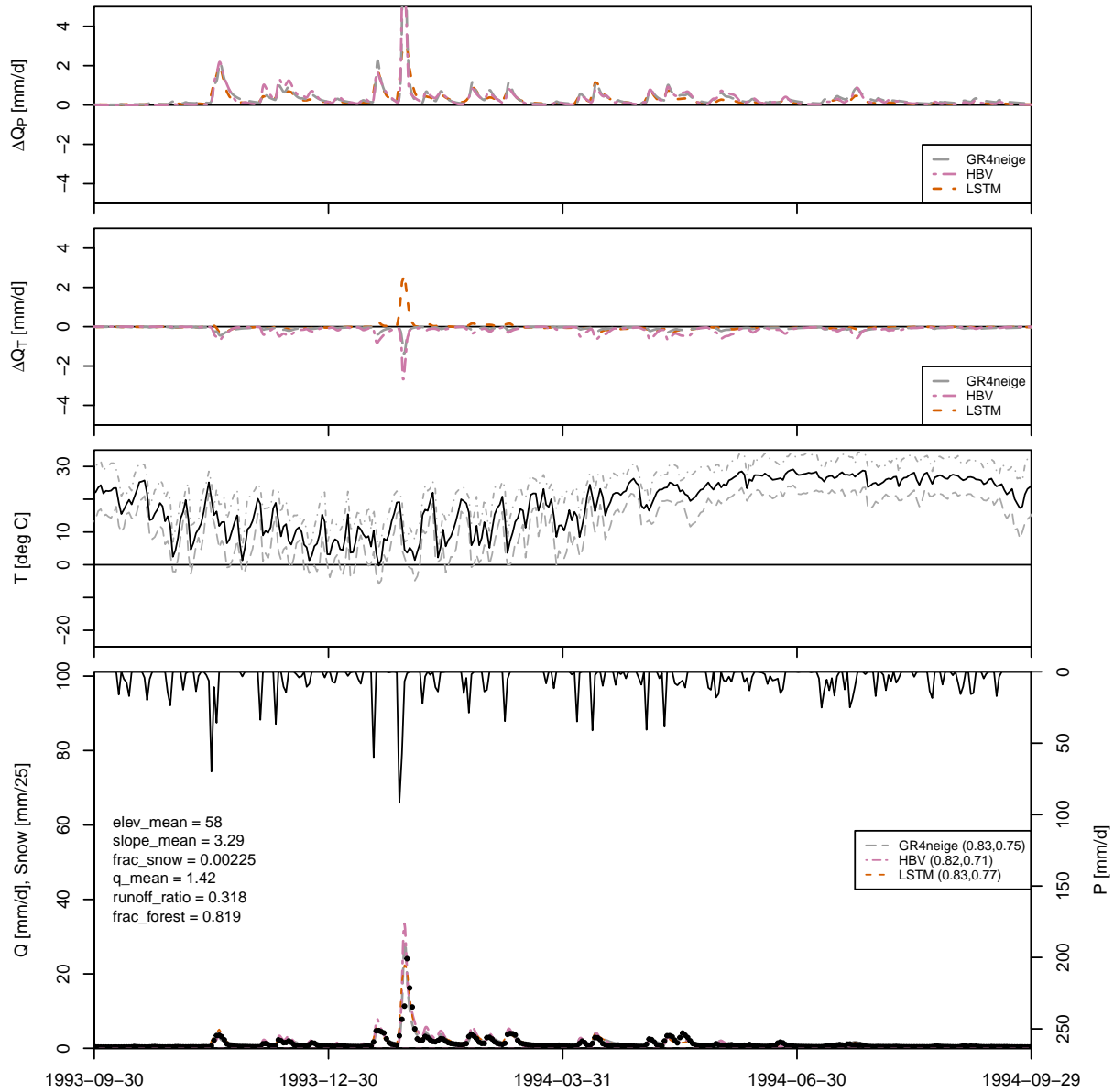
**Figure S4.** Results for basin 11468500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.

855 The Figures S10 to S13 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 02363000.

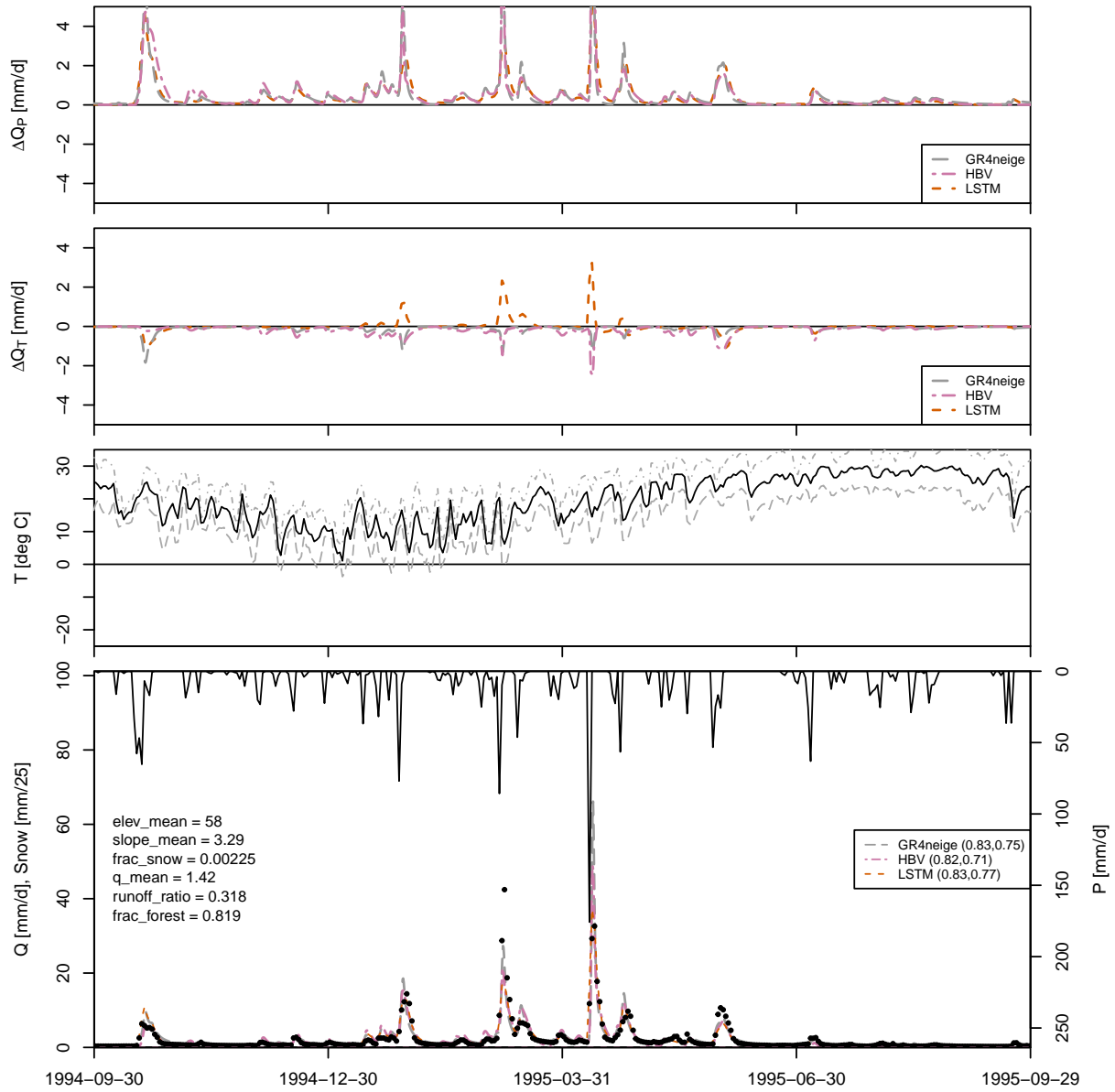


**Figure S5.** Results for basin 11468500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.

The Figures S14 to S17 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 12013500.

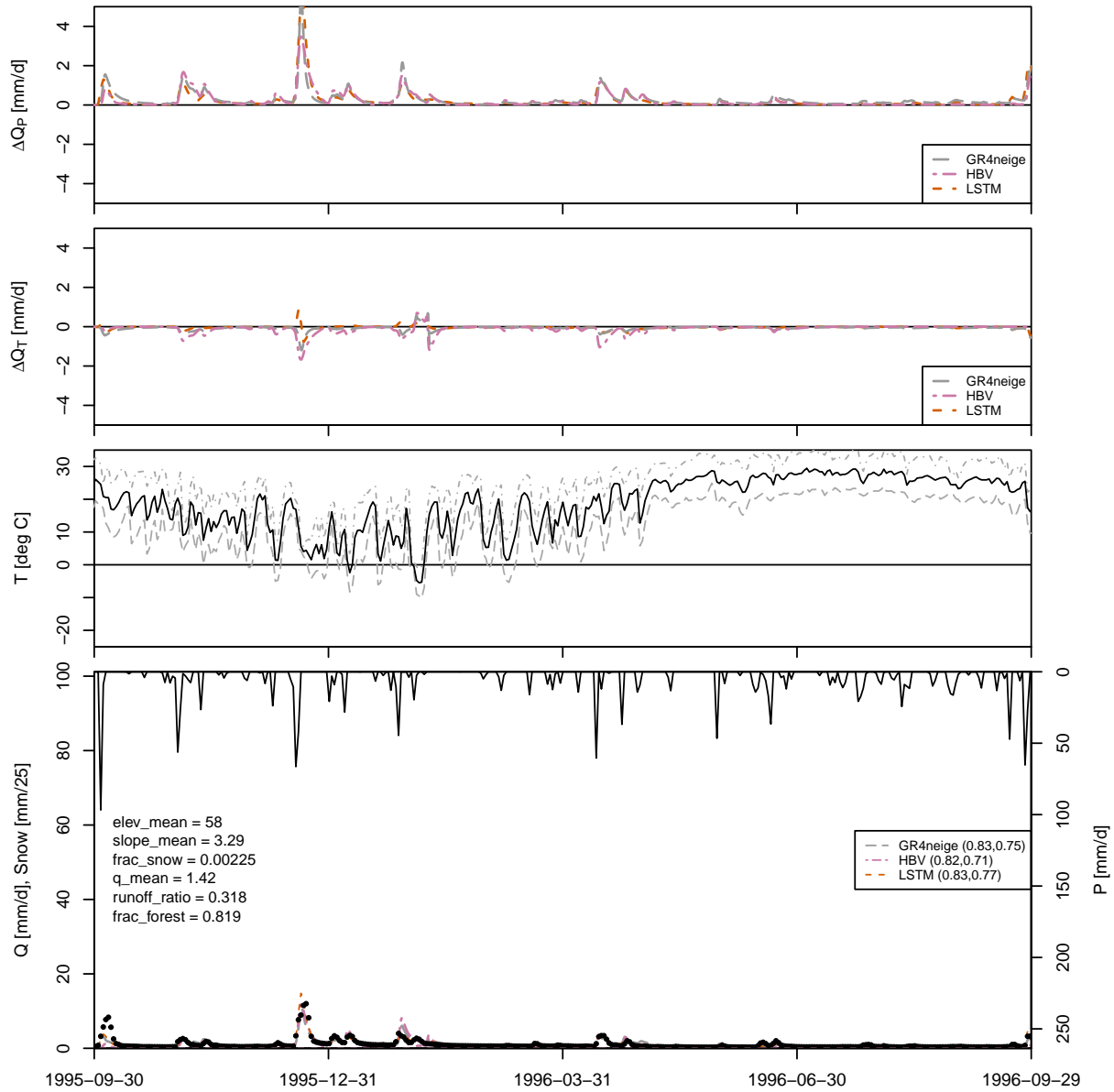


**Figure S6.** Results for basin 08014500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.

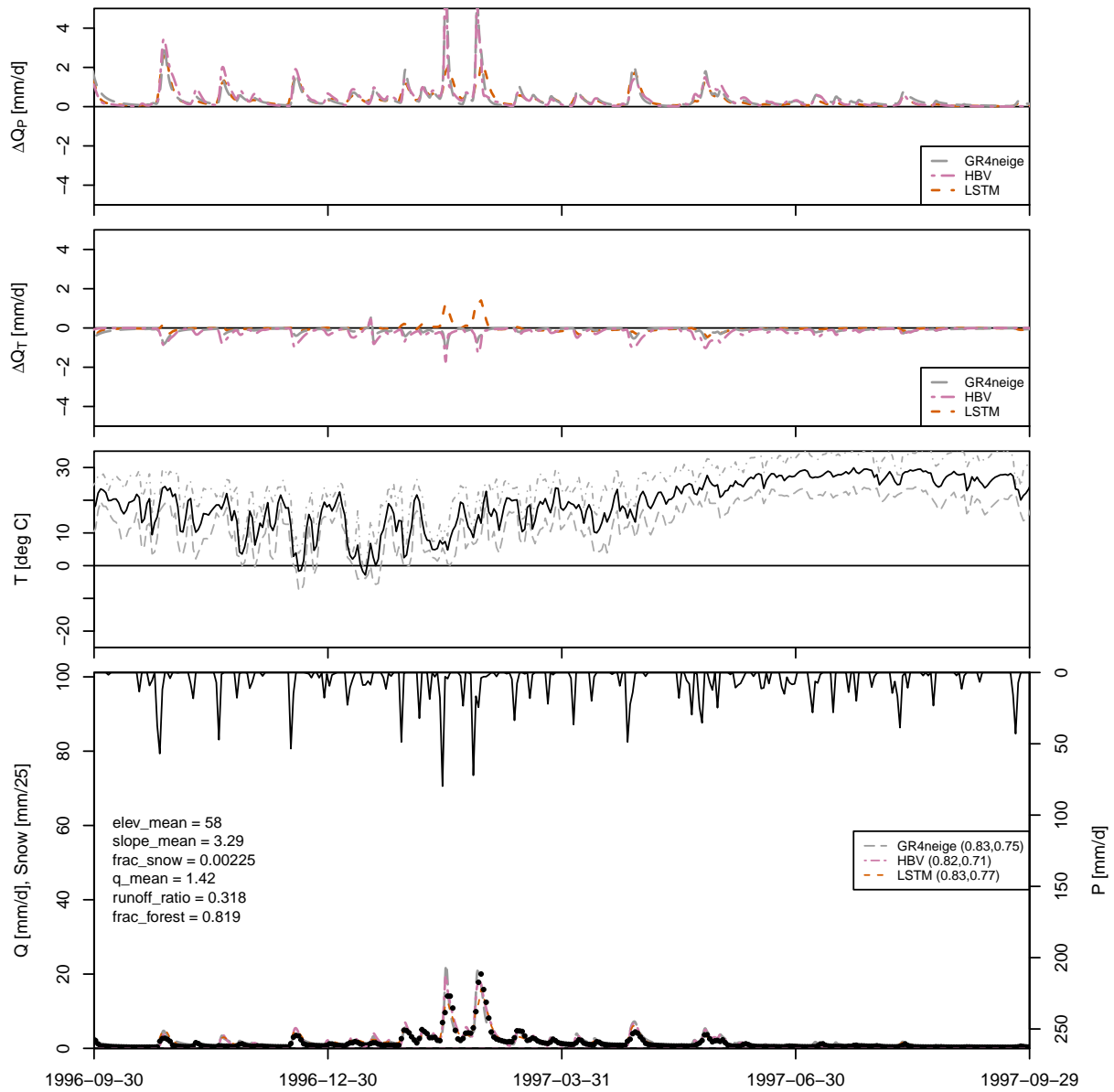


**Figure S7.** Results for basin 08014500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.

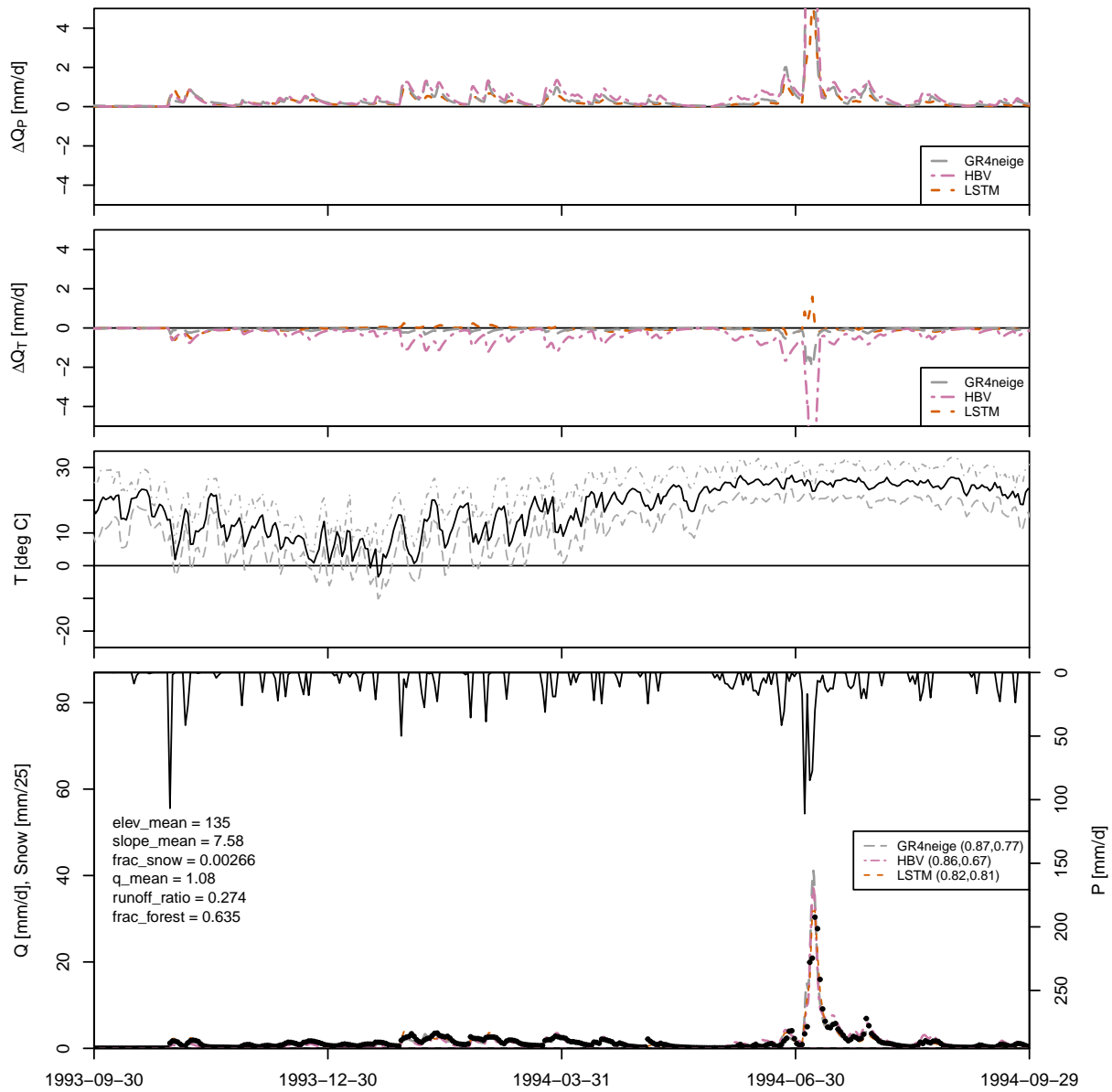




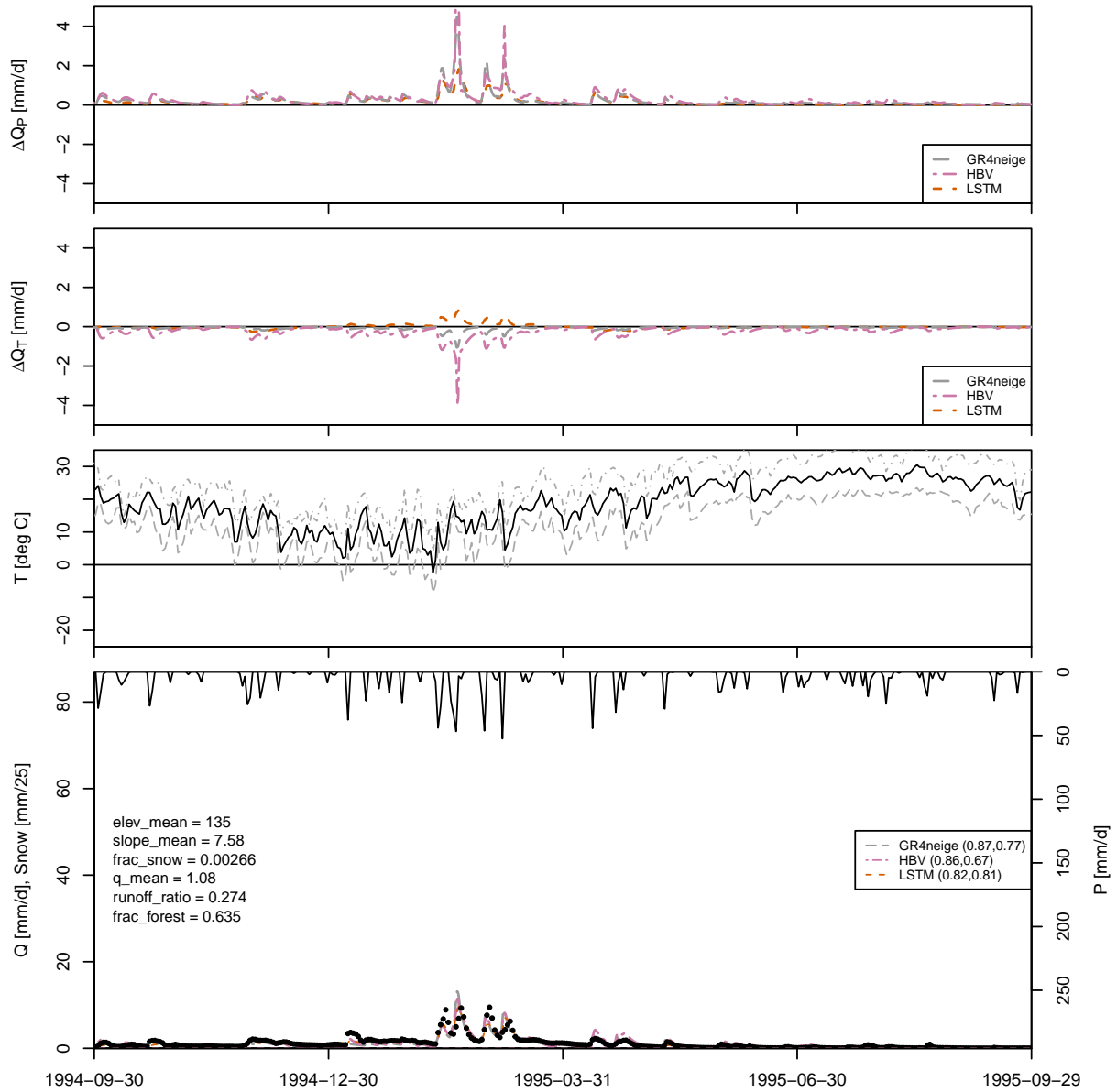
**Figure S8.** Results for basin 08014500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.



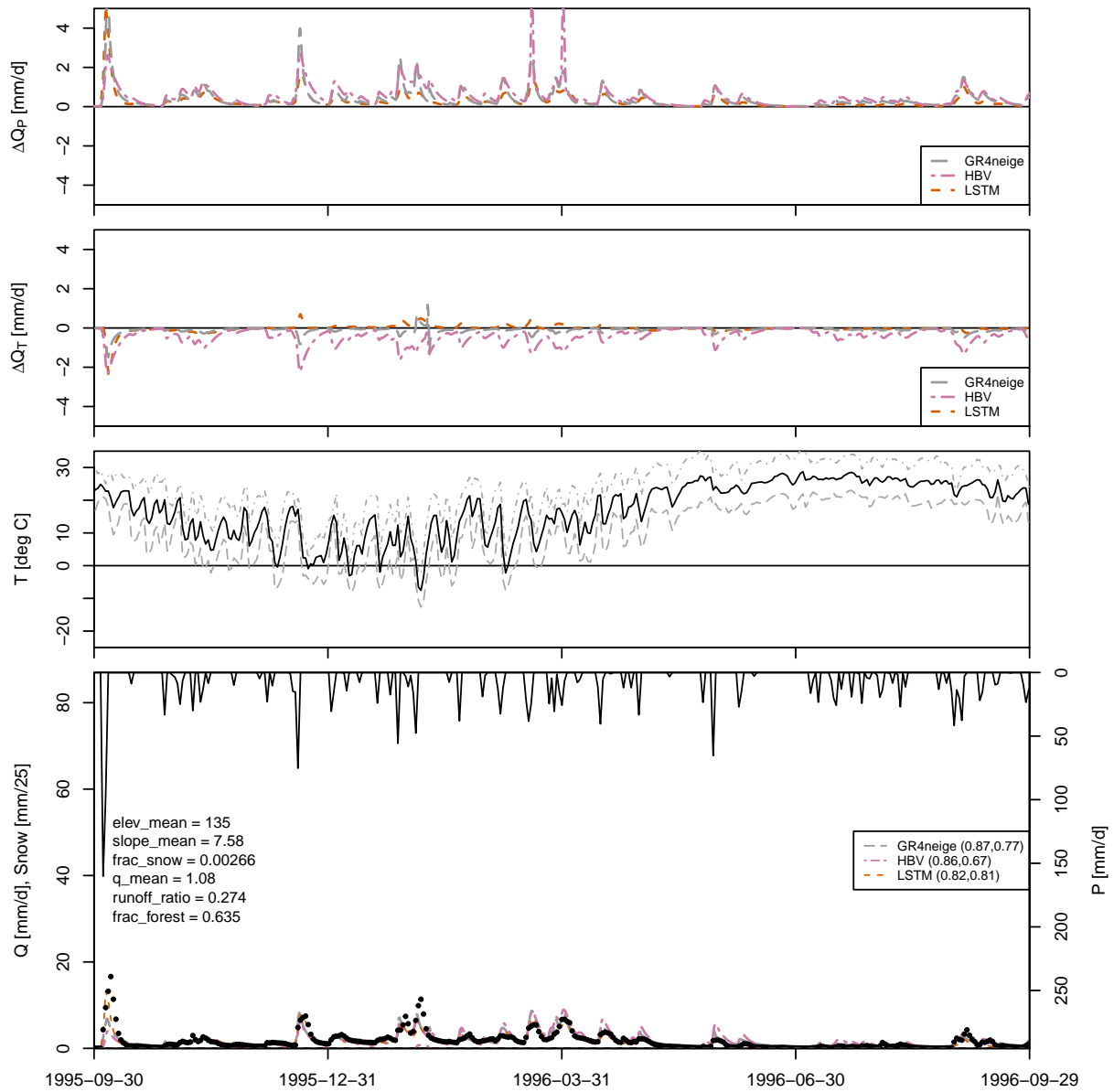
**Figure S9.** Results for basin 08014500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.



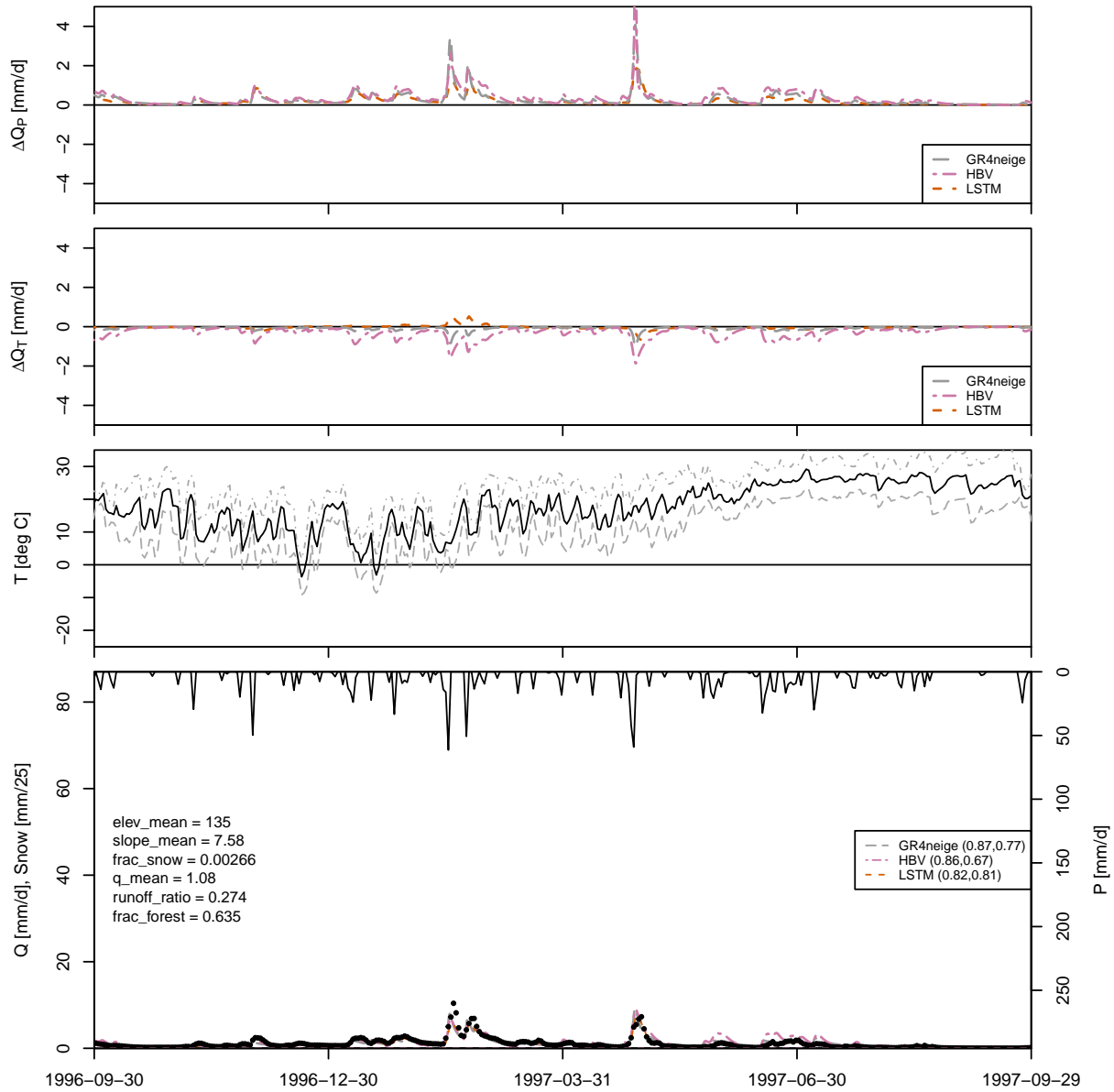
**Figure S10.** Results for basin 02363000, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.



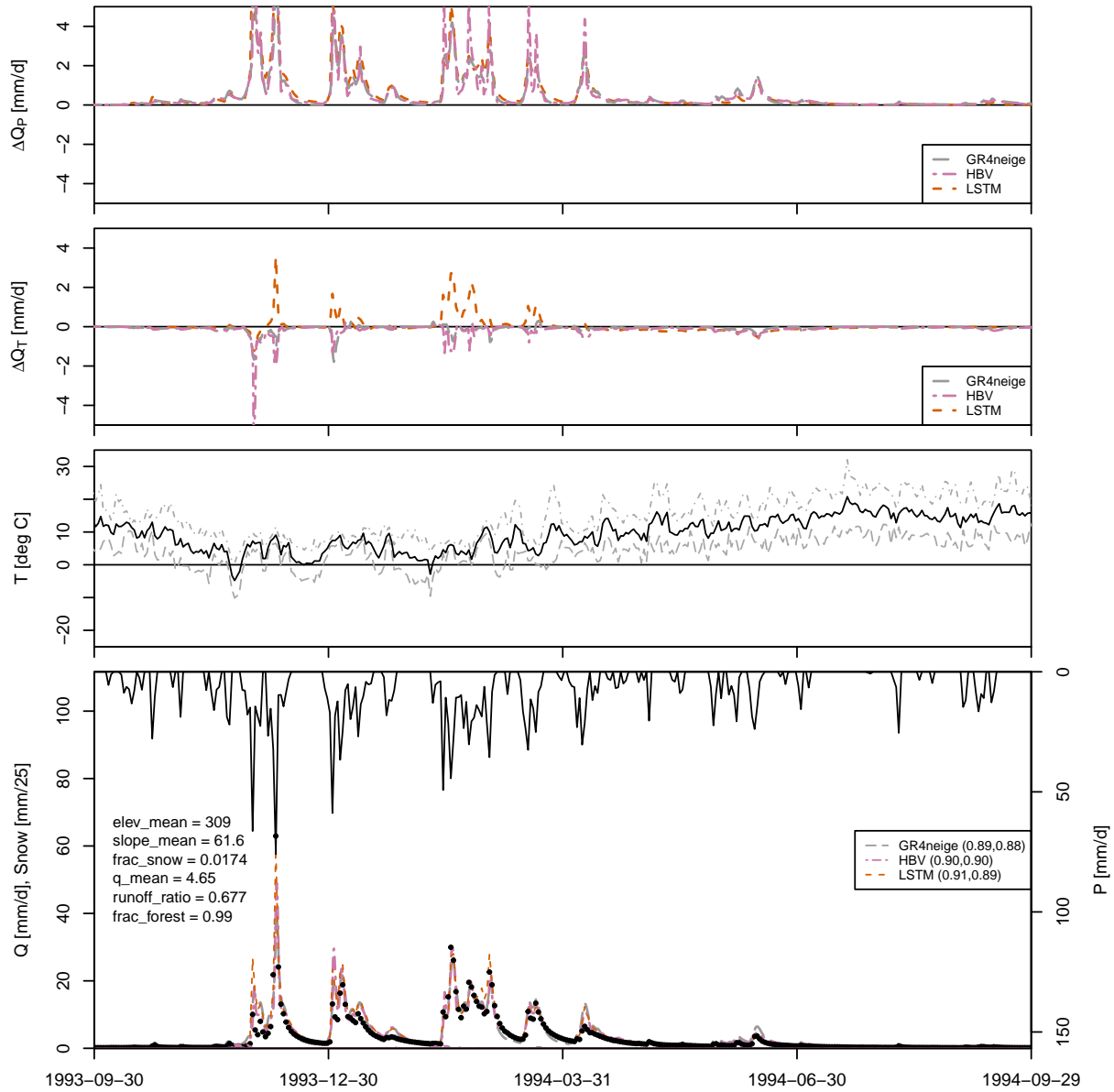
**Figure S11.** Results for basin 02363000, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.



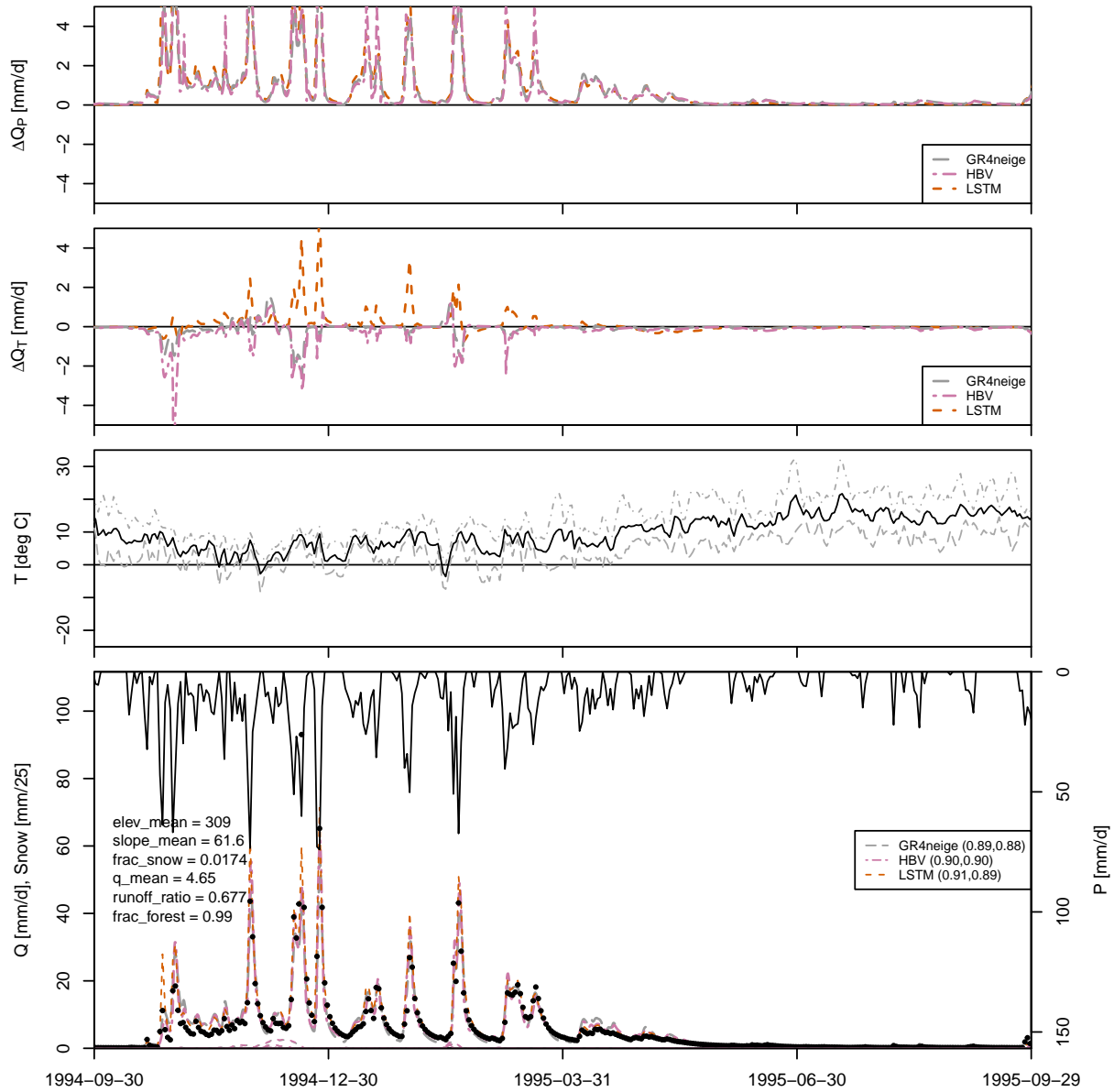
**Figure S12.** Results for basin 02363000, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.



**Figure S13.** Results for basin 02363000, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.

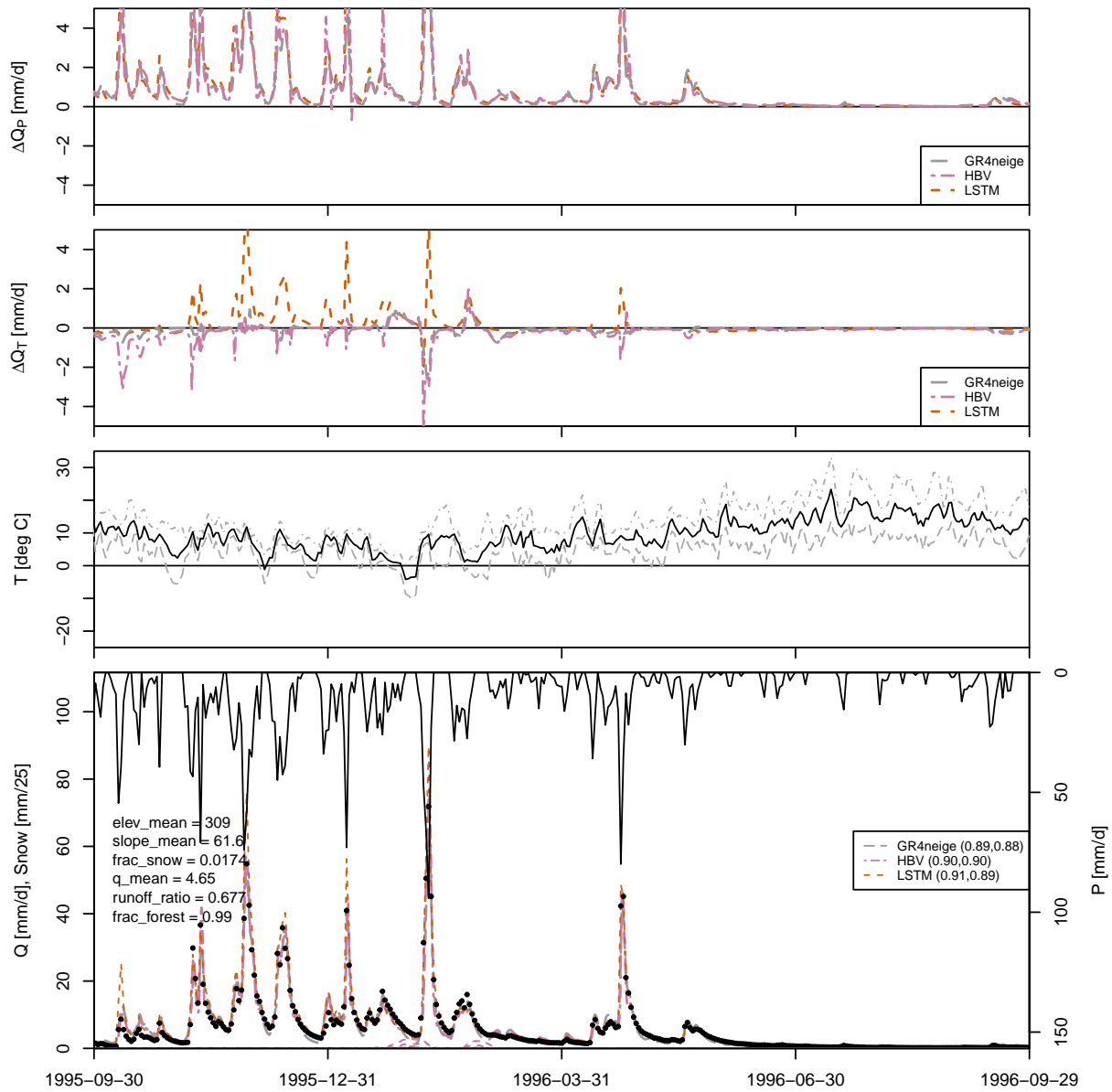


**Figure S14.** Results for basin 12013500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.

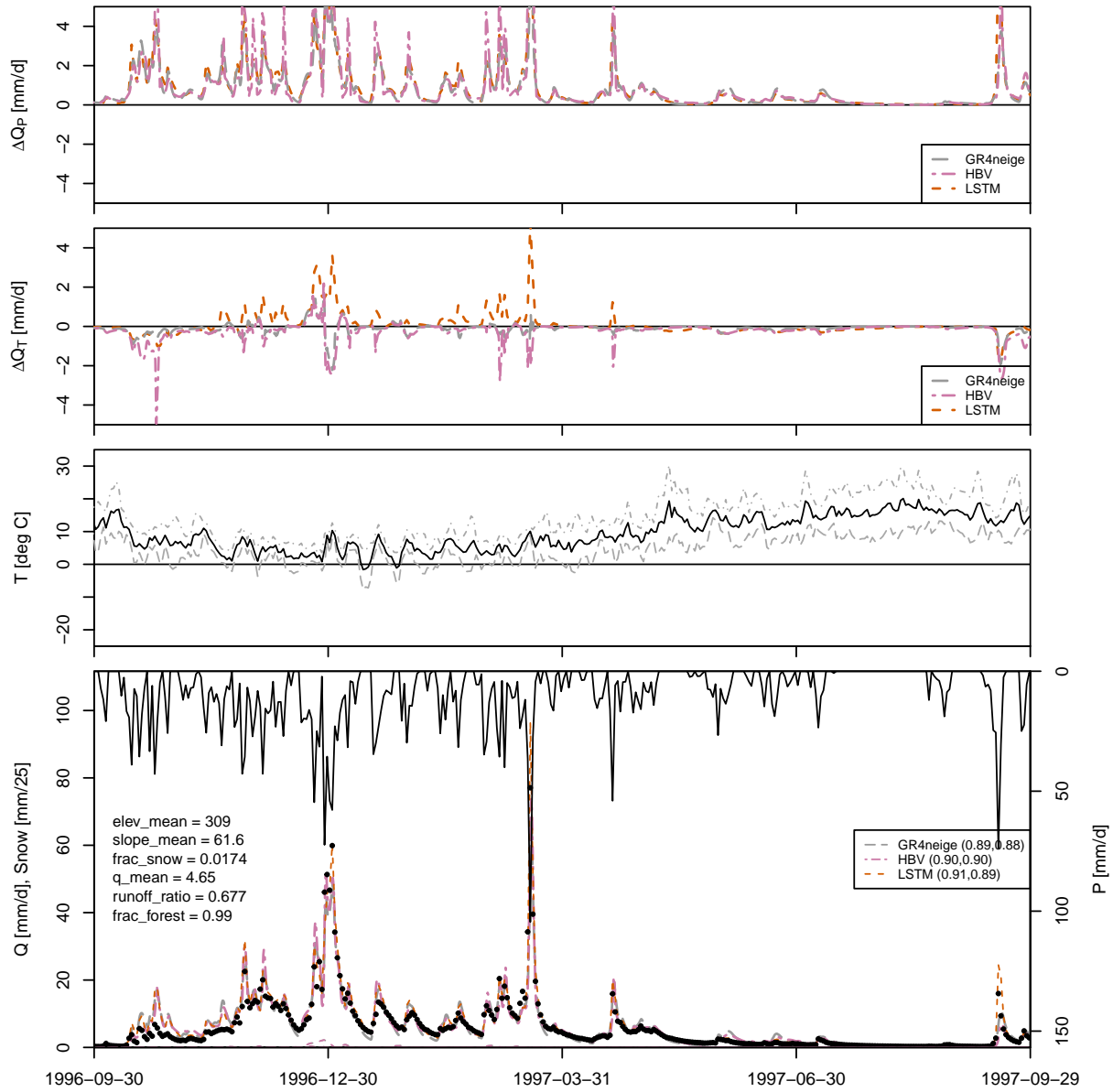


**Figure S15.** Results for basin 12013500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.





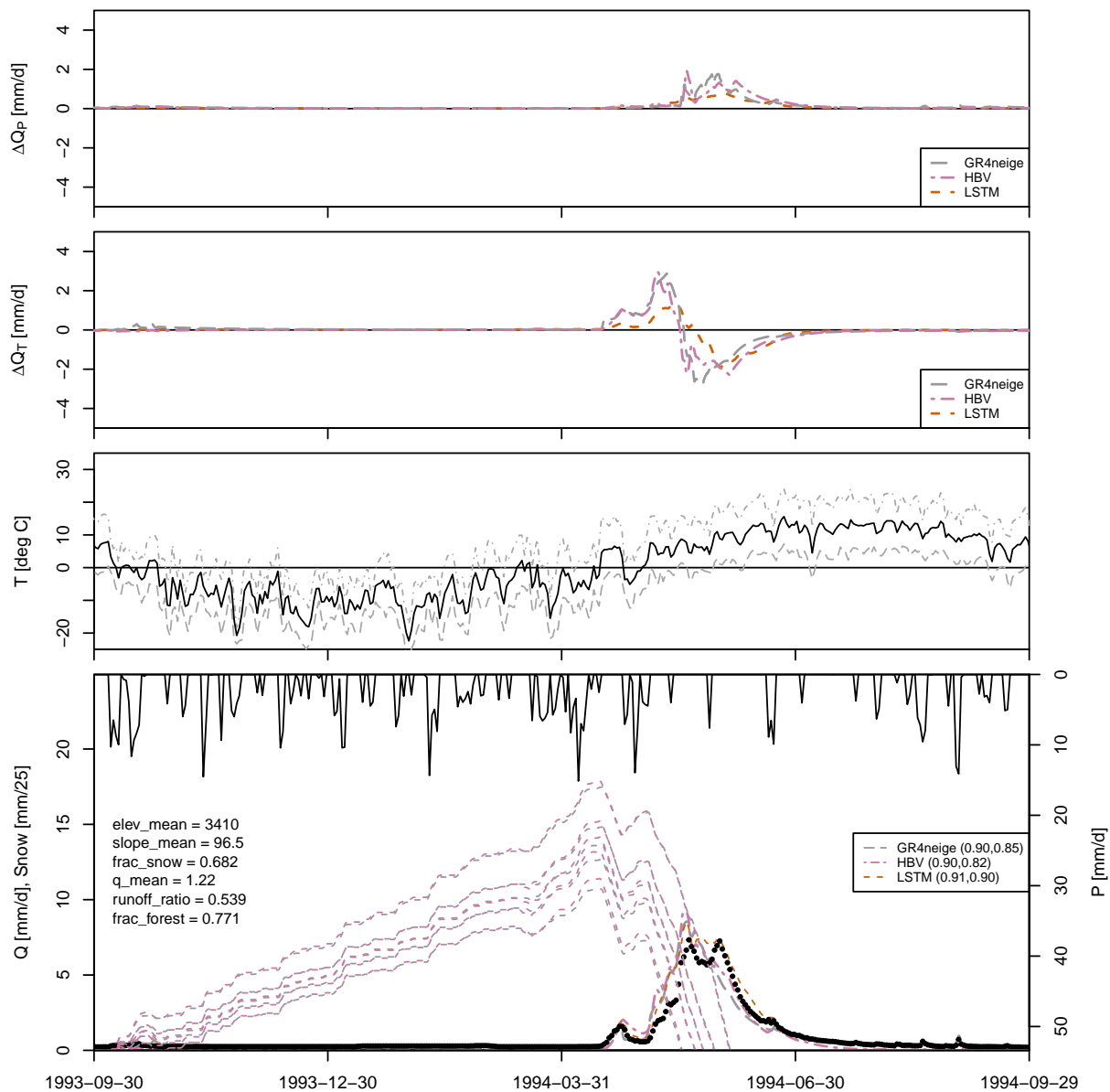
**Figure S16.** Results for basin 12013500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.



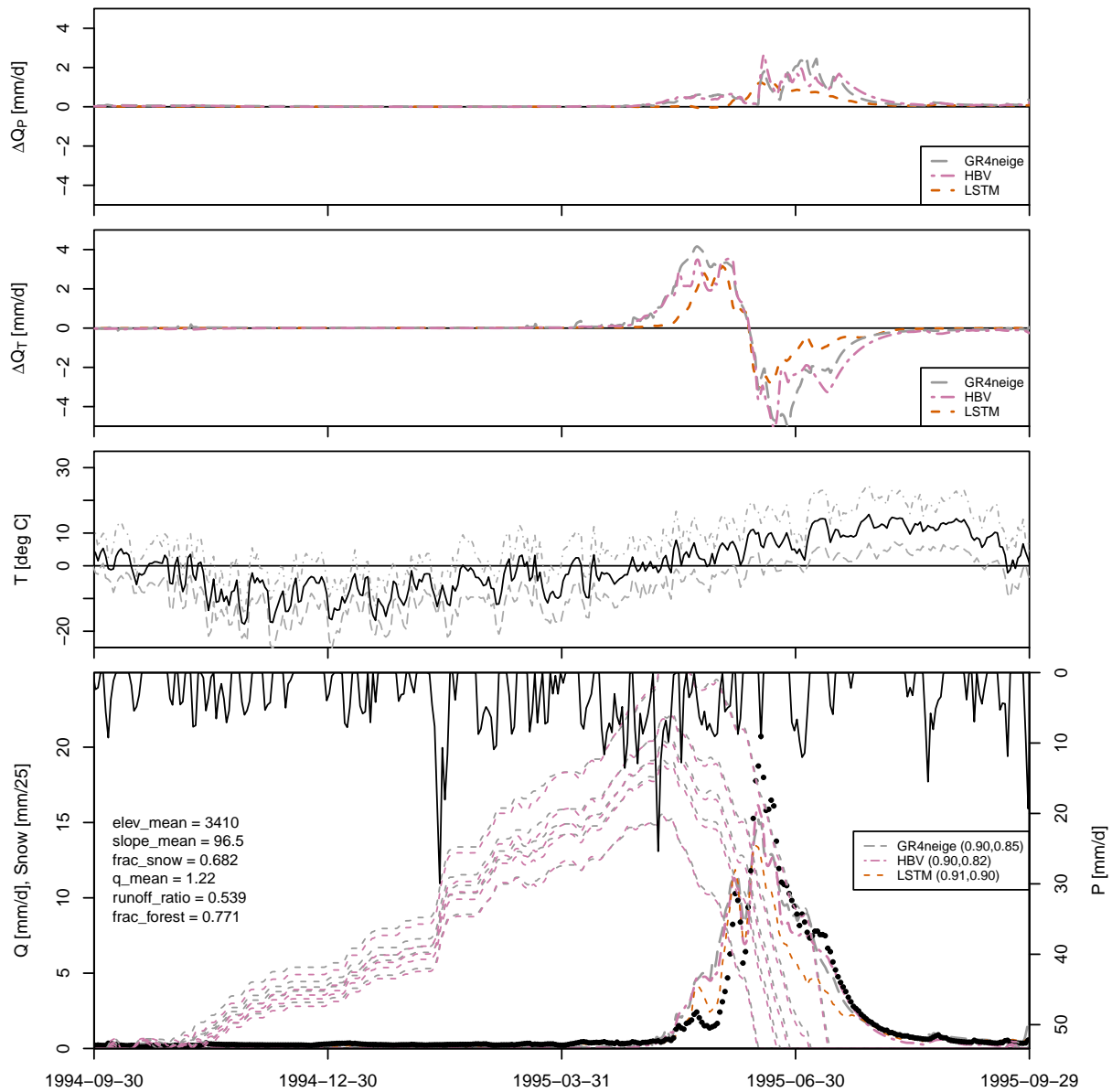
**Figure S17.** Results for basin 12013500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.

### S3 Comprehensive Results for Very High Altitude (Cold) Basins

The Figures S18 to S21 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 09066000.

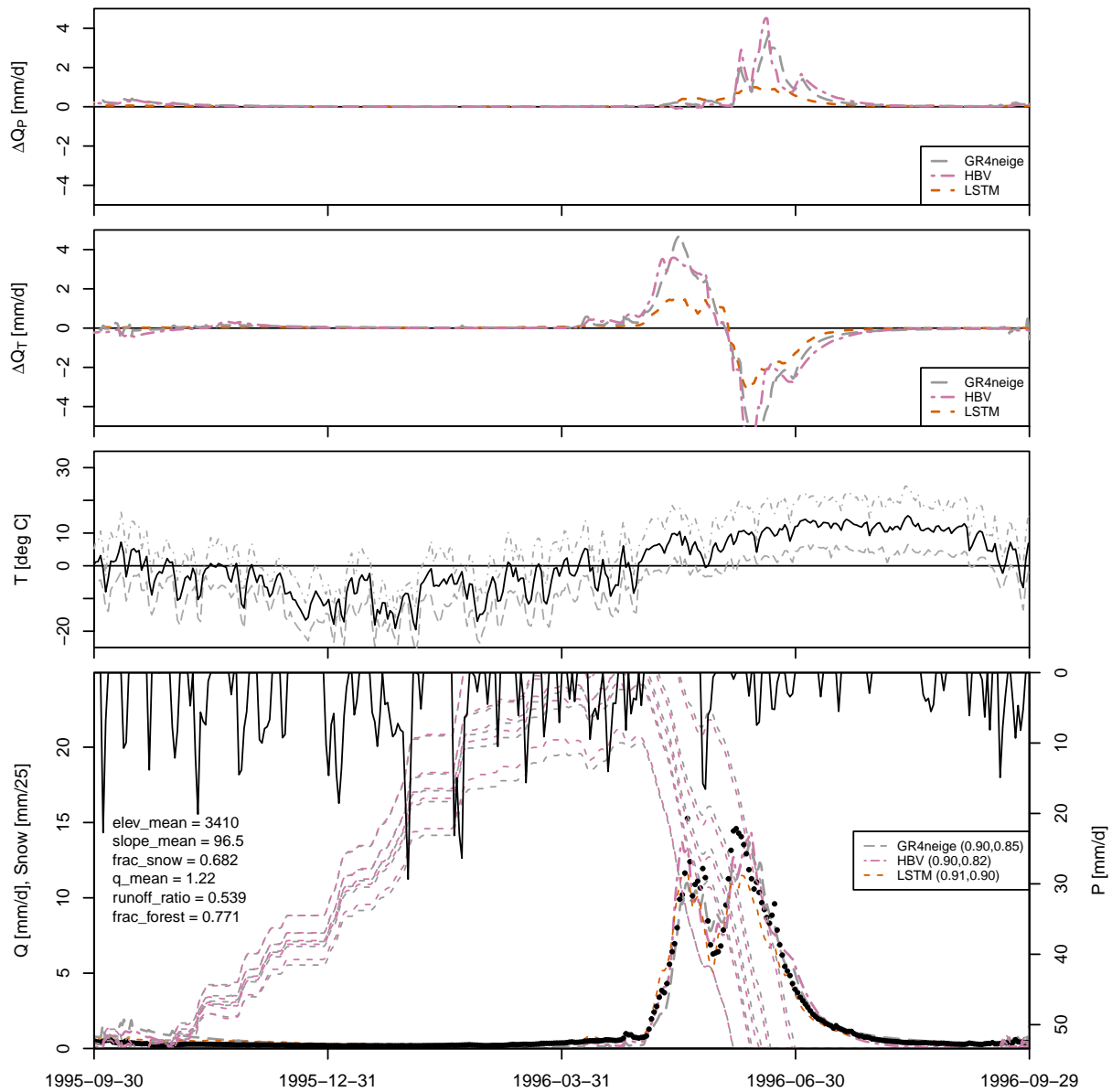


**Figure S18.** Results for basin 09066000, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.



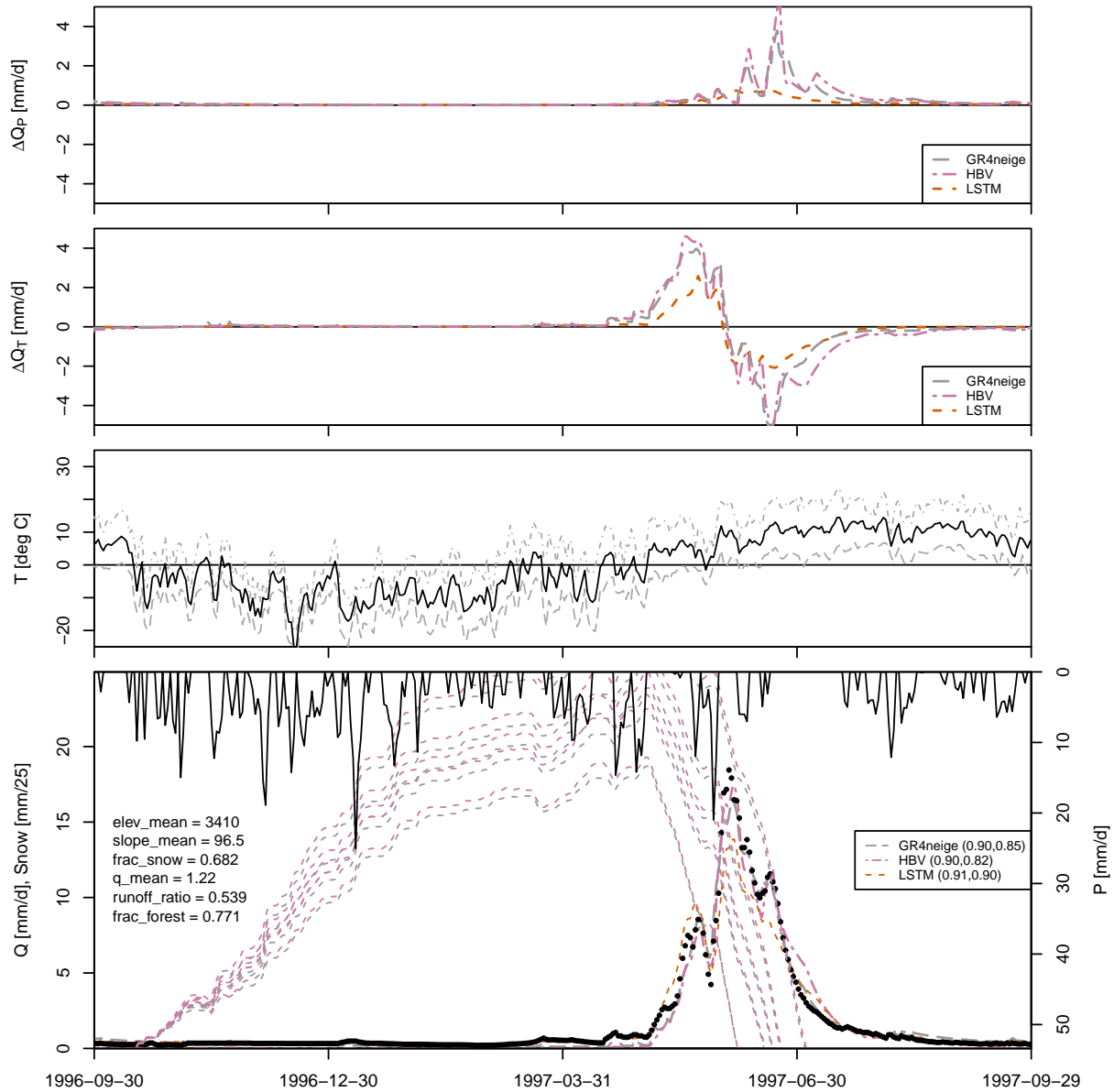
**Figure S19.** Results for basin 09066000, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.

865 The Figures S22 to S25 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 07083000.



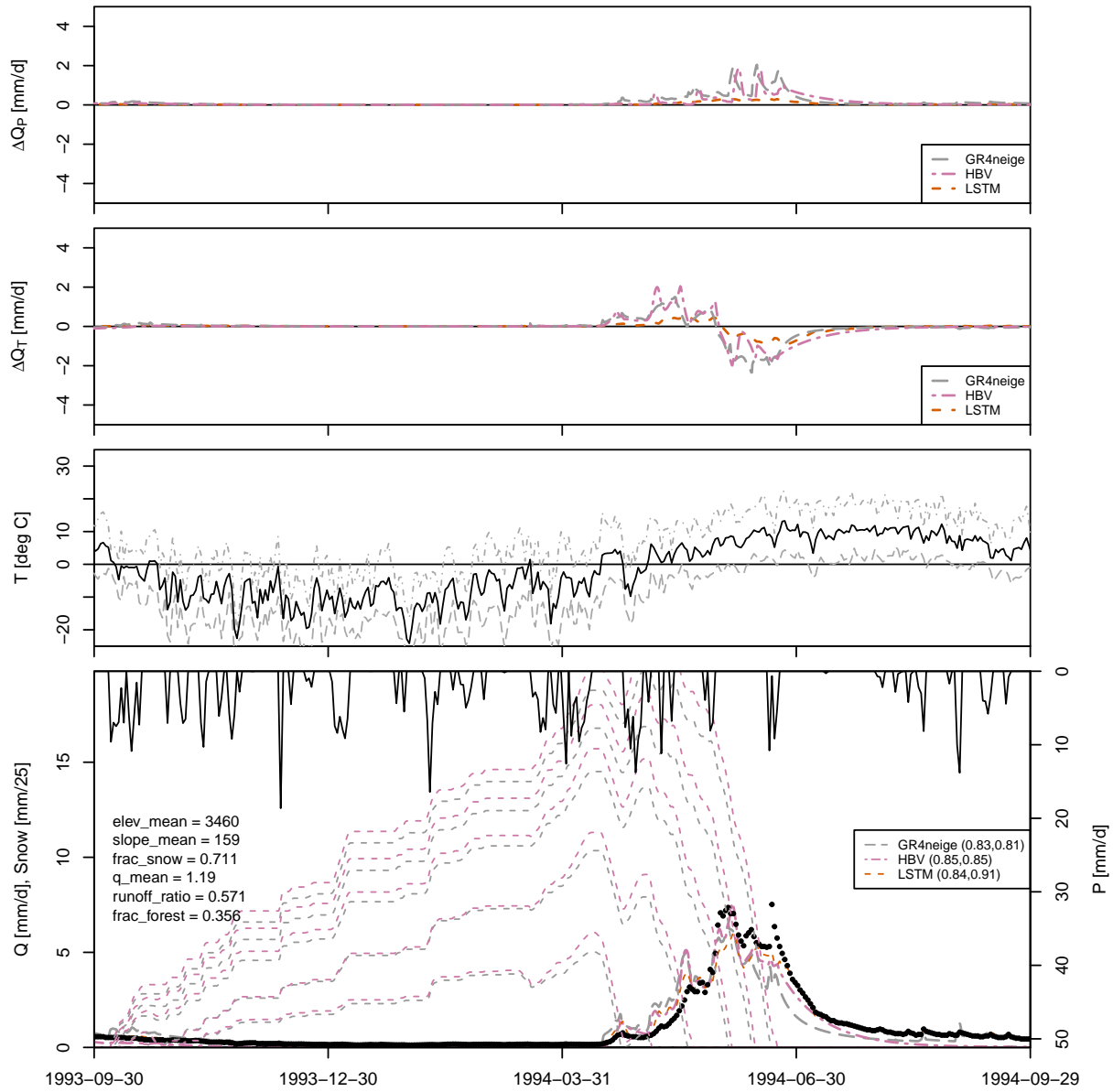
**Figure S20.** Results for basin 09066000, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.

The Figures S26 to S29 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 06614800.

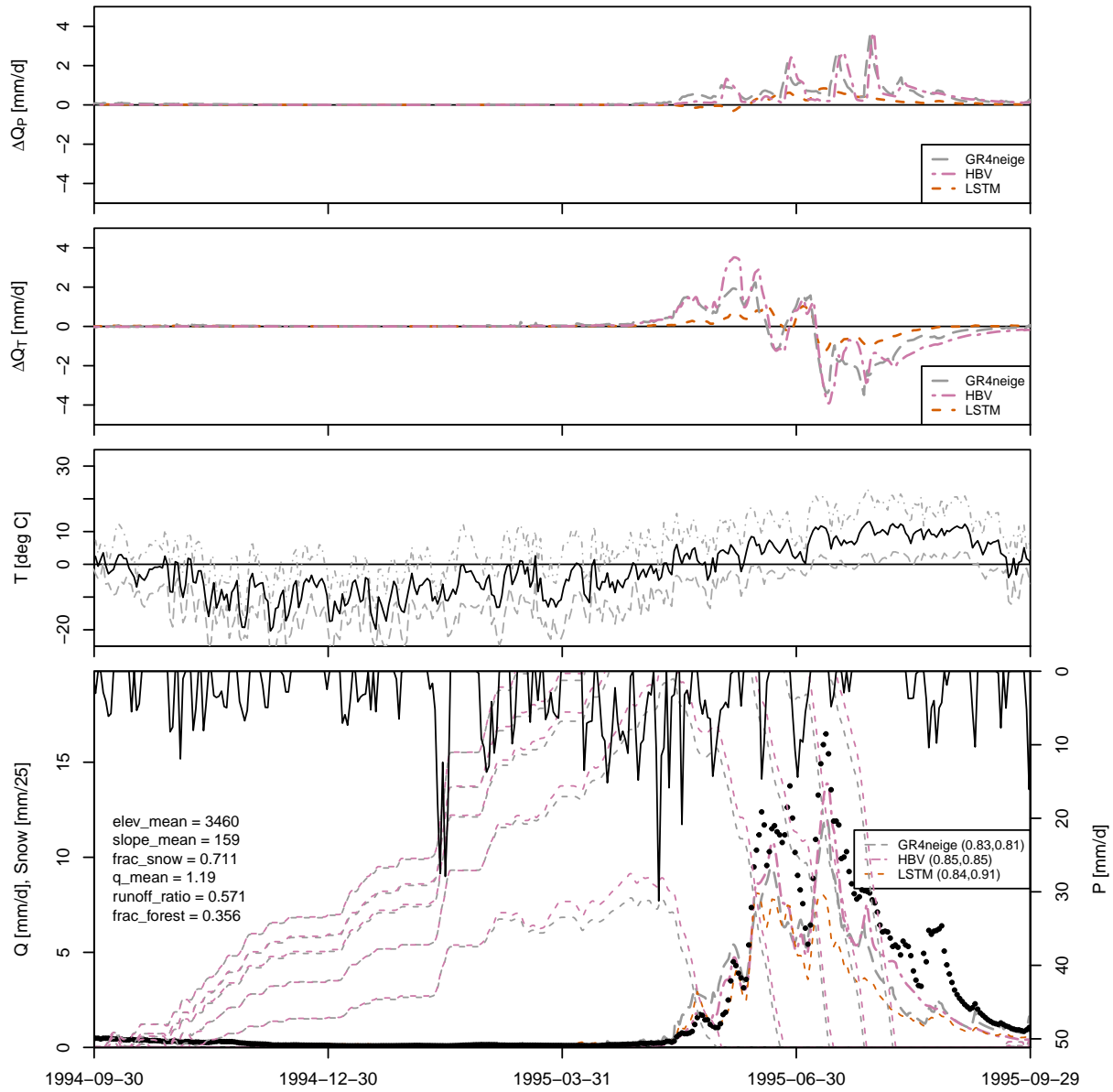


**Figure S21.** Results for basin 09066000, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.

The Figures S30 to S33 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 09035800.

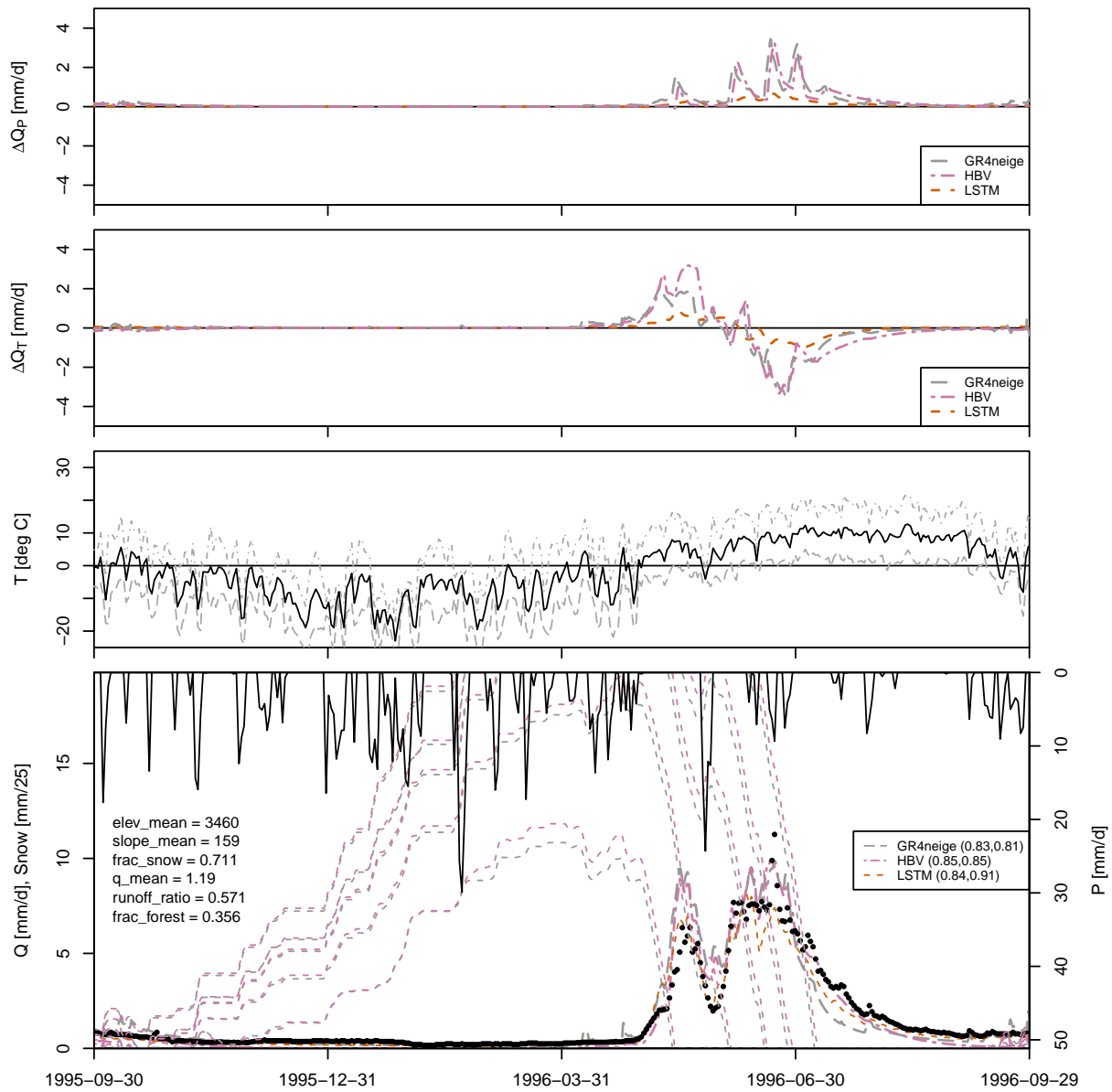


**Figure S22.** Results for basin 07083000, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.

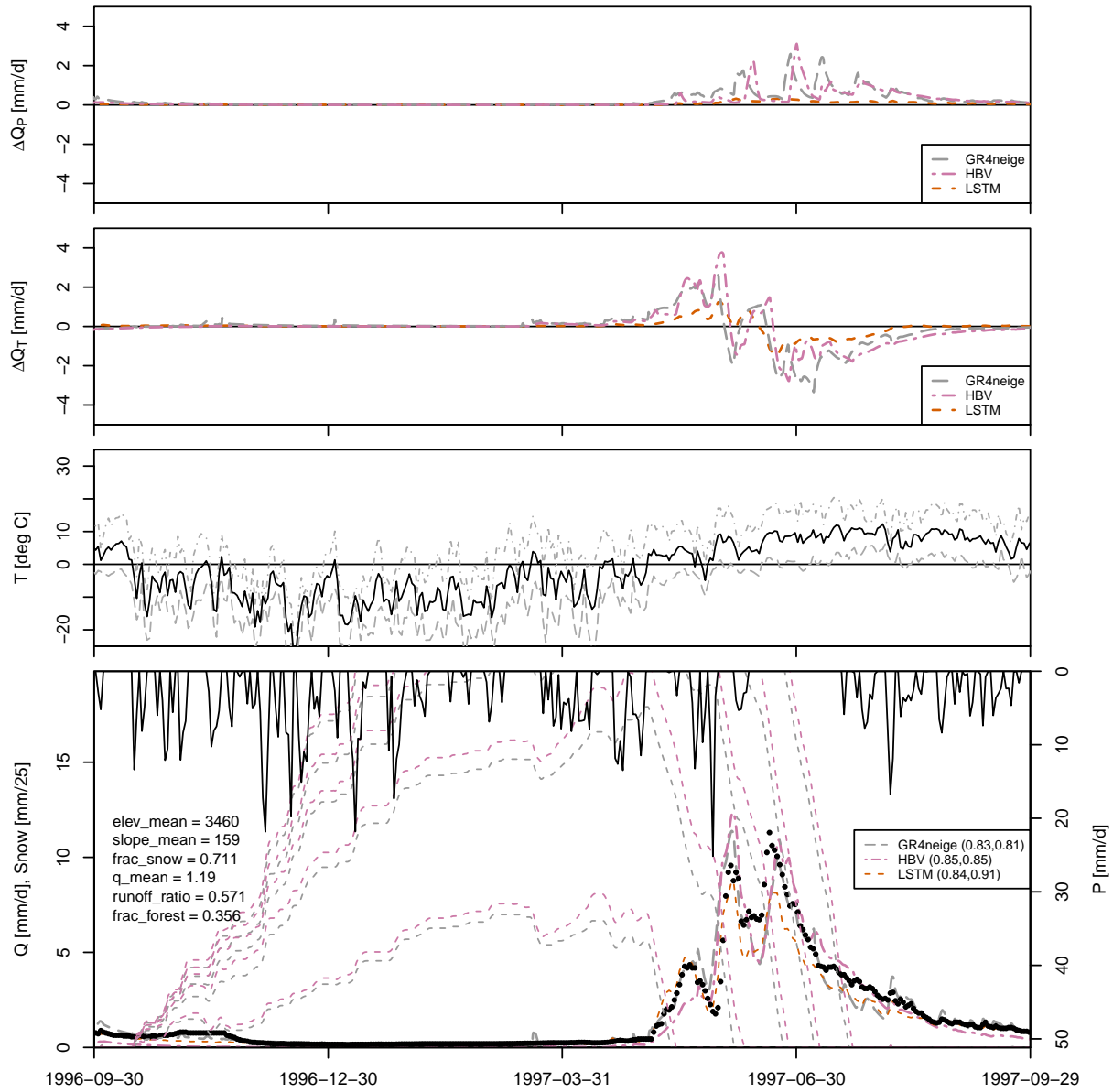


**Figure S23.** Results for basin 07083000, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.

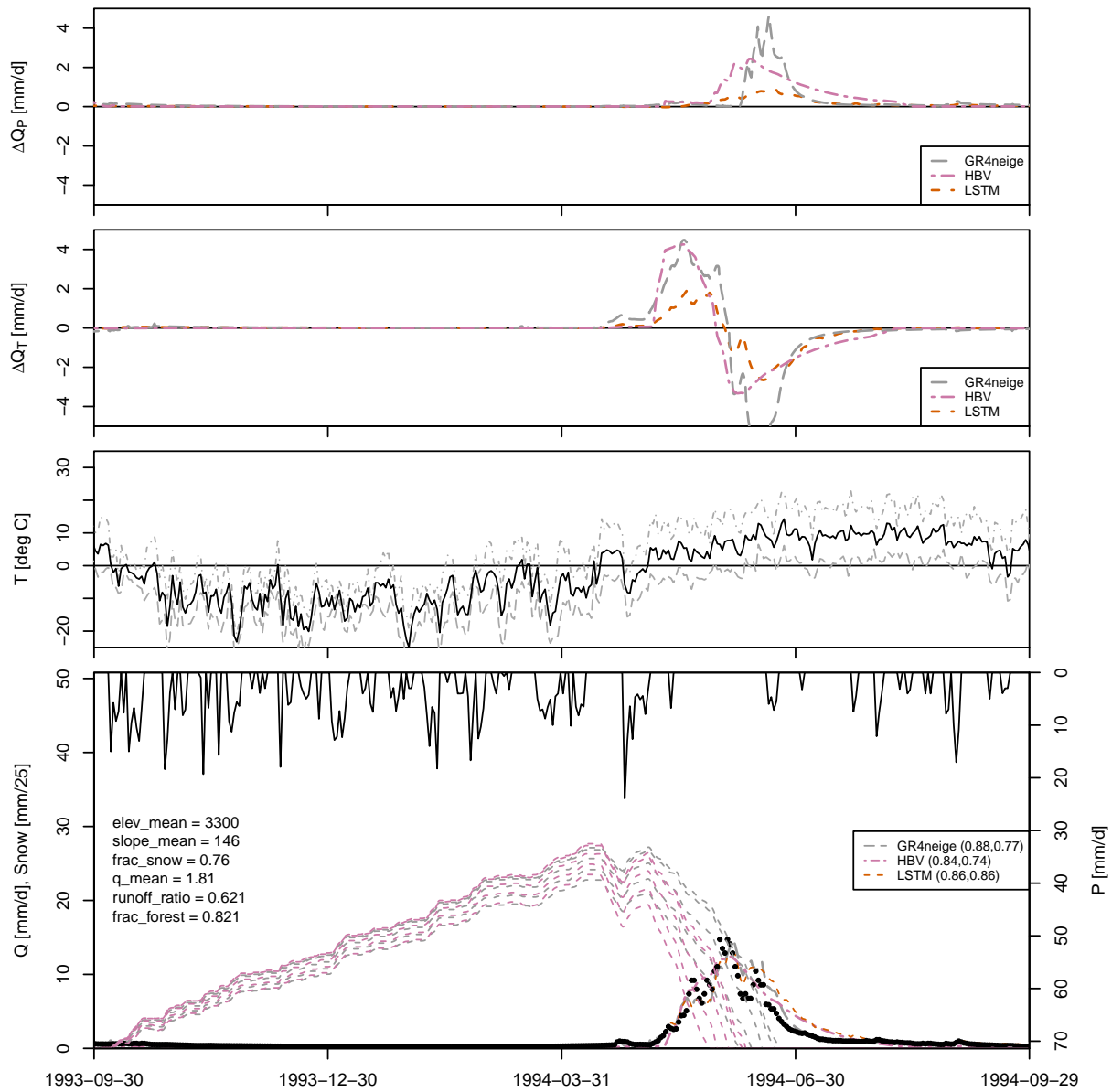




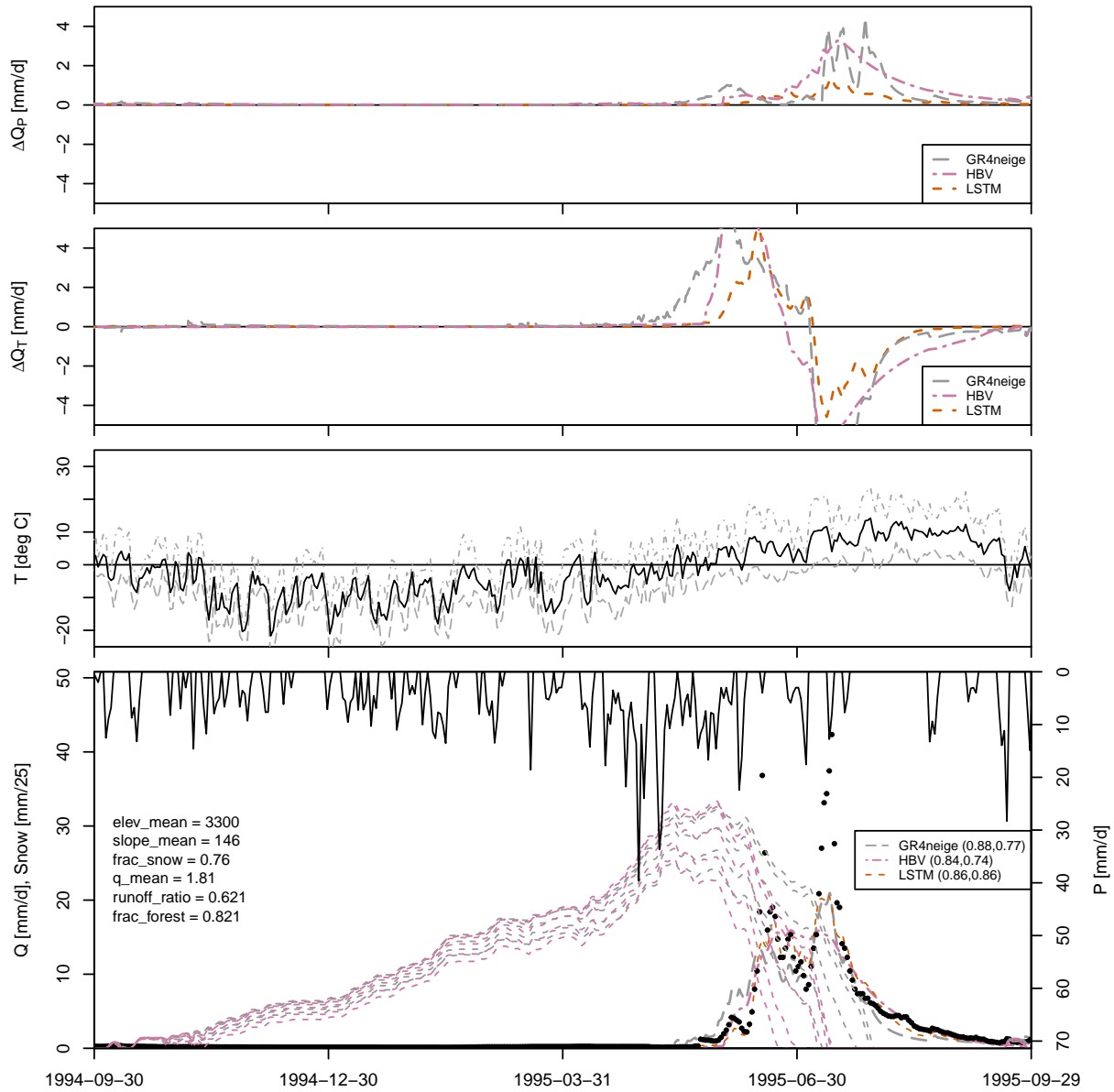
**Figure S24.** Results for basin 07083000, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.



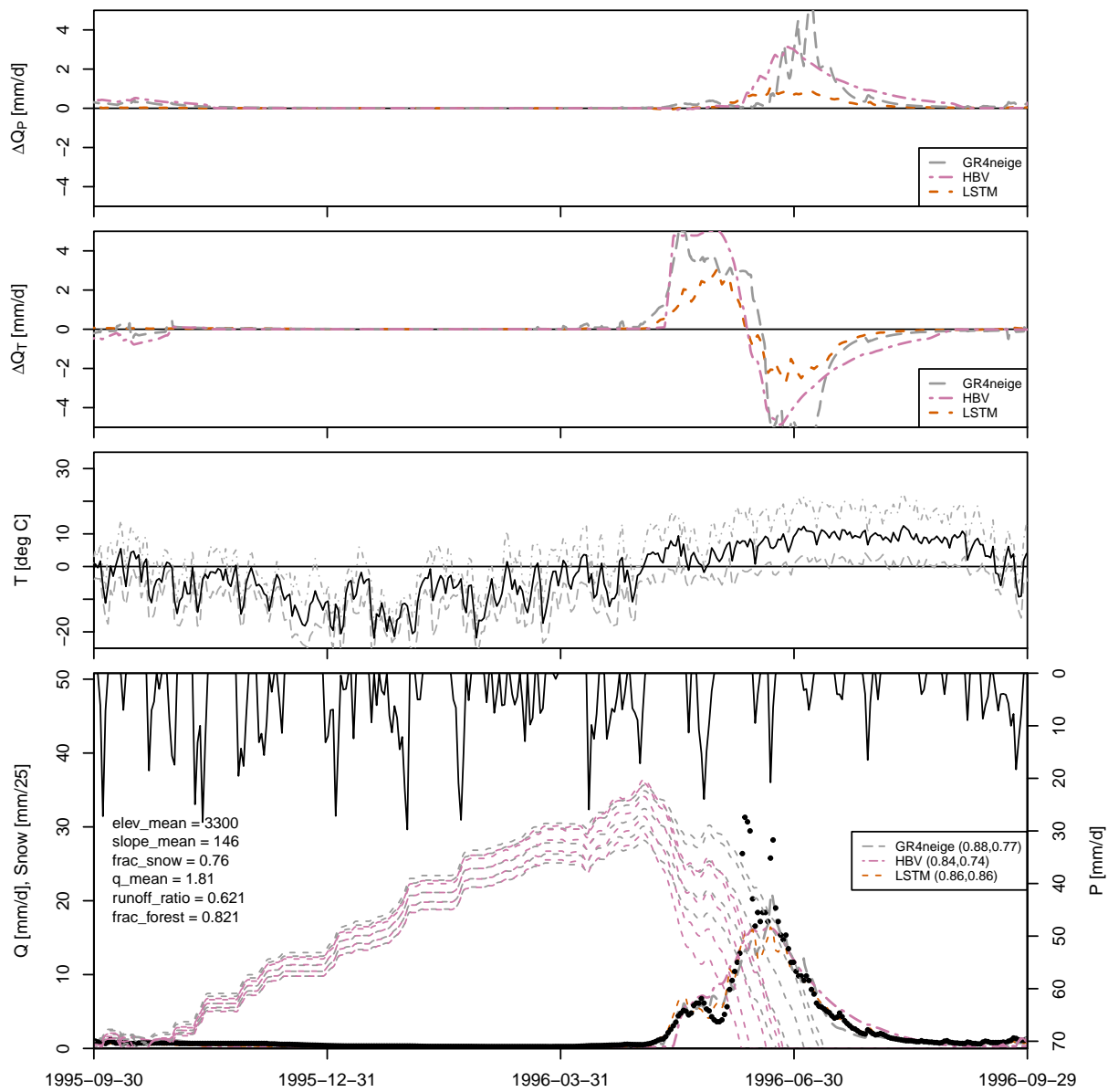
**Figure S25.** Results for basin 07083000, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.



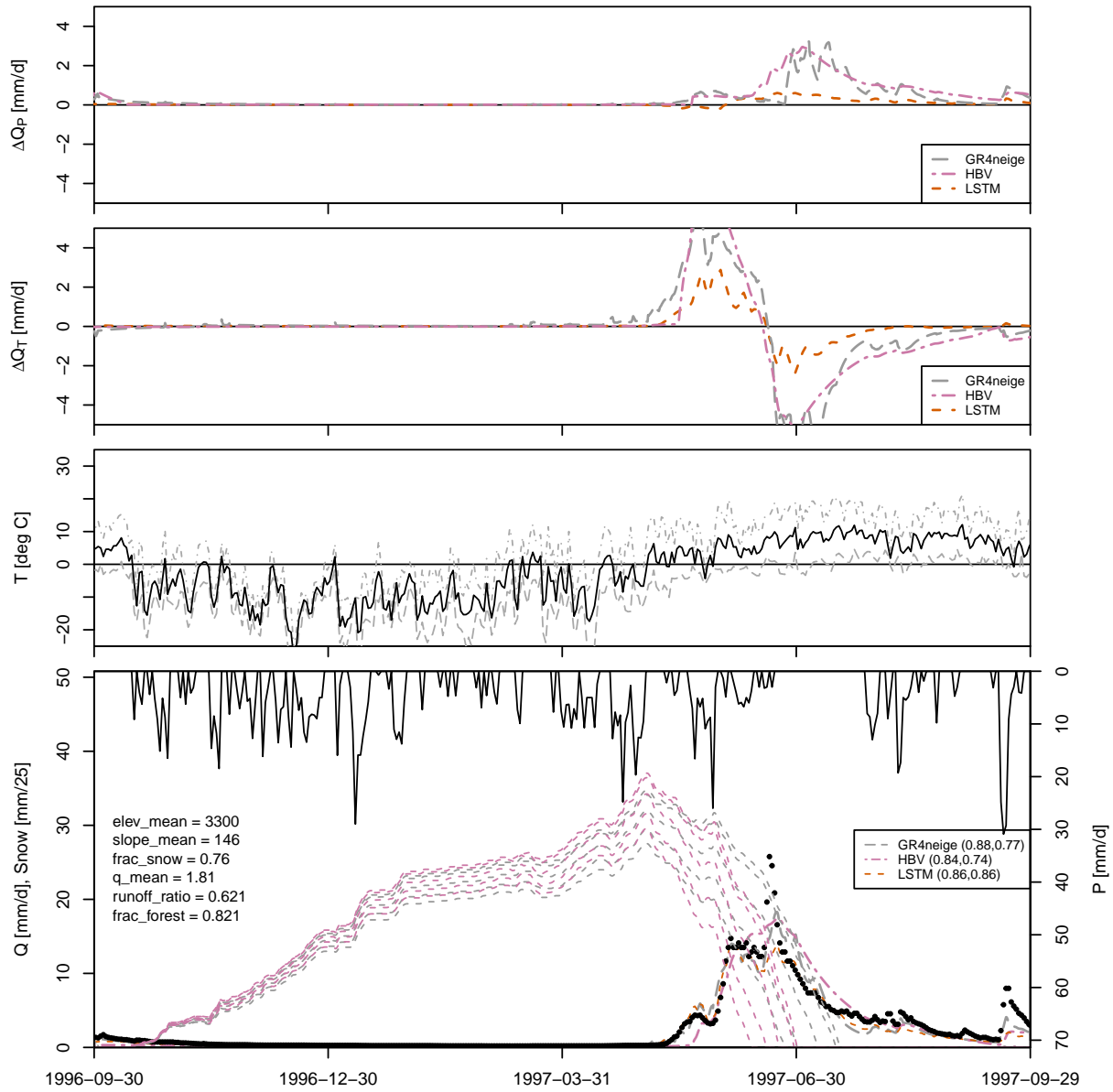
**Figure S26.** Results for basin 06614800, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.



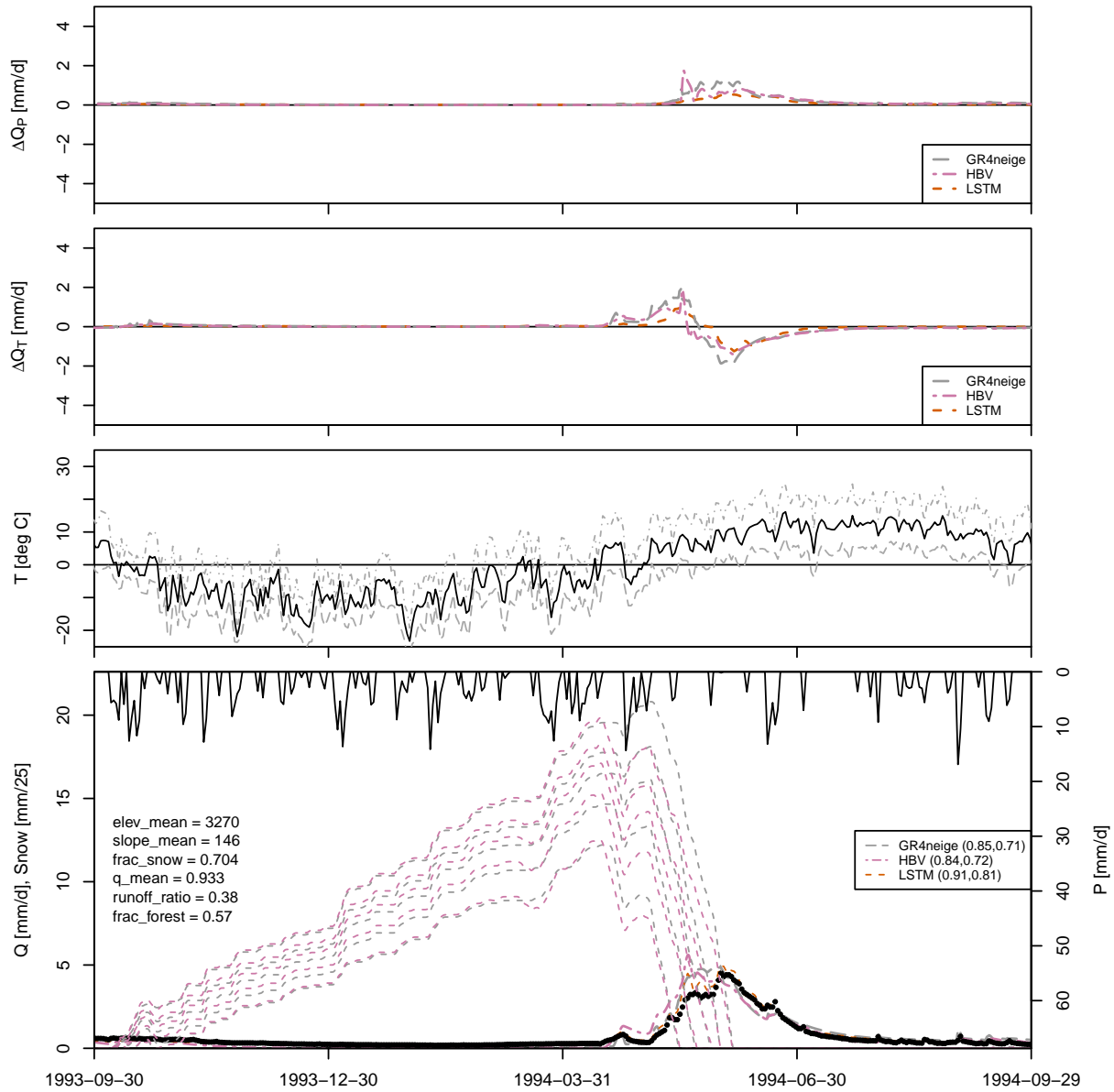
**Figure S27.** Results for basin 06614800, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.



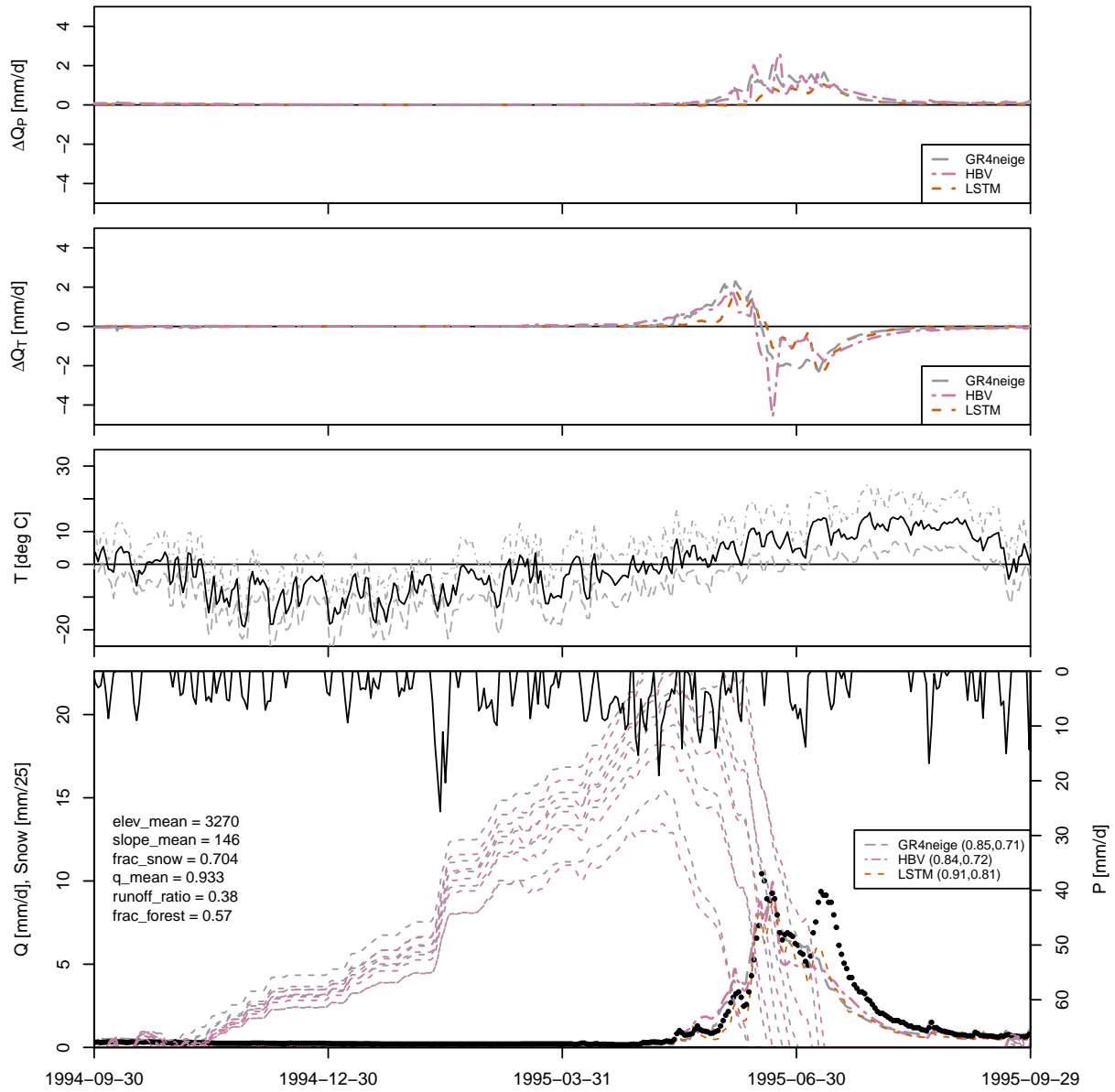
**Figure S28.** Results for basin 06614800, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.



**Figure S29.** Results for basin 06614800, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.

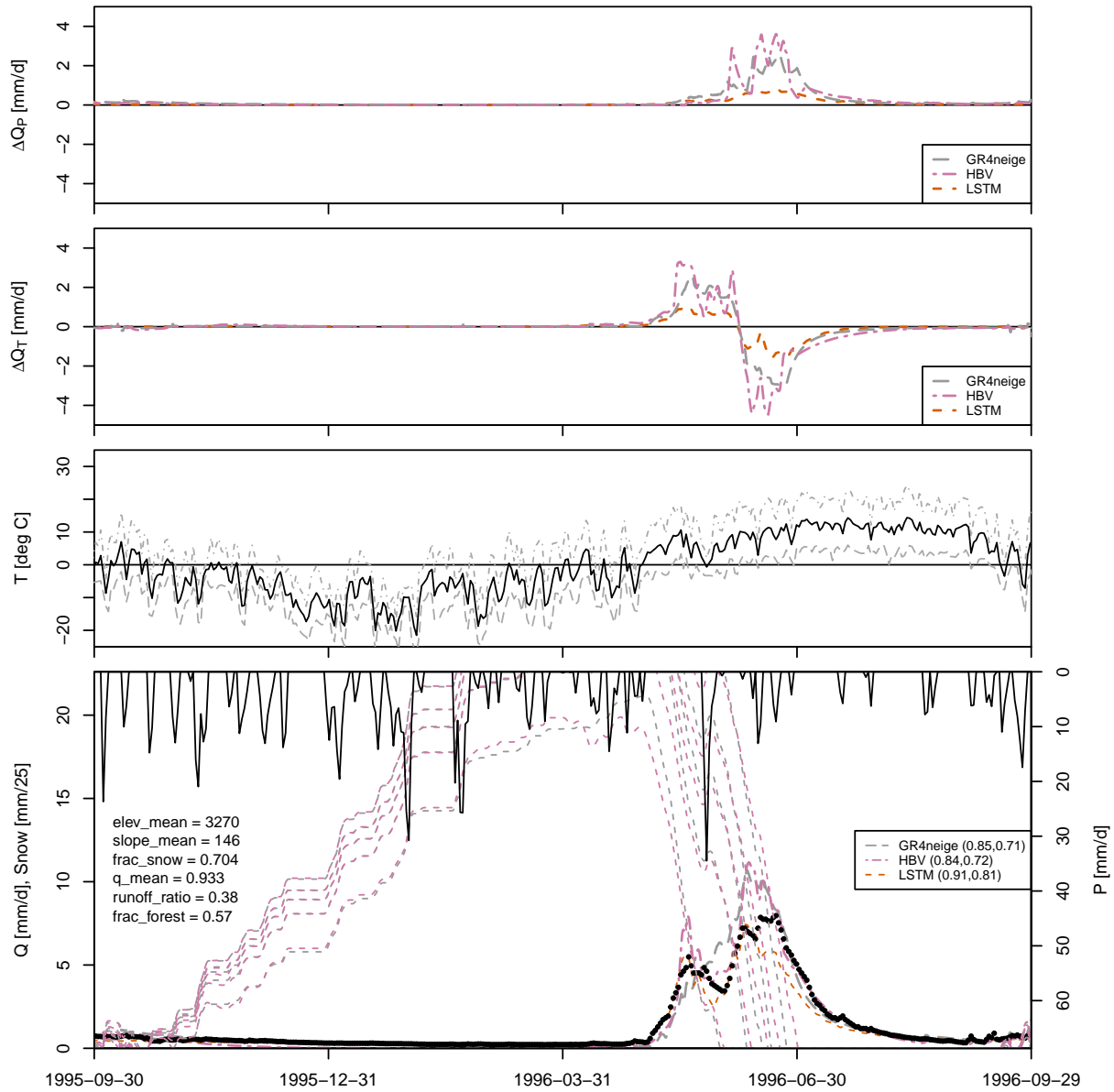


**Figure S30.** Results for basin 09035800, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.

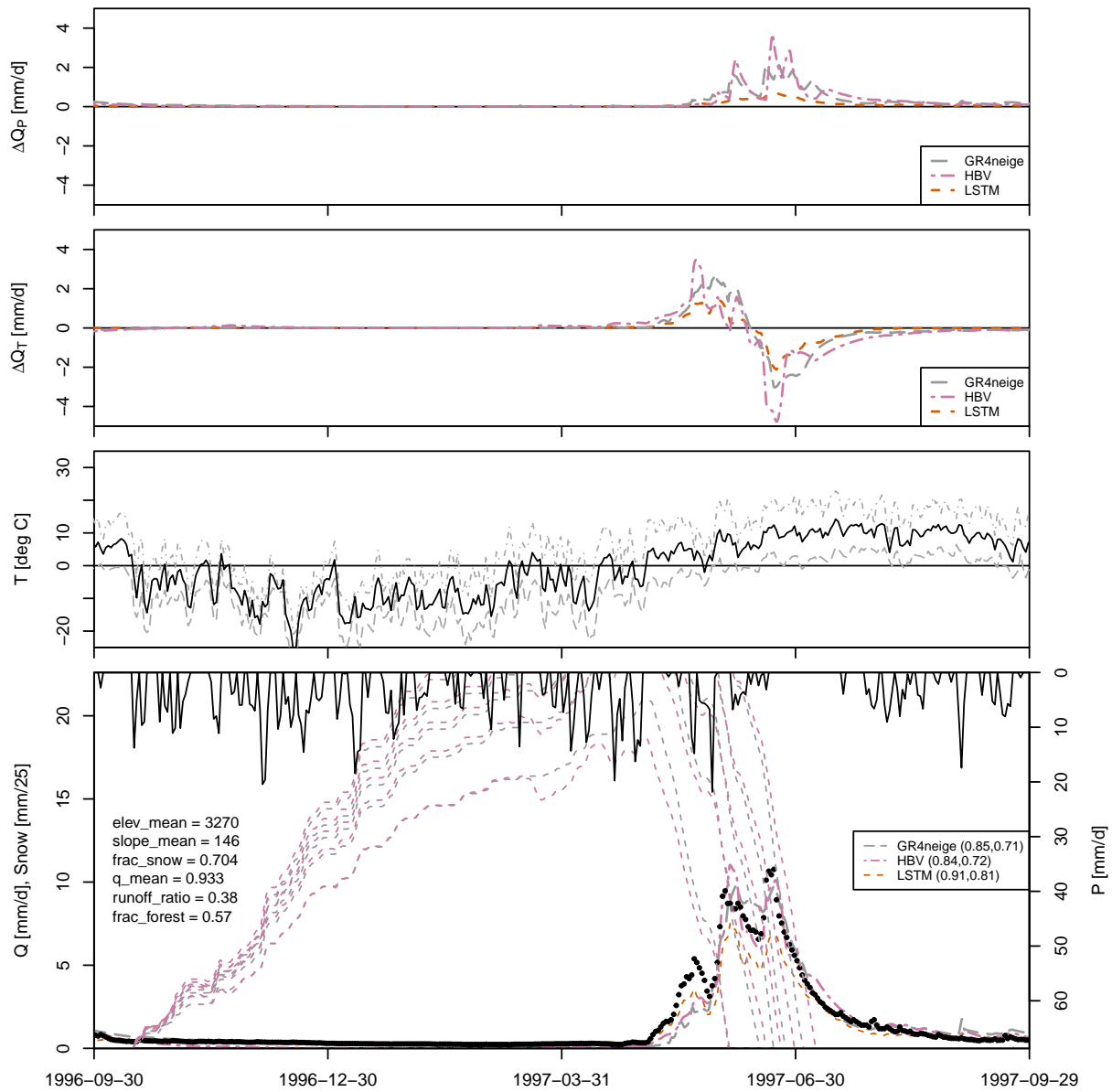


**Figure S31.** Results for basin 09035800, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.





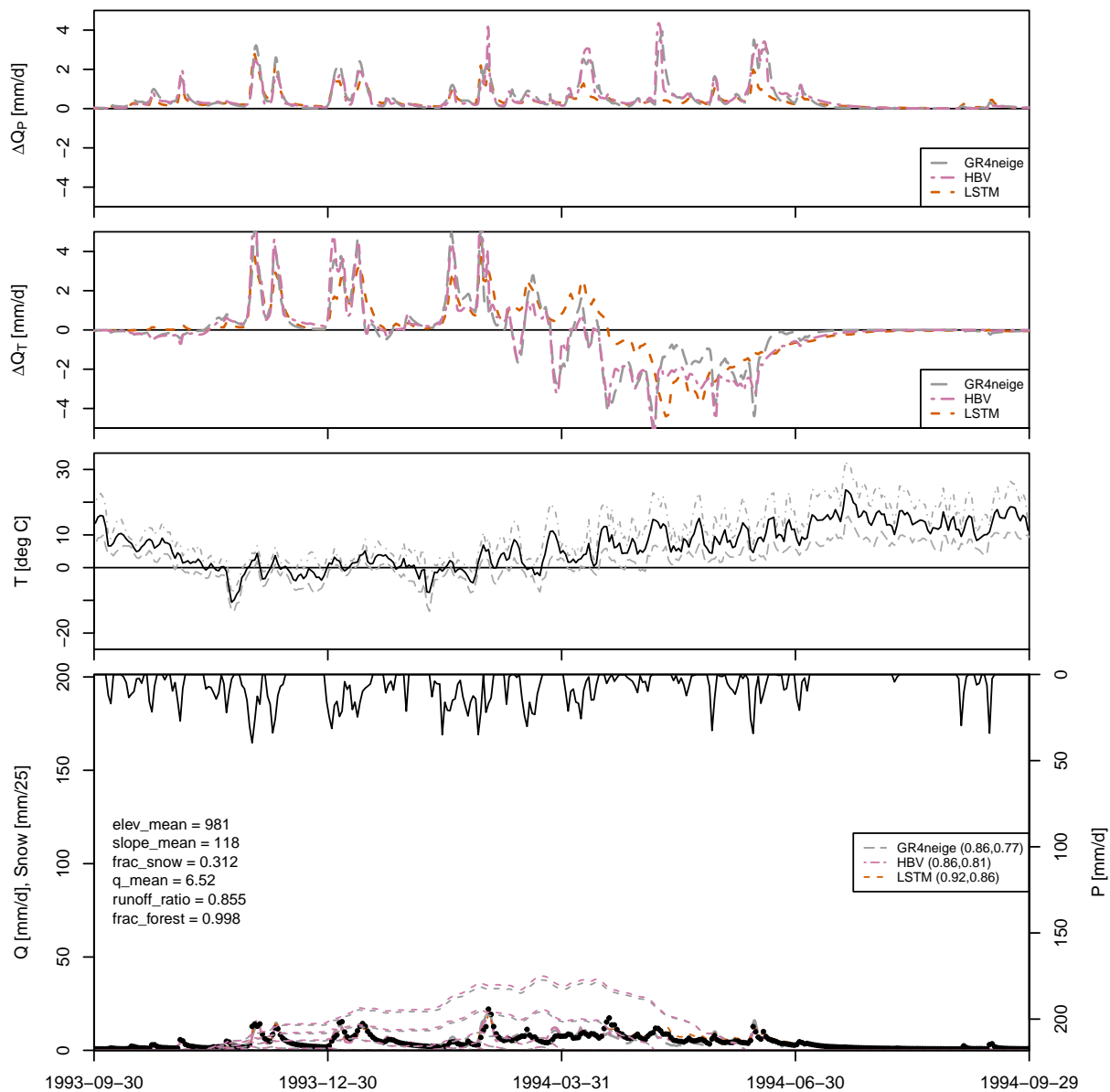
**Figure S32.** Results for basin 09035800, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.



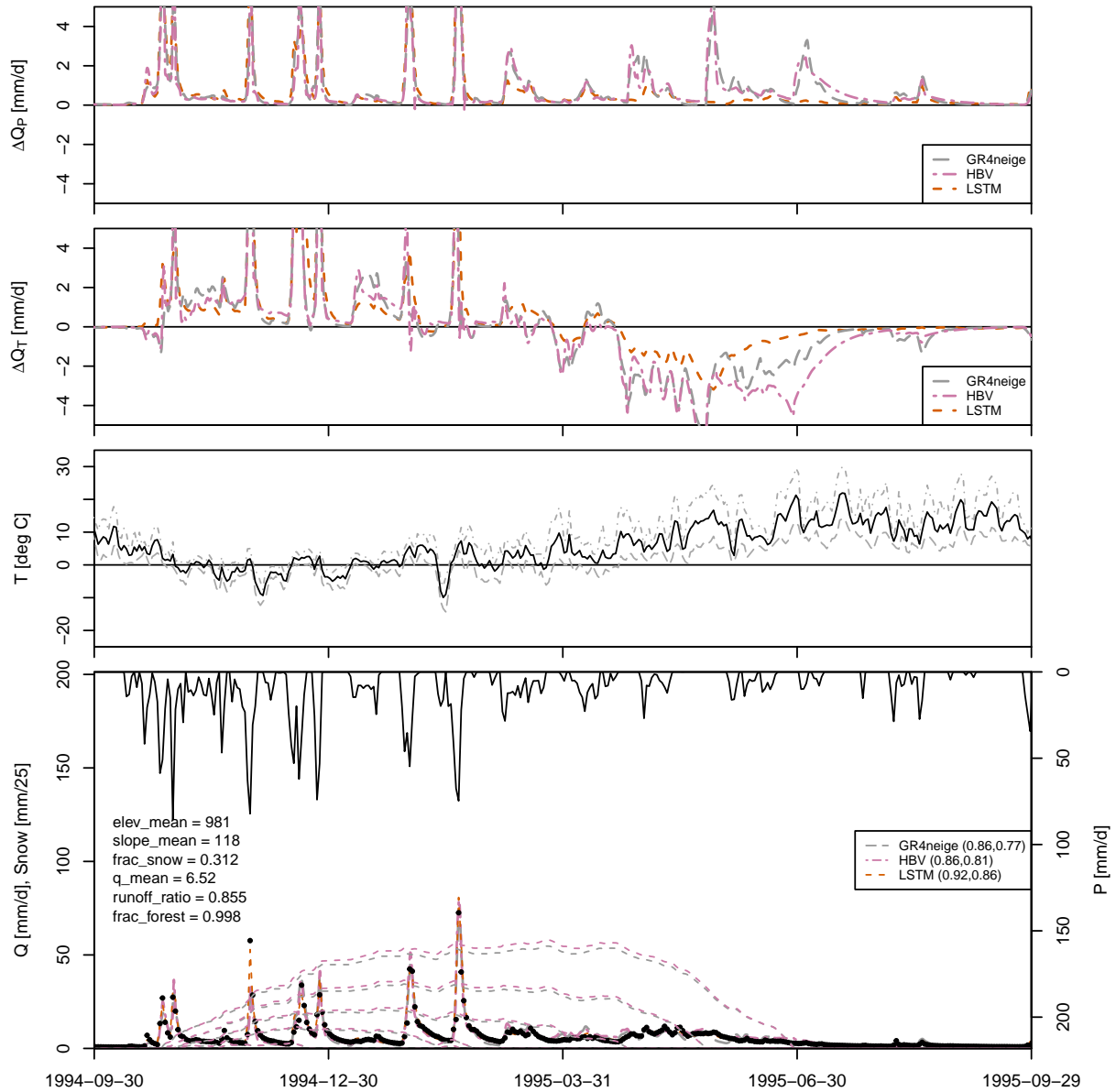
**Figure S33.** Results for basin 09035800, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.

#### S4 Comprehensive Results for Intermediate Altitude Basins

875 The Figures S34 to S37 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 12143600.

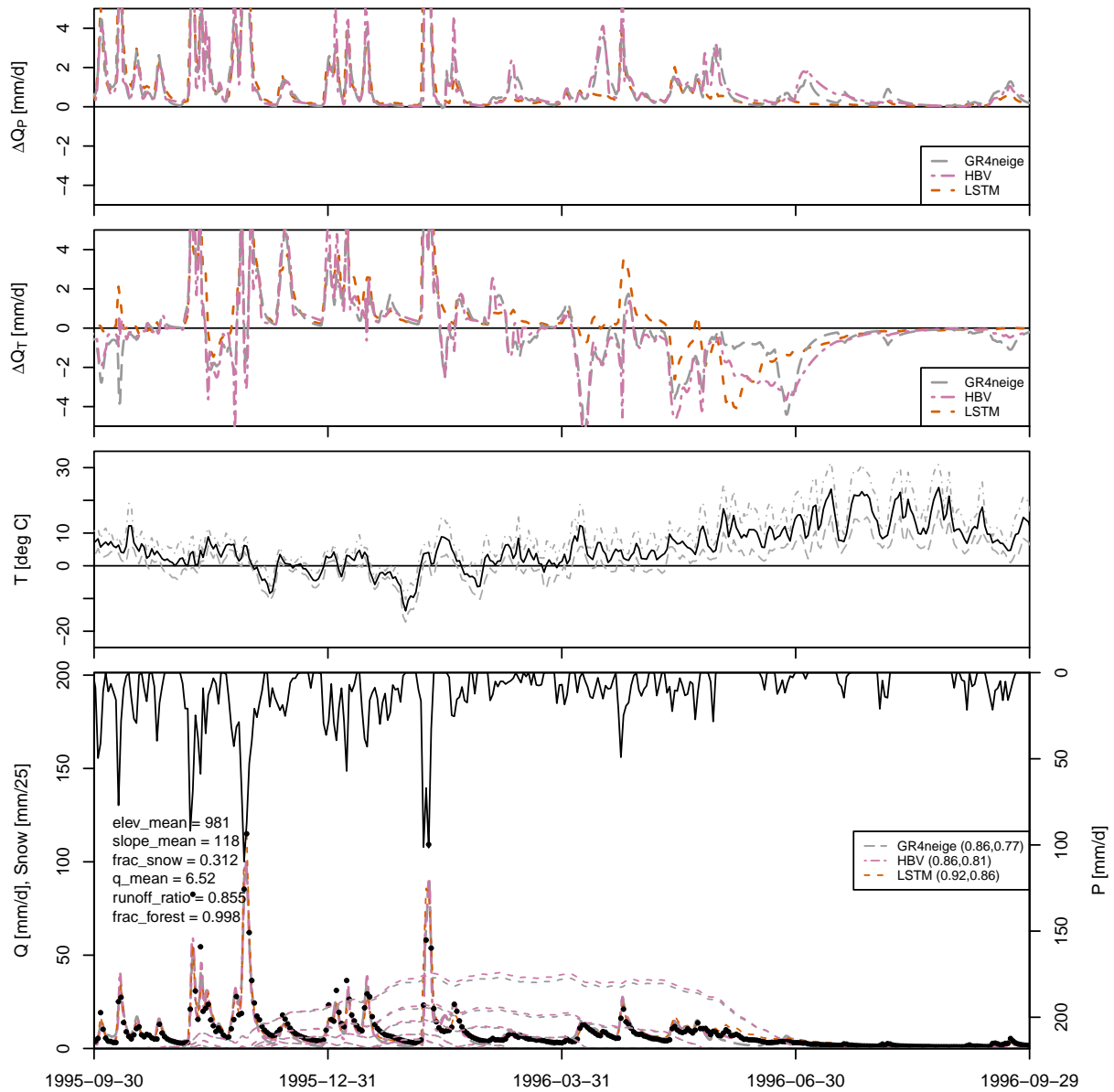


**Figure S34.** Results for basin 12143600, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.



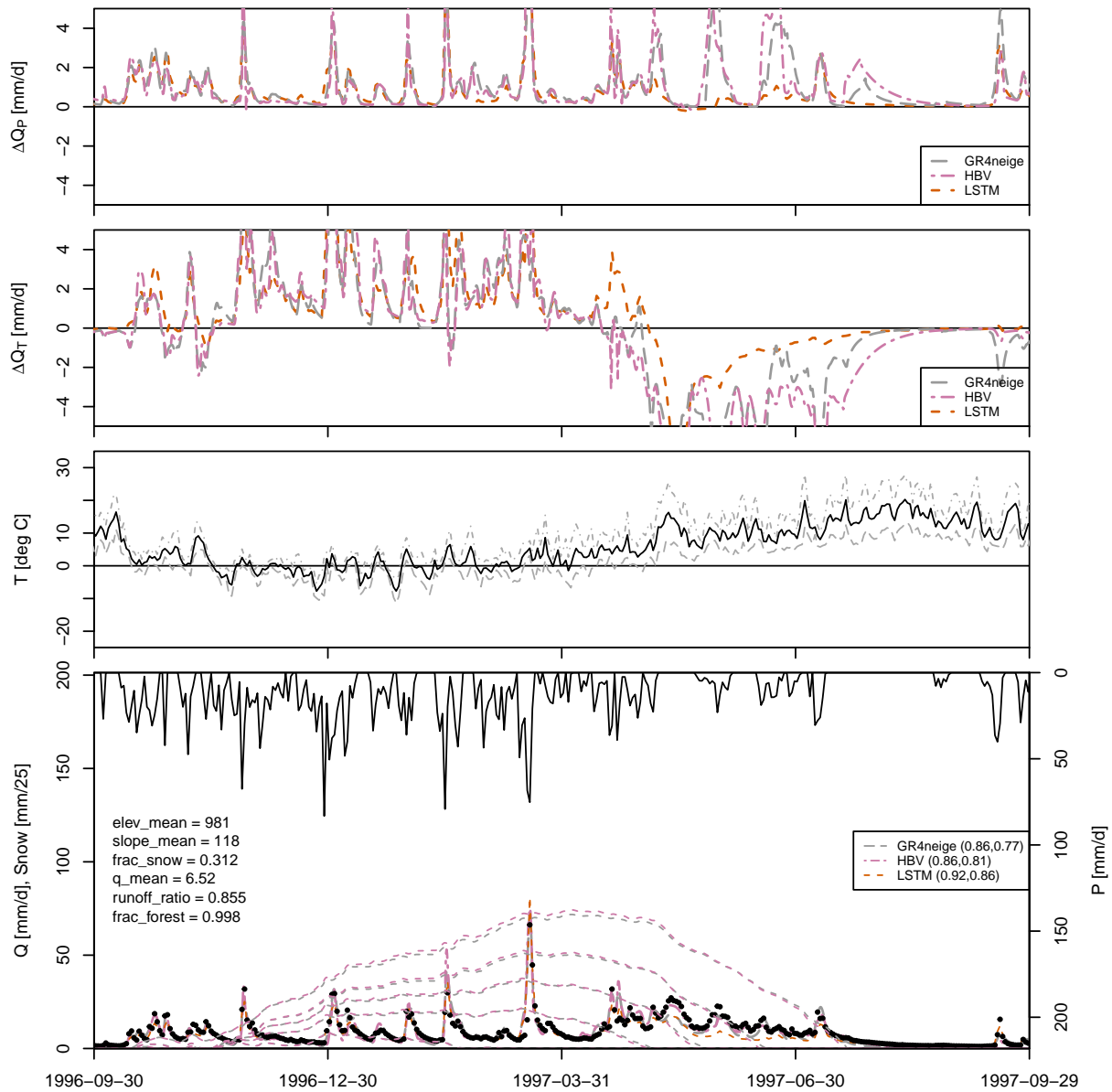
**Figure S35.** Results for basin 12143600, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.

The Figures S38 to S41 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 14216500.



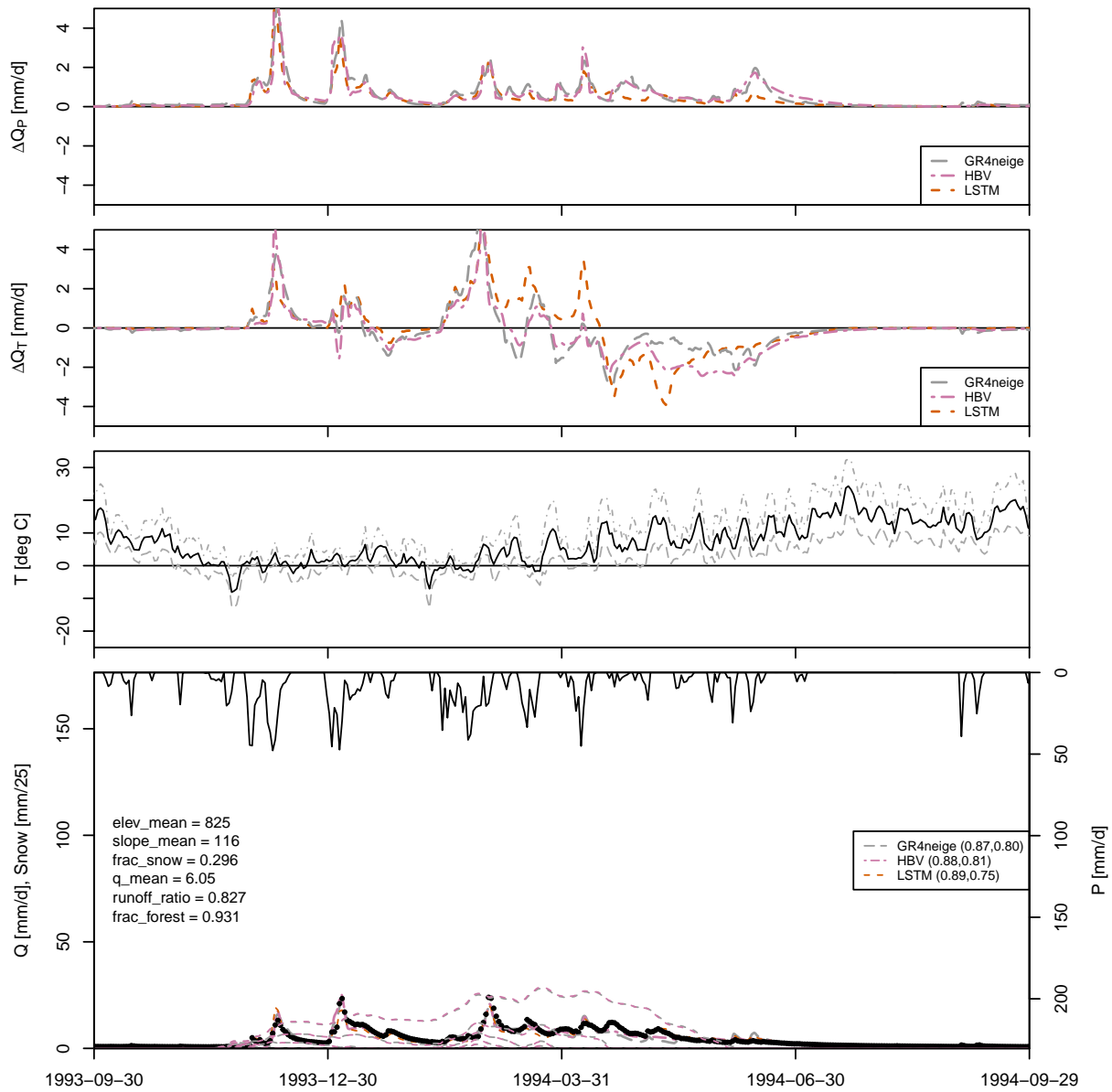
**Figure S36.** Results for basin 12143600, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.

The Figures S42 to S45 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 12114500.

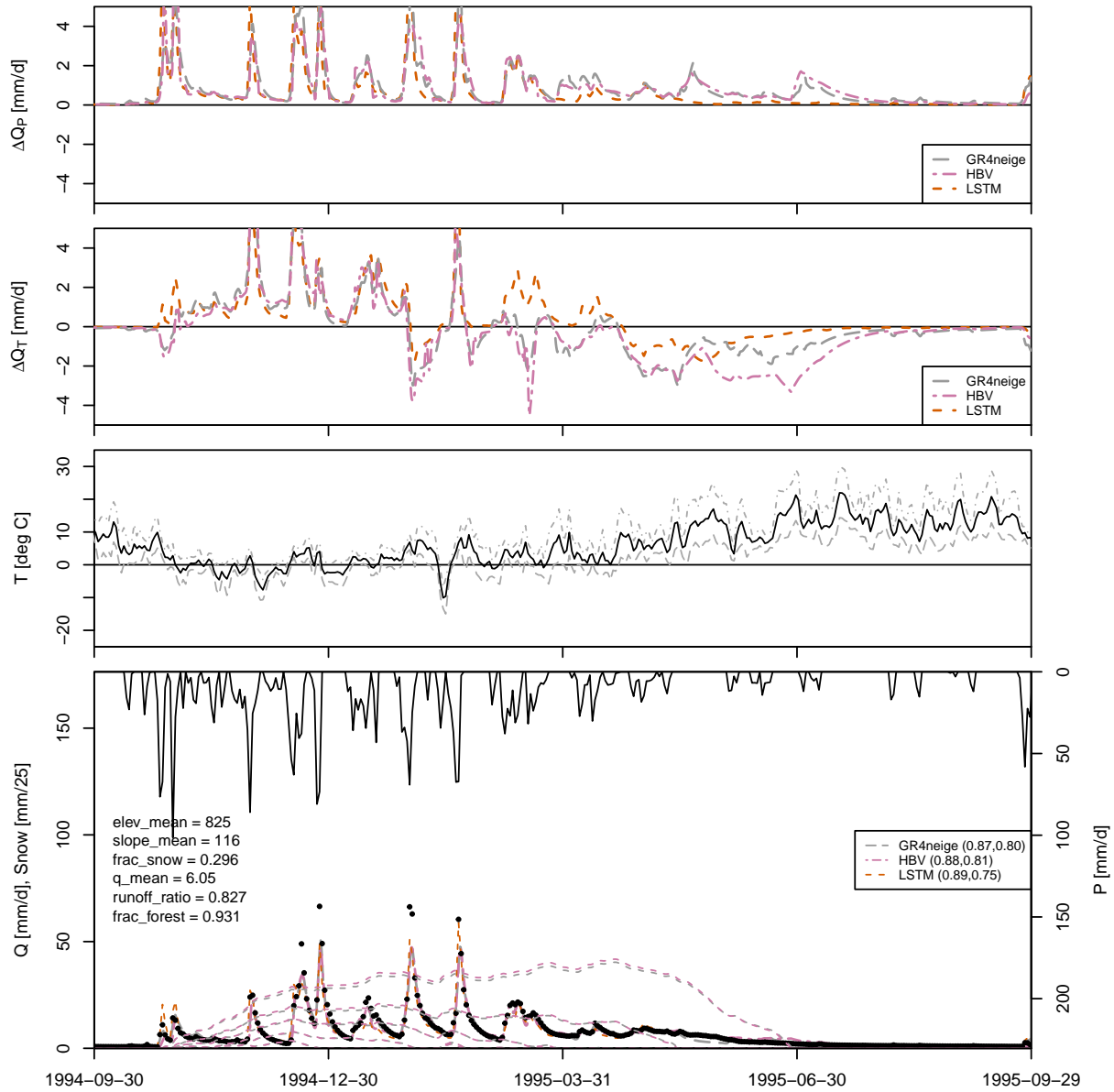


**Figure S37.** Results for basin 12143600, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.

The Figures S46 to S49 show the results for the last two years of the calibration period and for the first two years of the validation period for the basin 14154500.

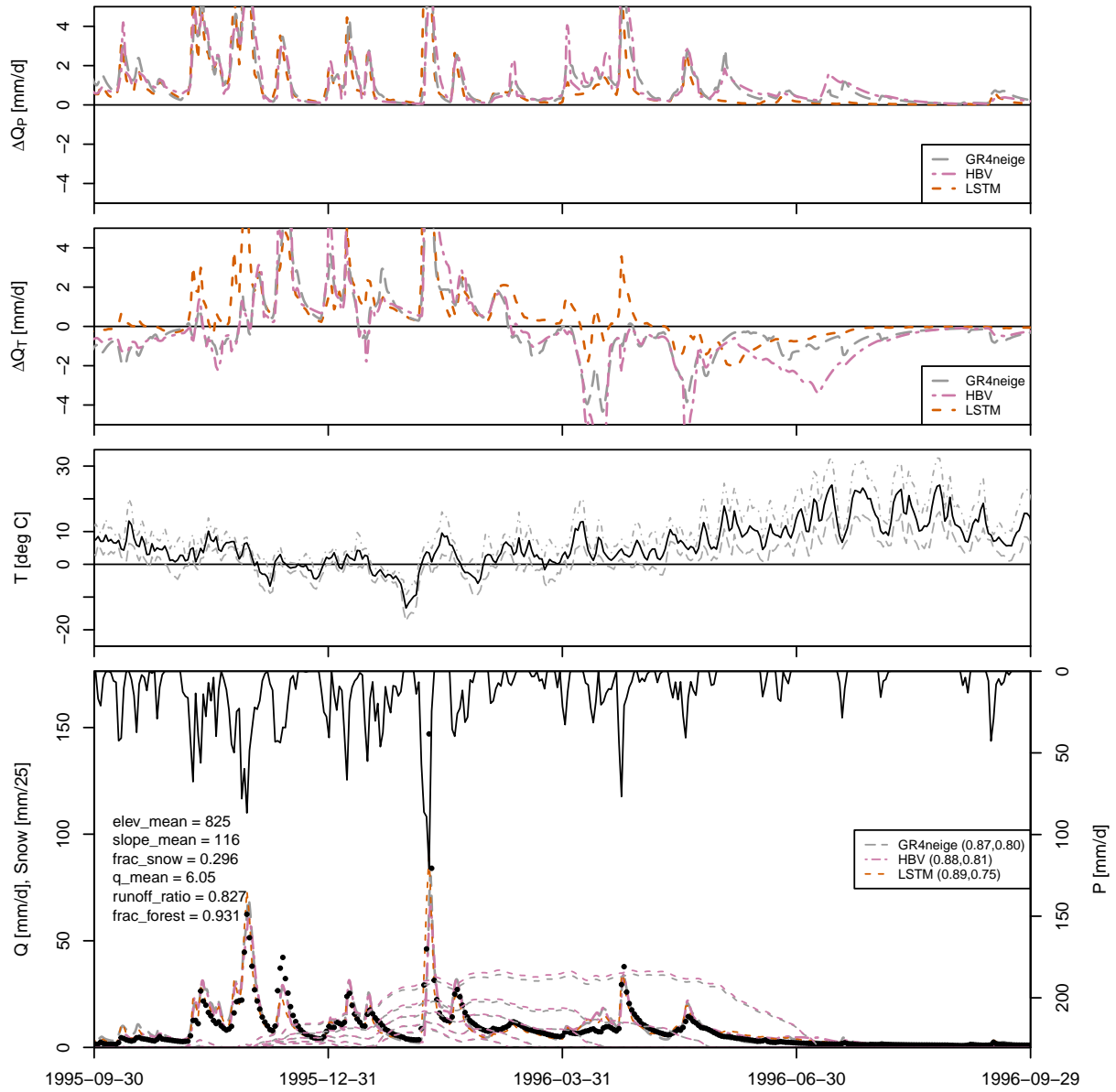


**Figure S38.** Results for basin 14216500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.

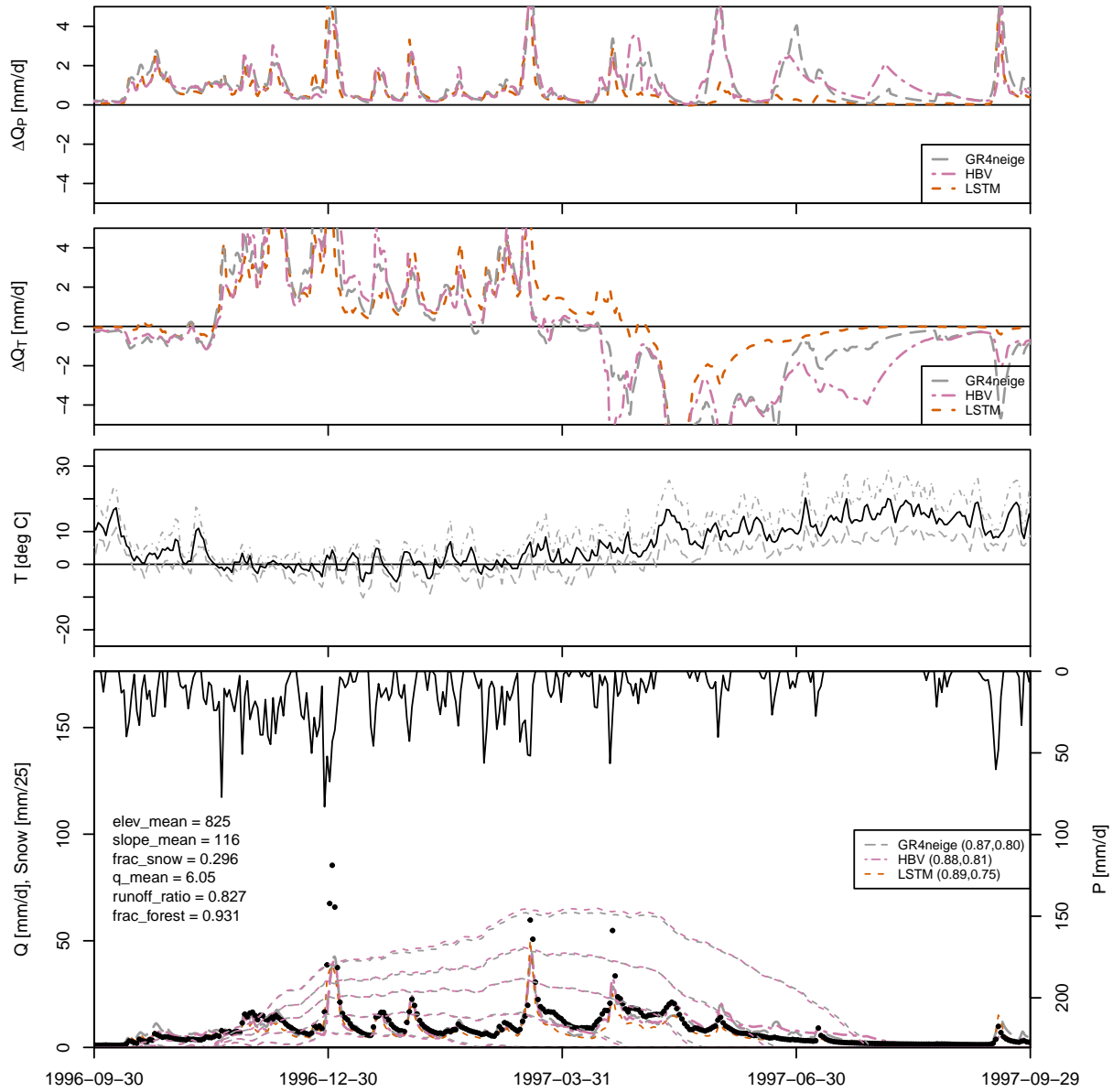


**Figure S39.** Results for basin 14216500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.

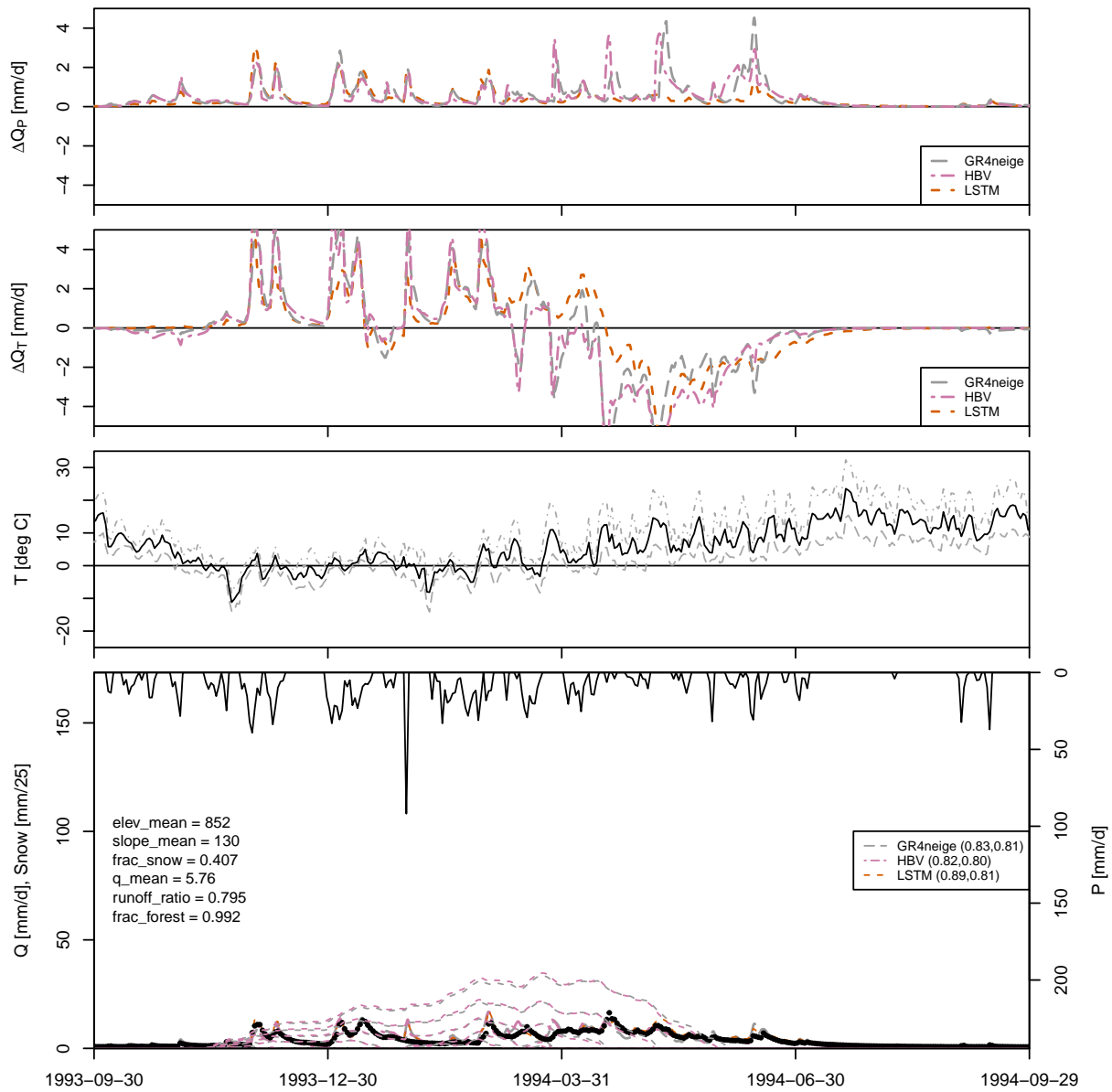




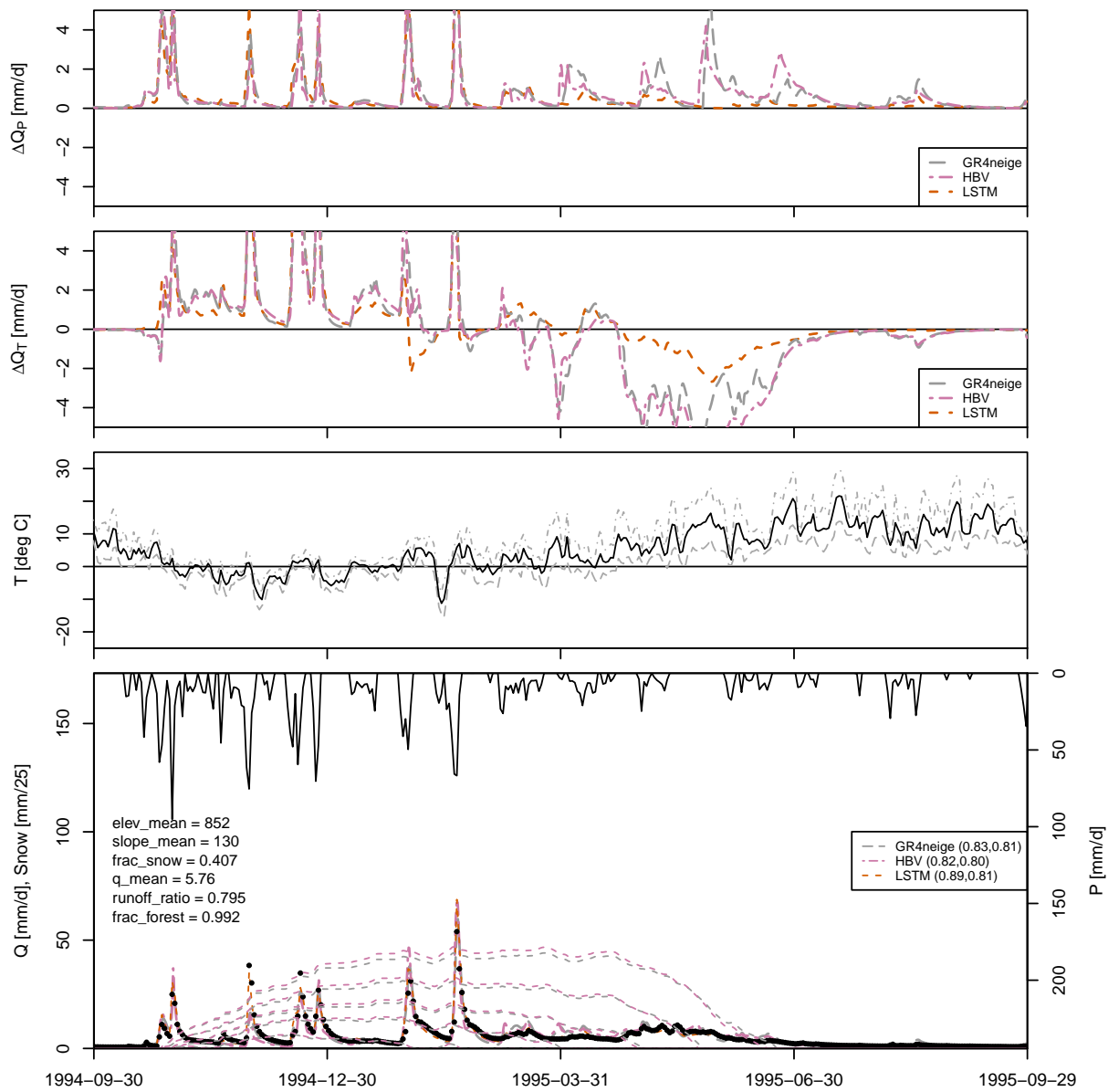
**Figure S40.** Results for basin 14216500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.



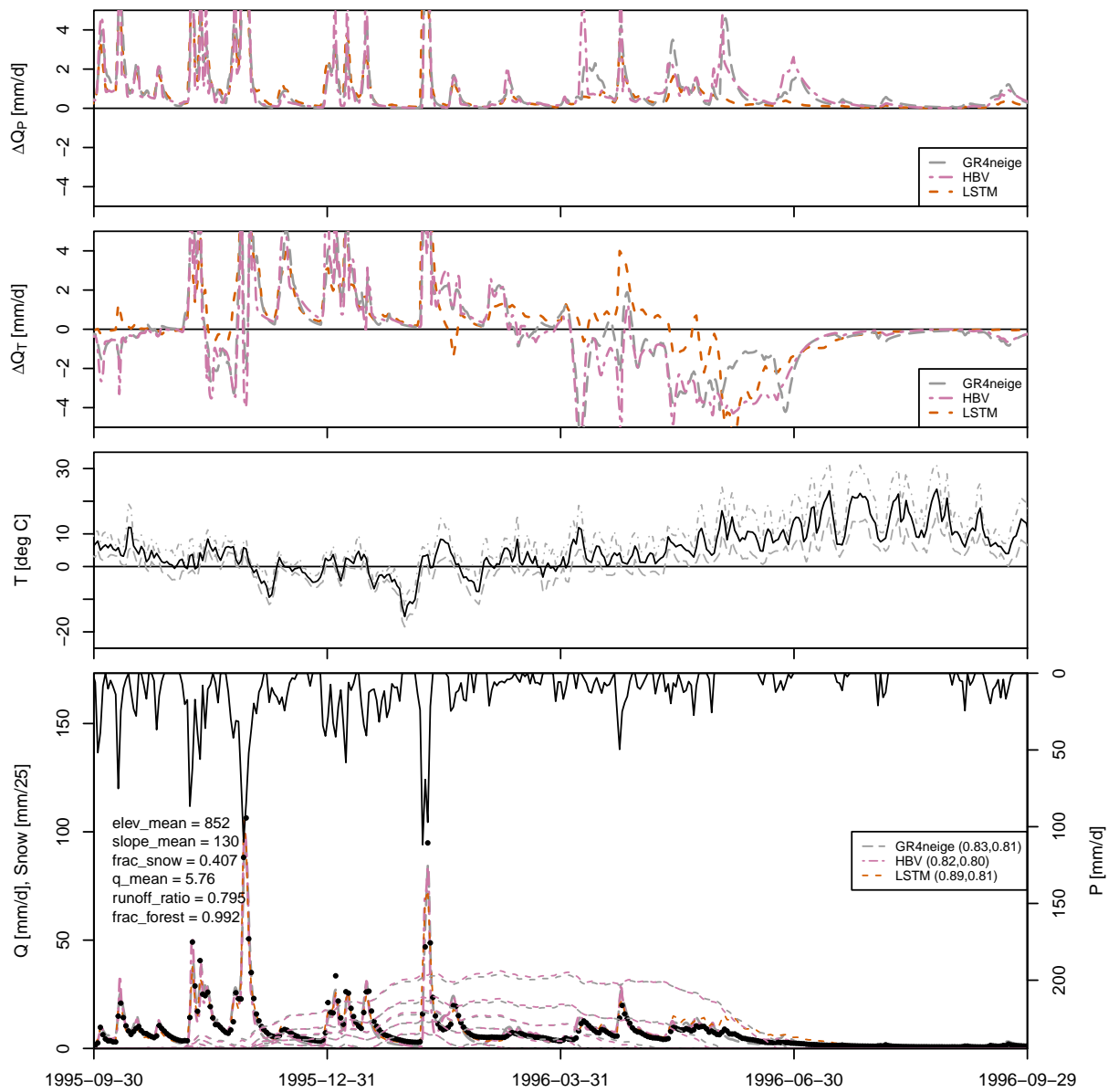
**Figure S41.** Results for basin 14216500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.



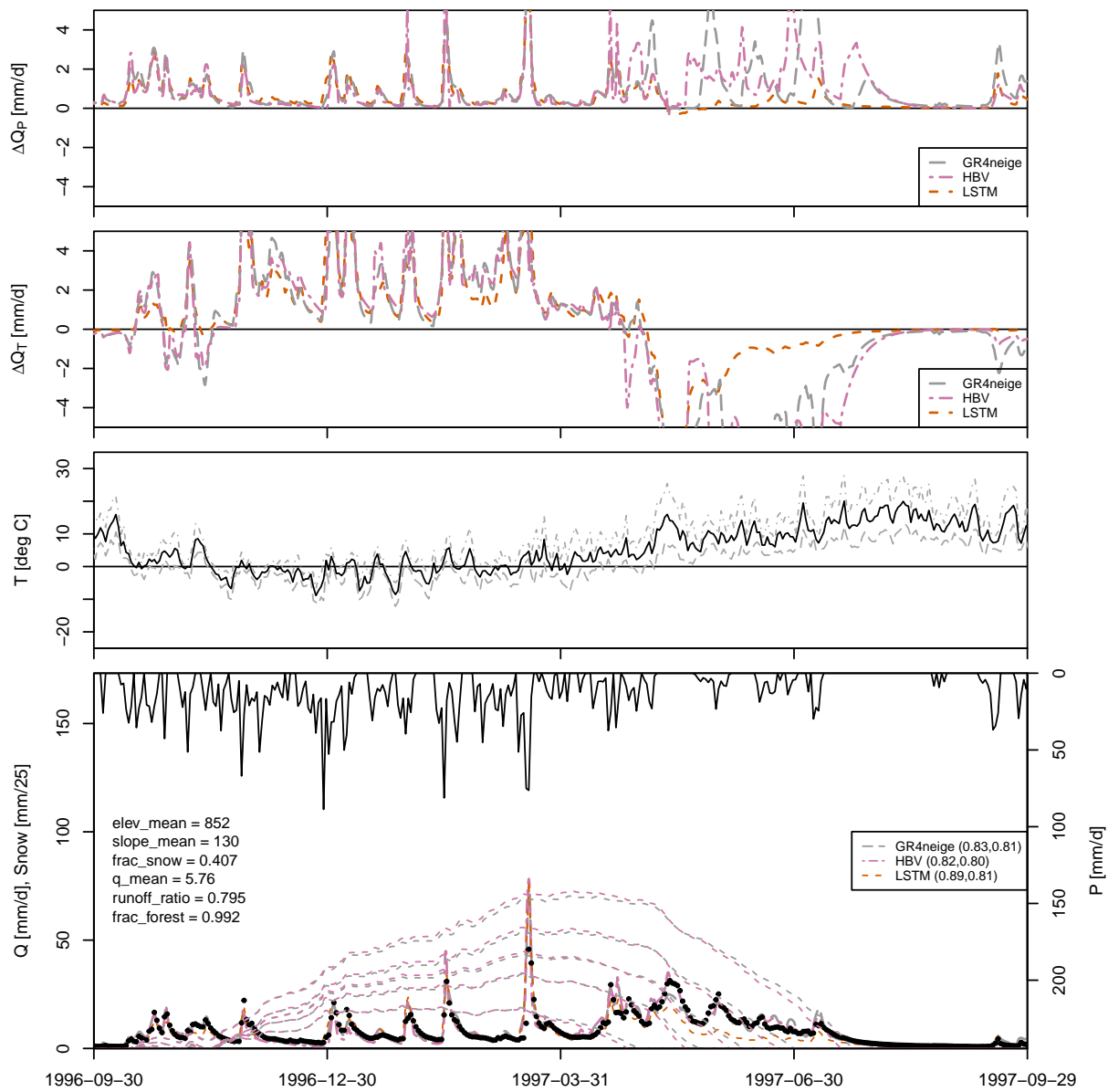
**Figure S42.** Results for basin 12114500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.



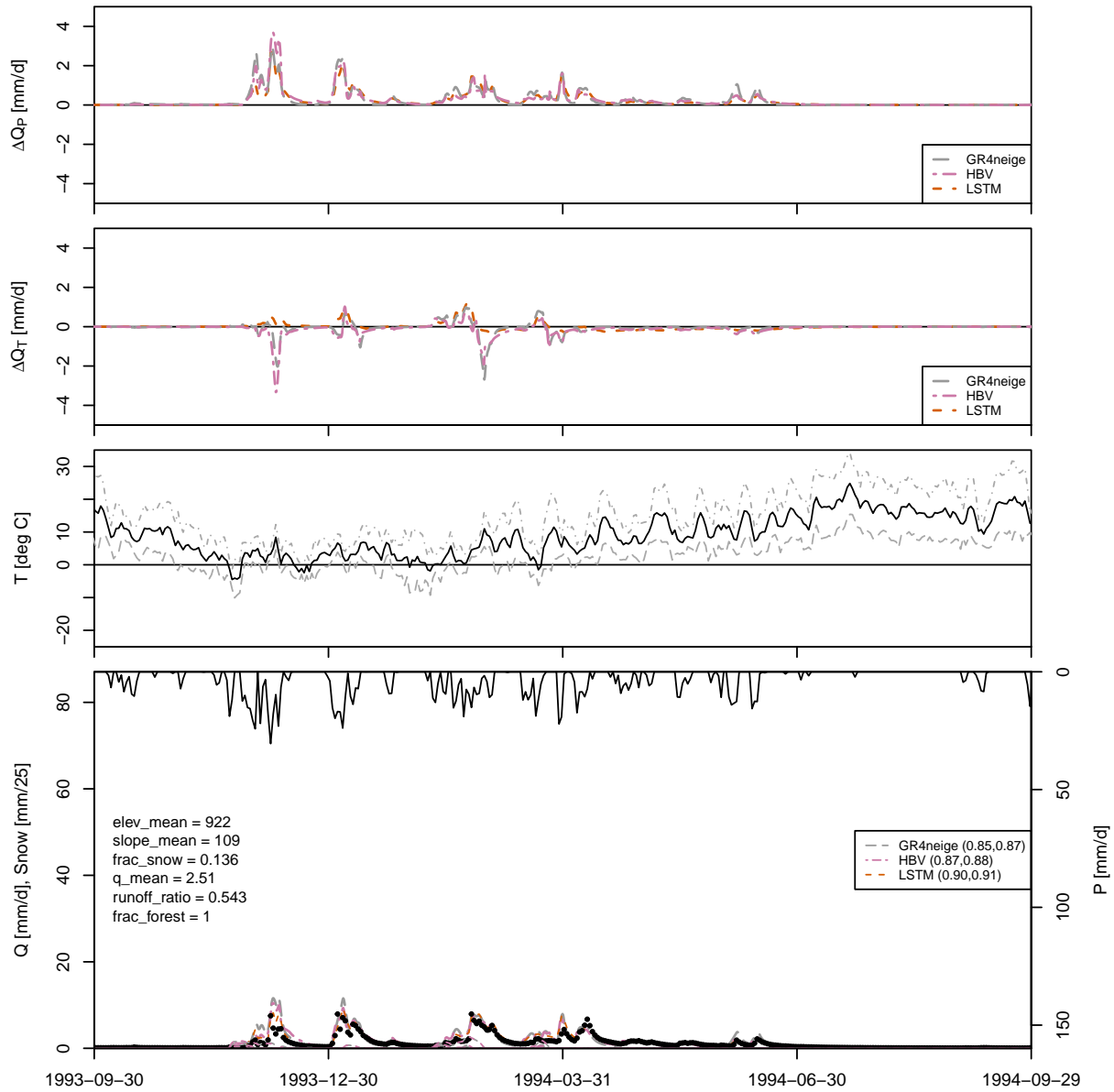
**Figure S43.** Results for basin 12114500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.



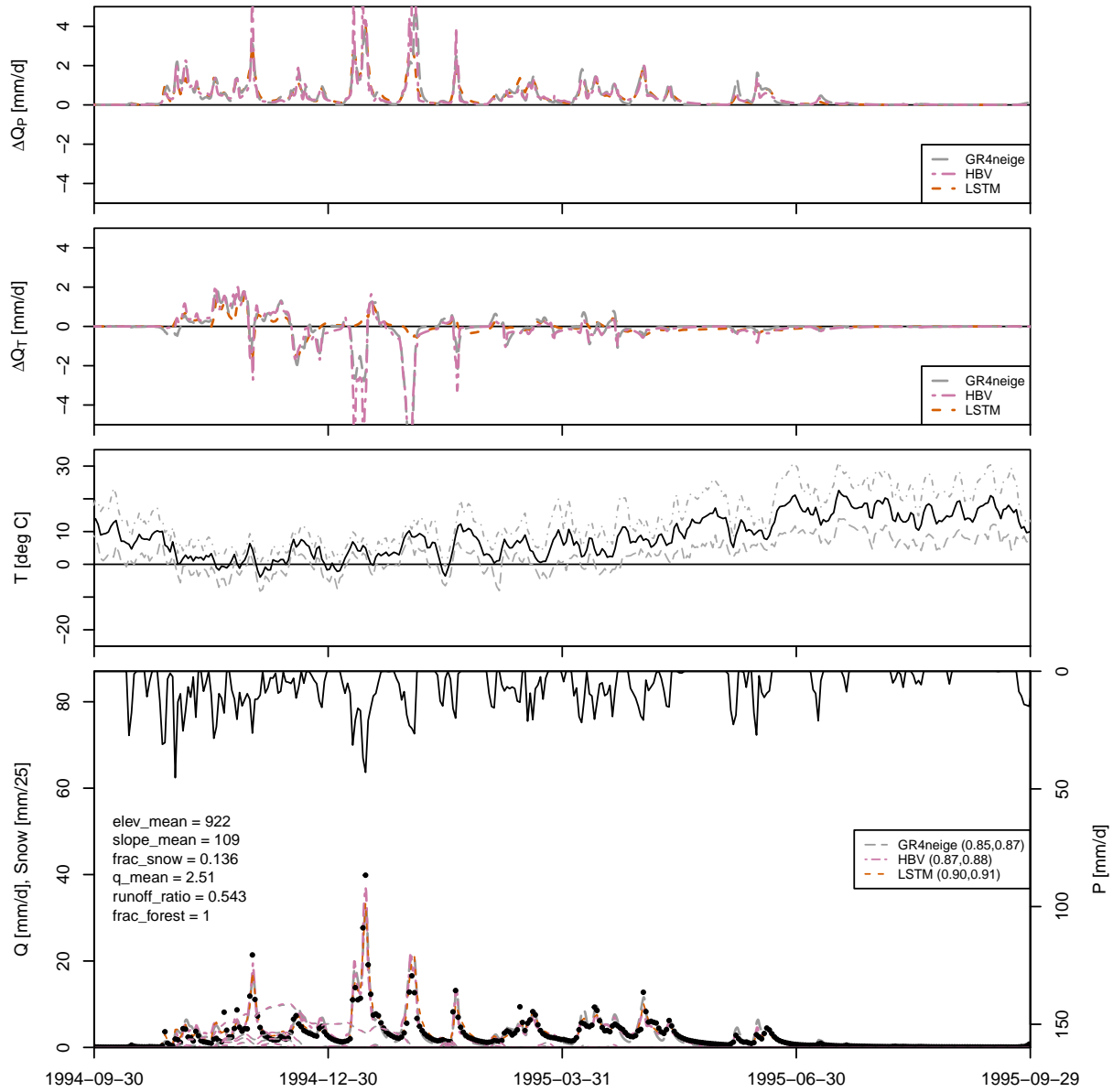
**Figure S44.** Results for basin 12114500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.



**Figure S45.** Results for basin 12114500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.

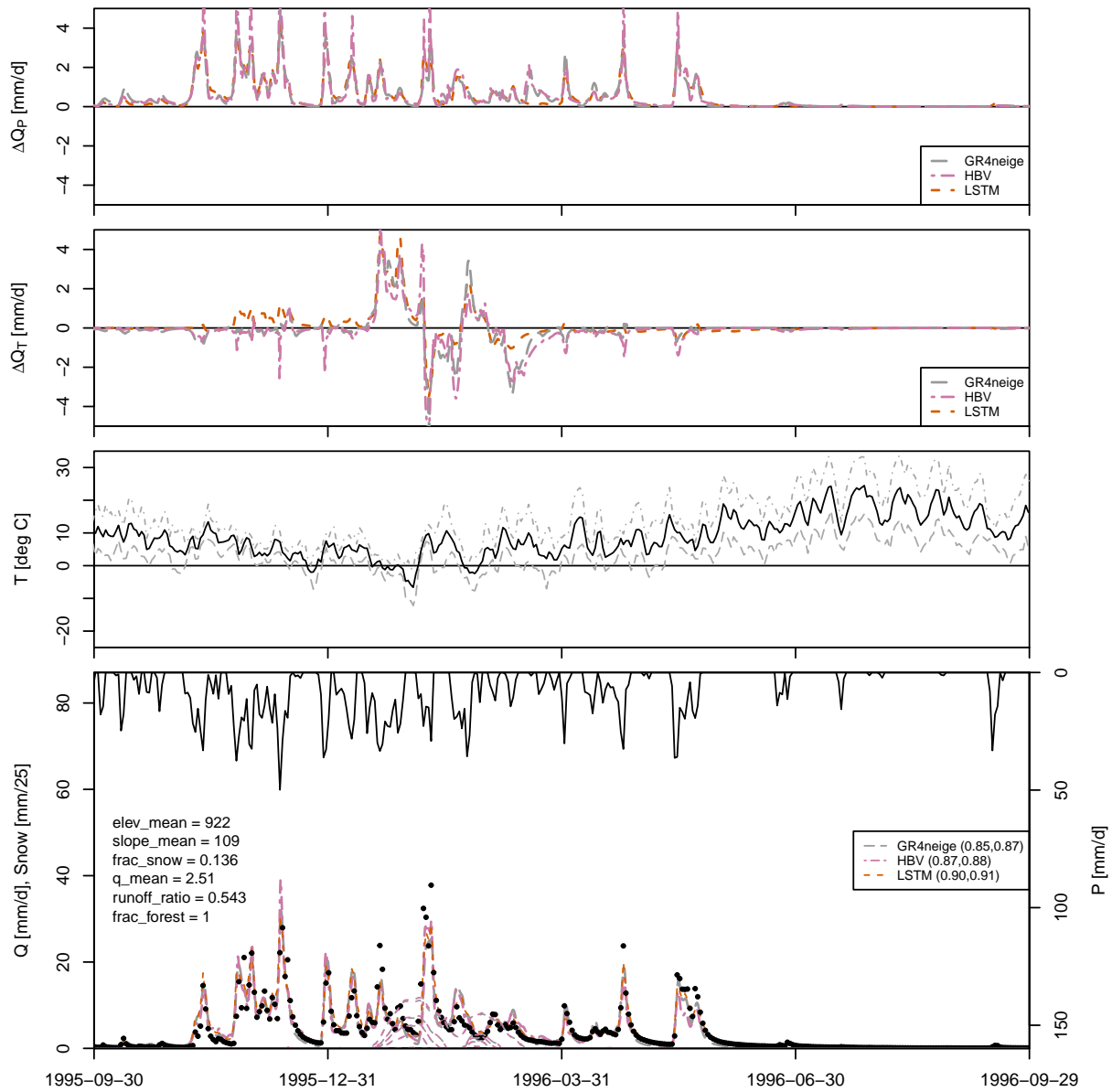


**Figure S46.** Results for basin 14154500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 4 for an explanation of the plot panels.

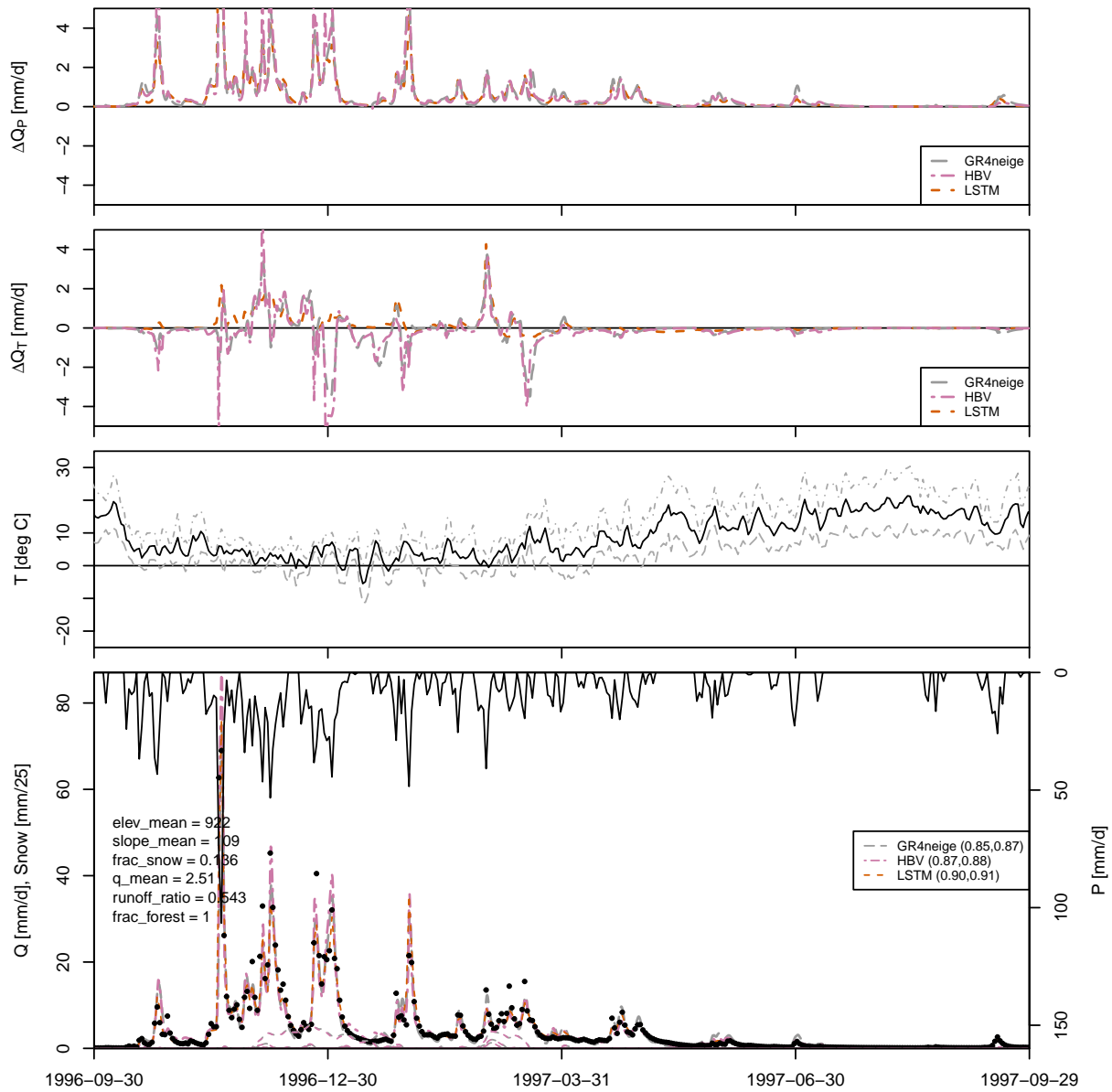


**Figure S47.** Results for basin 14154500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 4 for an explanation of the plot panels.





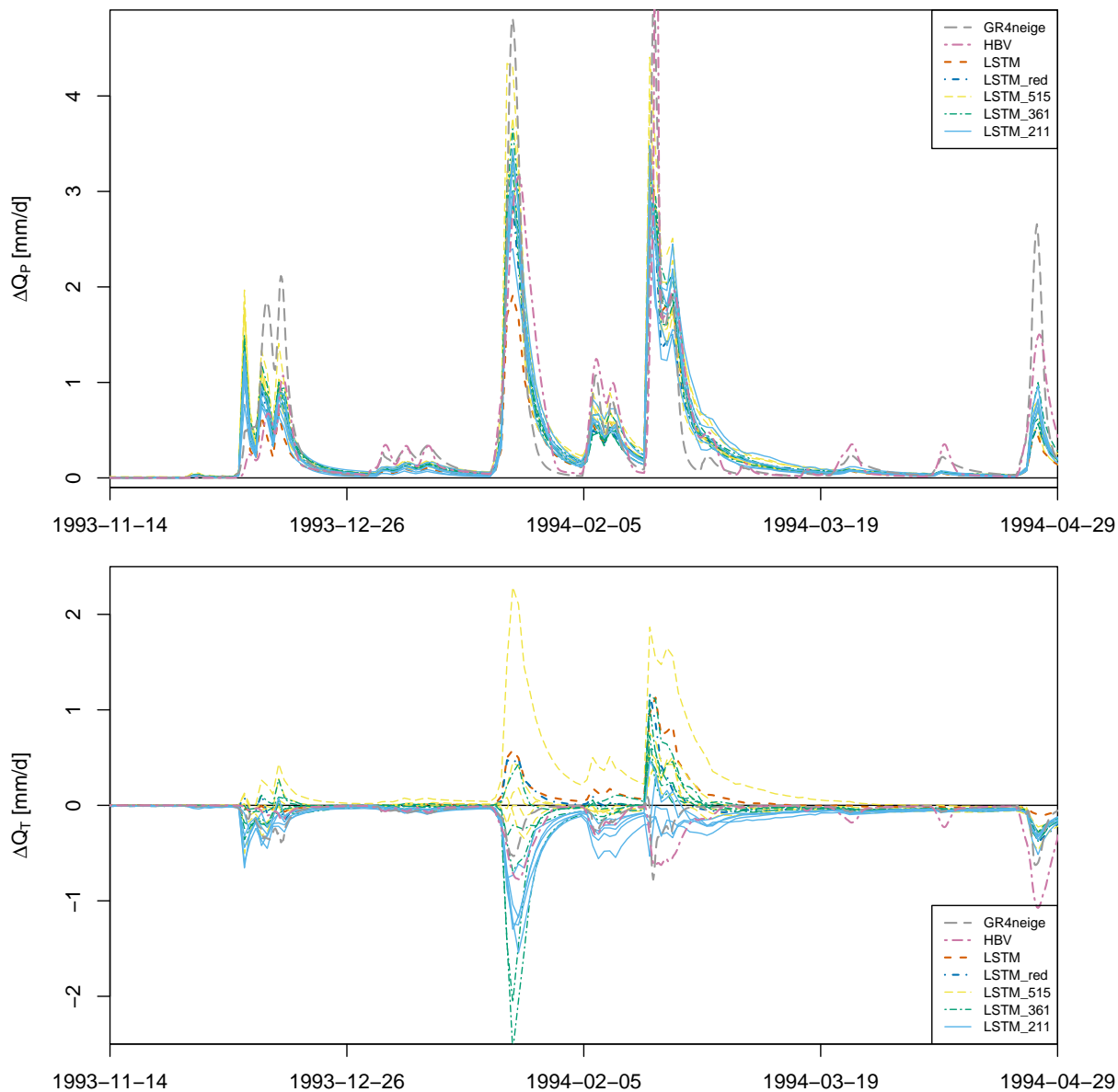
**Figure S48.** Results for basin 14154500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 4 for an explanation of the plot panels.



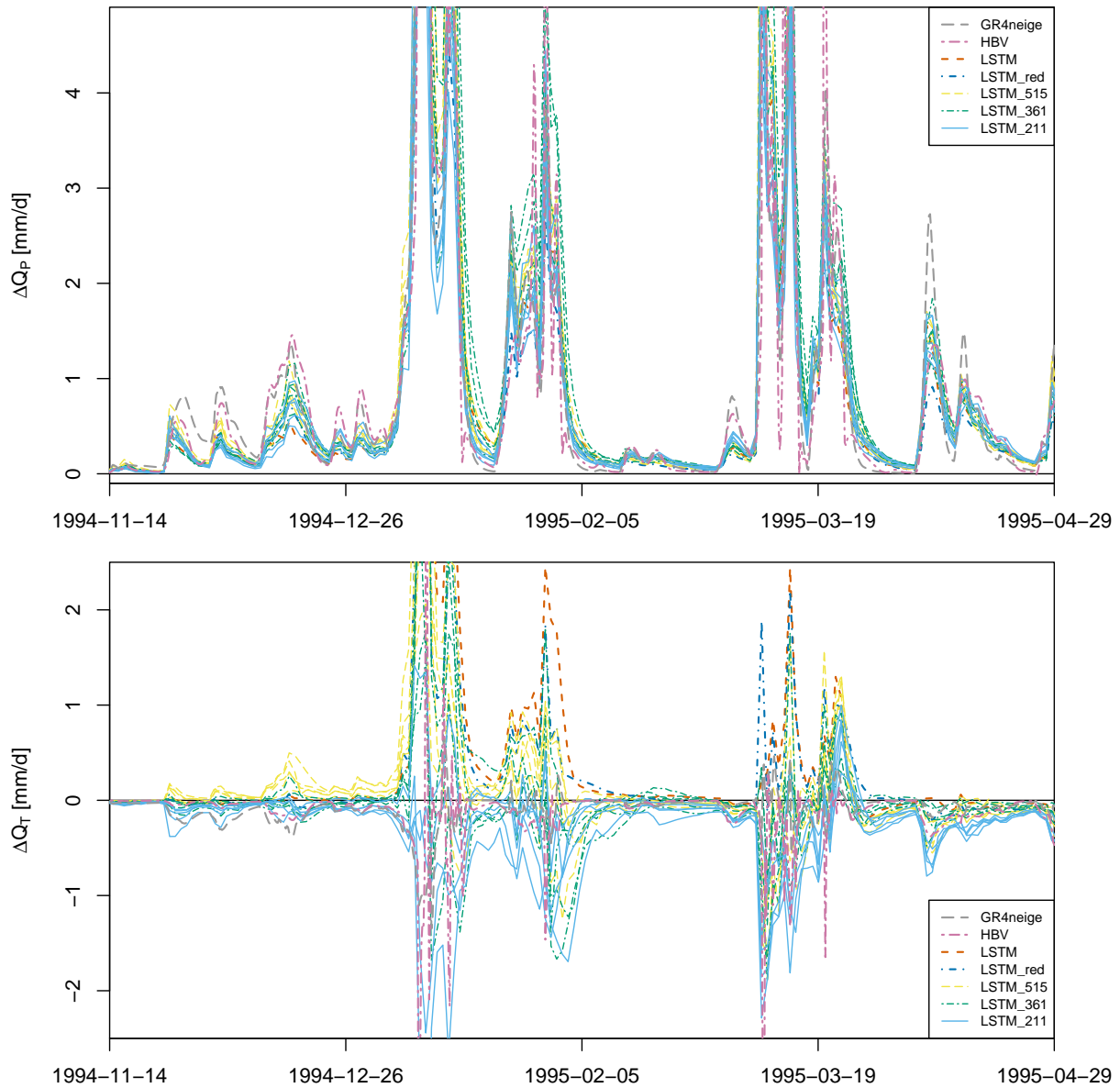
**Figure S49.** Results for basin 14154500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 4 for an explanation of the plot panels.

## S5 Sensitivity Analysis for Low Altitude Warm Basins

The Figures S50 to S53 show results within the last two years of the calibration period and within the first two years of the validation period for the basin 11468500.

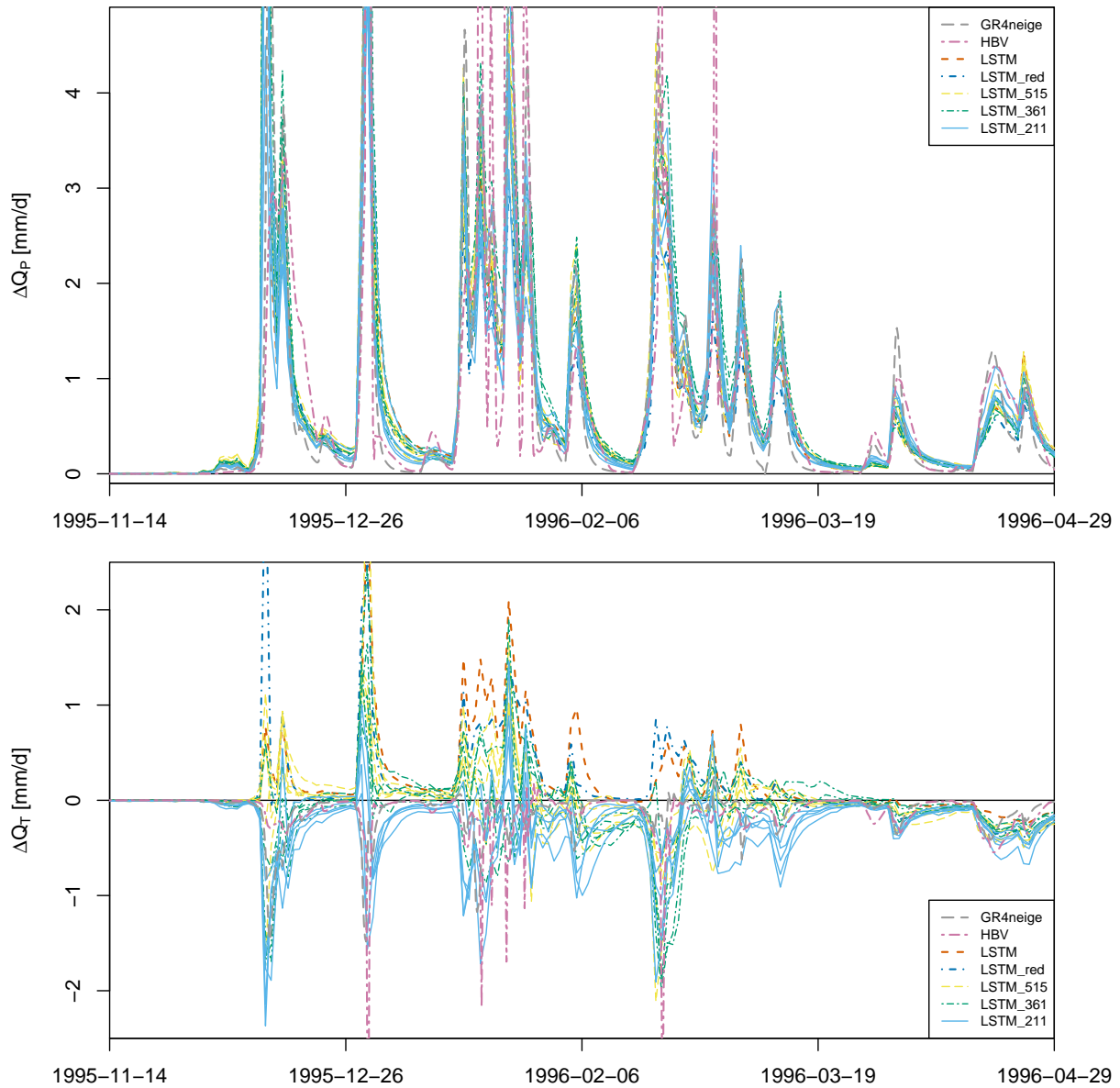


**Figure S50.** Sensitivities for basin 14154500, Nov. 1993 - April 1994 (part of validation). See Fig. 7 for an explanation of the plot panels.



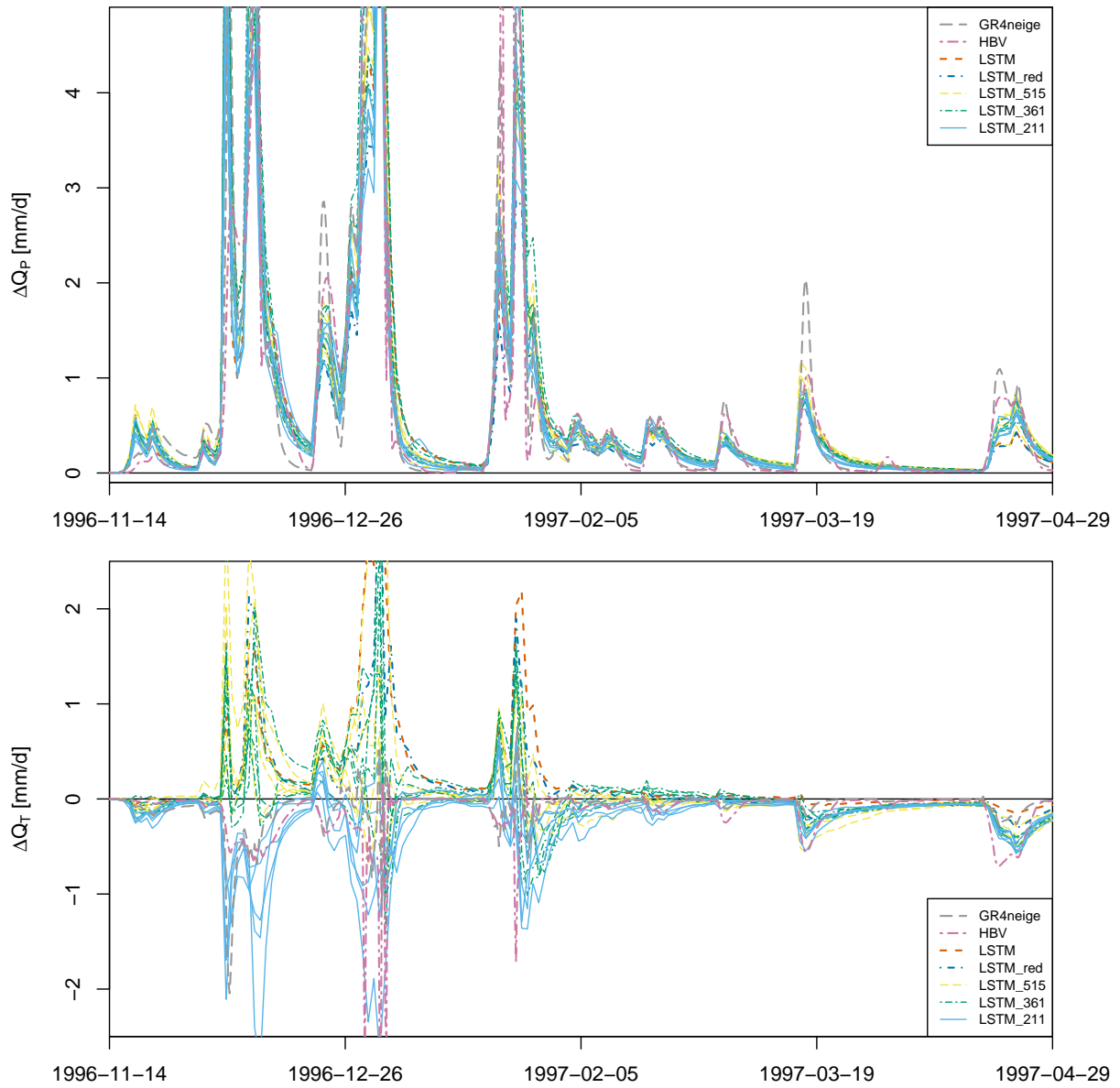
**Figure S51.** Sensitivities for basin 14154500, Nov. 1994 - April 1995 (part of validation). See Fig. 7 for an explanation of the plot panels.

The Figures S54 to S57 show results within the last two years of the calibration period and within the first two years of the validation period for the basin 08014500.



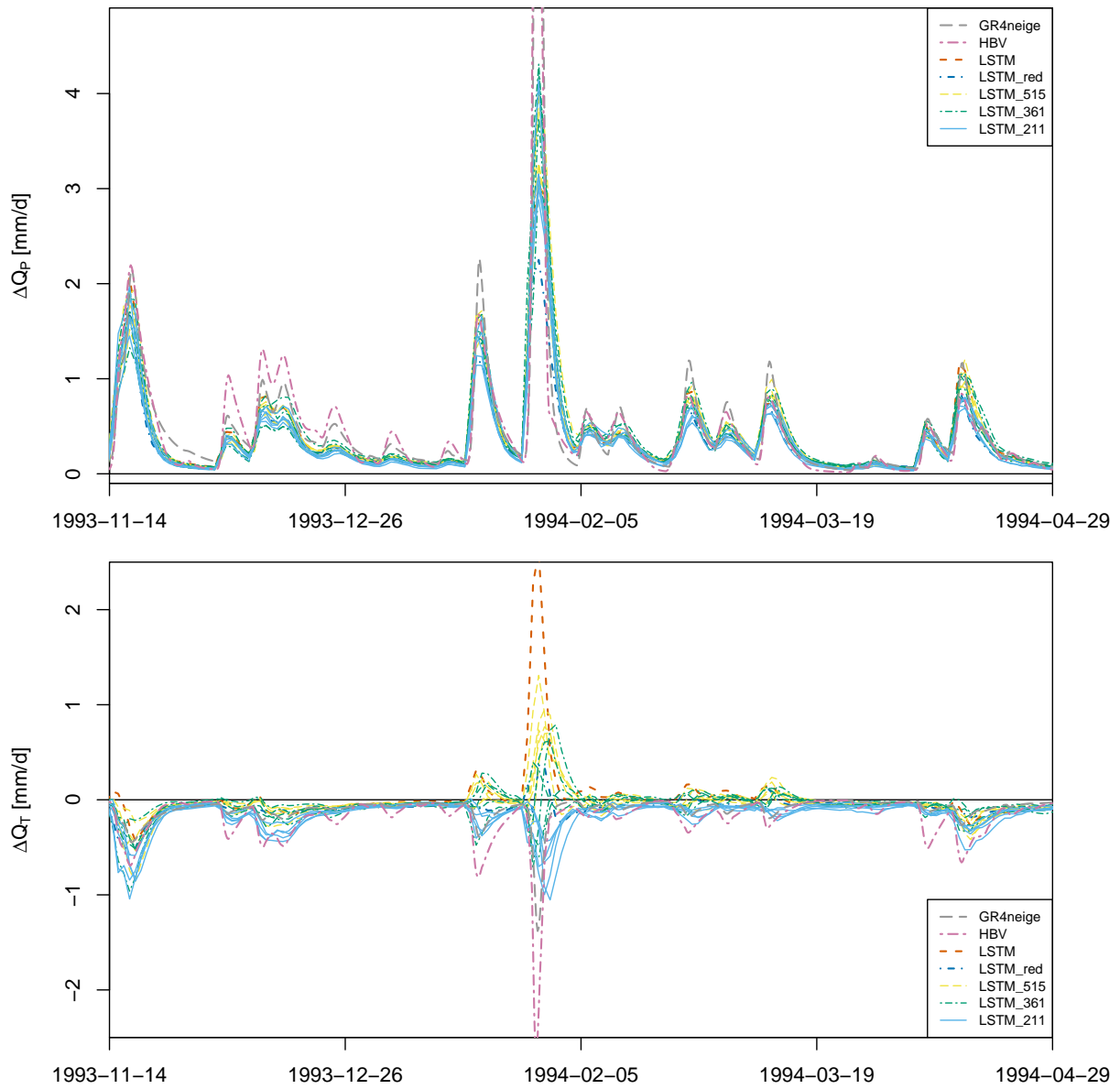
**Figure S52.** Sensitivities for basin 14154500, Nov. 1995 - April 1996 (part of validation). See Fig. 7 for an explanation of the plot panels.

The Figures S58 to S61 show results within the last two years of the calibration period and within the first two years of the  
 895 validation period for the basin 02363000.

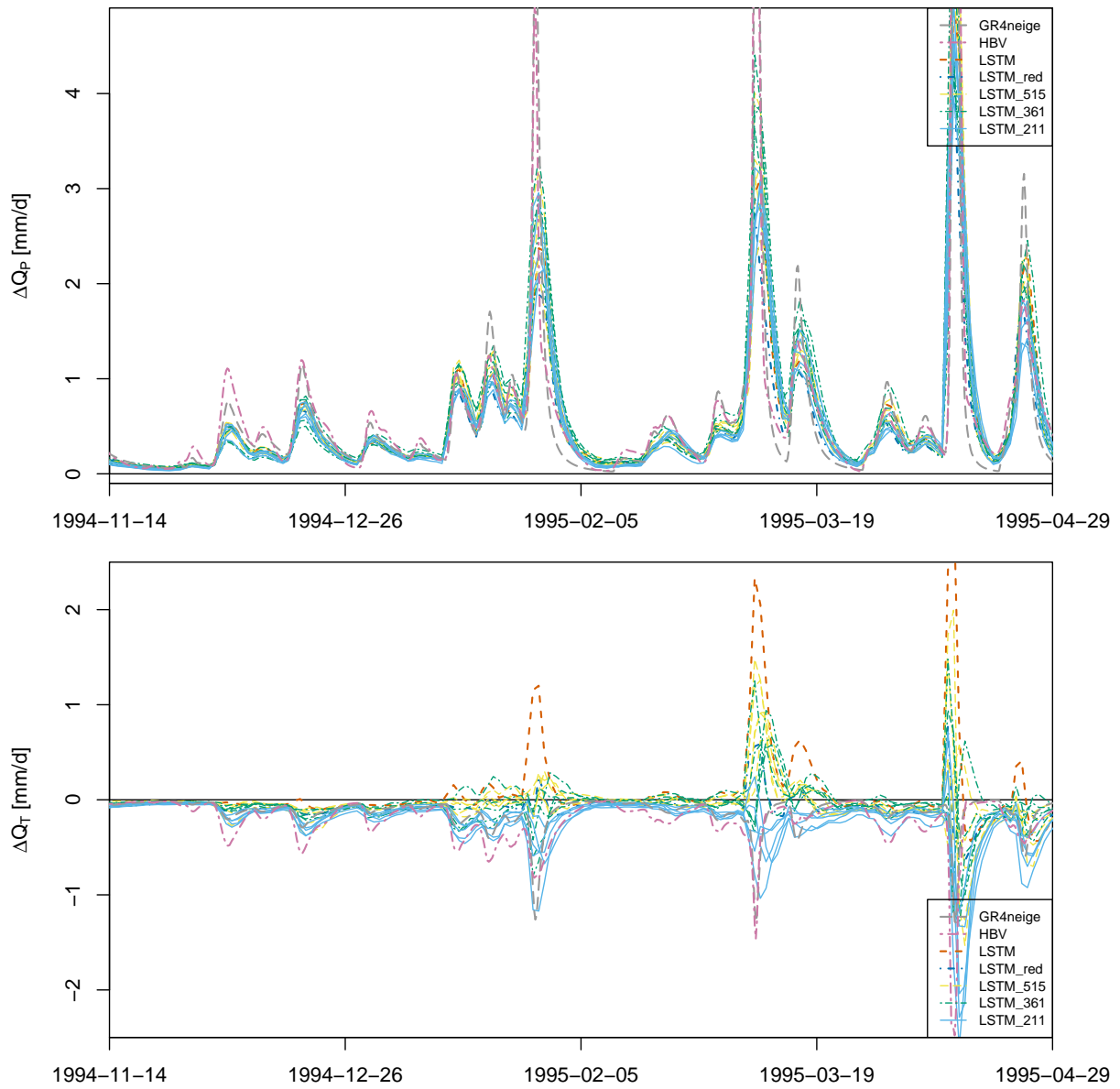


**Figure S53.** Sensitivities for basin 14154500, Nov. 1996 - April 1997 (part of validation). See Fig. 7 for an explanation of the plot panels.

The Figures S62 to S65 show results within the last two years of the calibration period and within the first two years of the validation period for the basin 12013500.

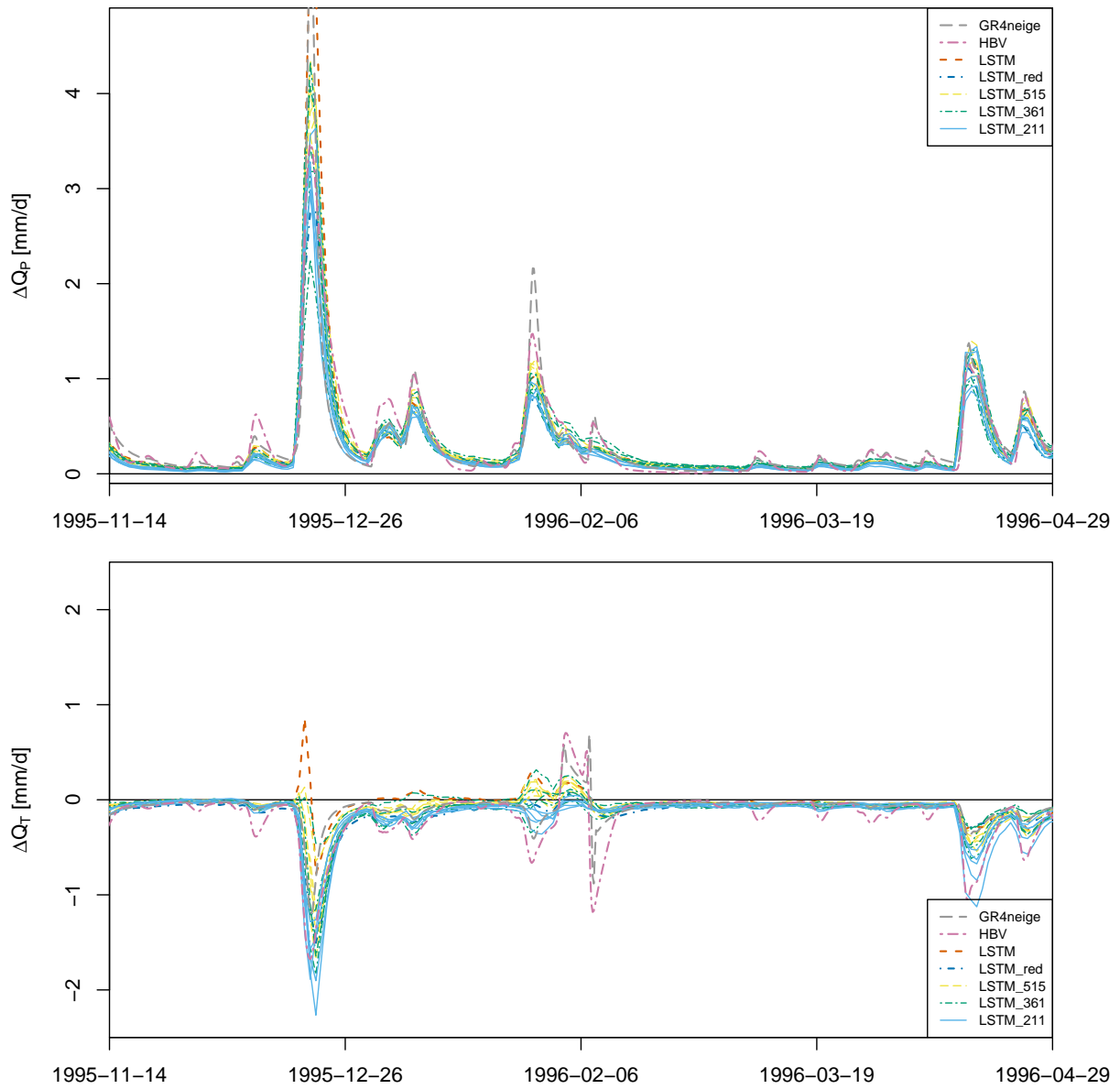


**Figure S54.** Sensitivities for basin 08014500, Nov. 1993 - April 1994 (part of validation). See Fig. 7 for an explanation of the plot panels.

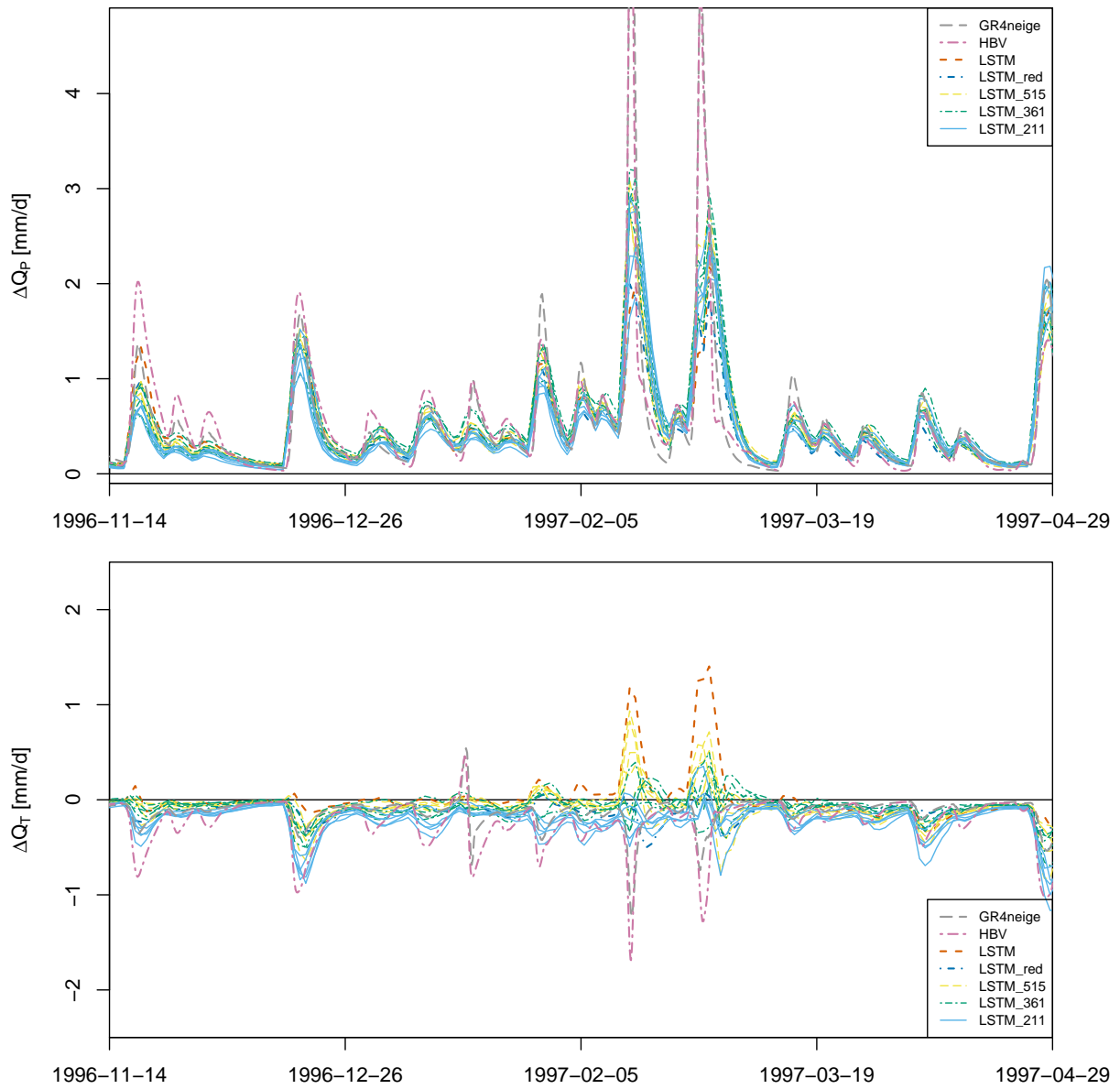


**Figure S55.** Sensitivities for basin 08014500, Nov. 1994 - April 1995 (part of validation). See Fig. 7 for an explanation of the plot panels.

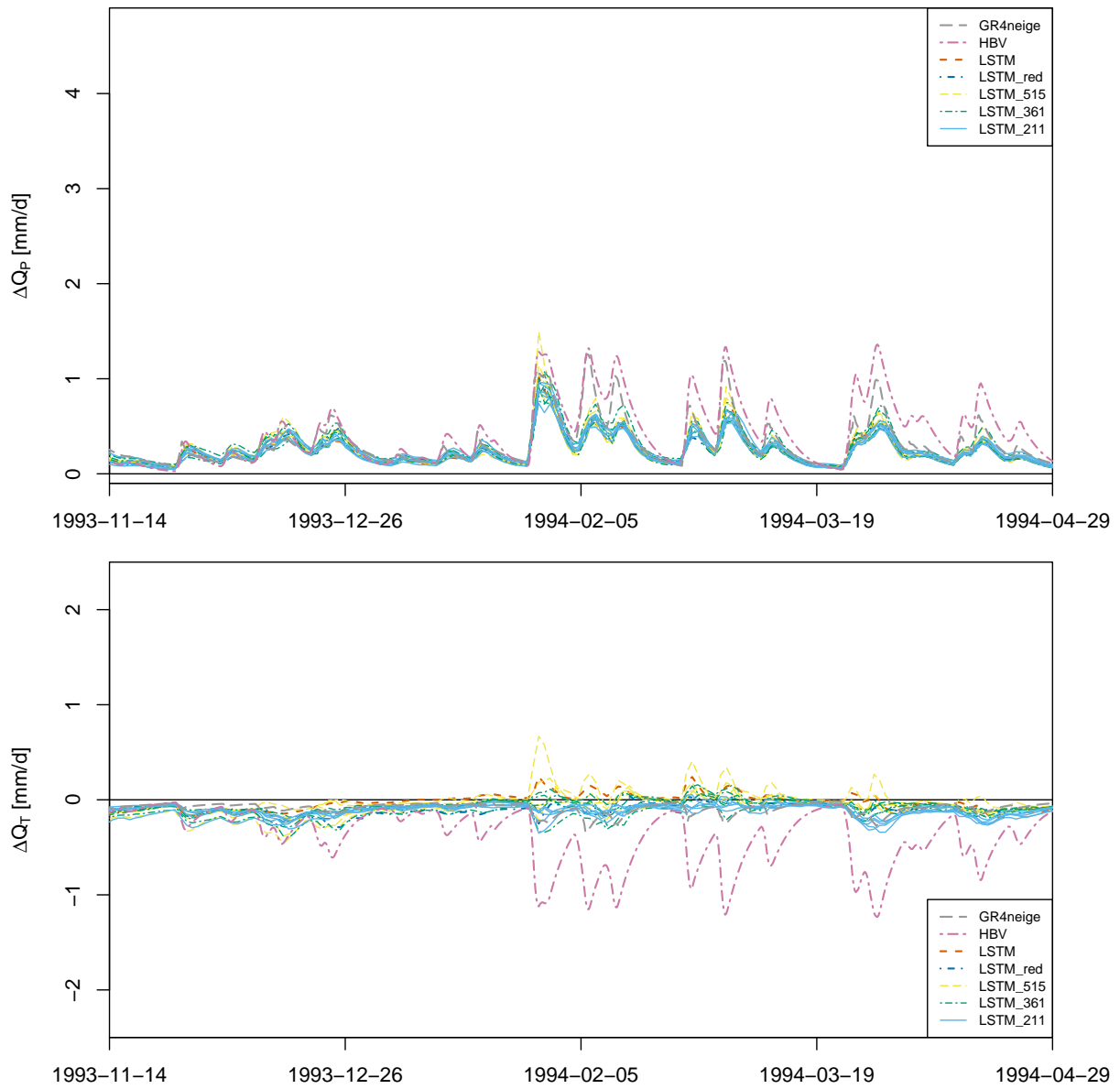




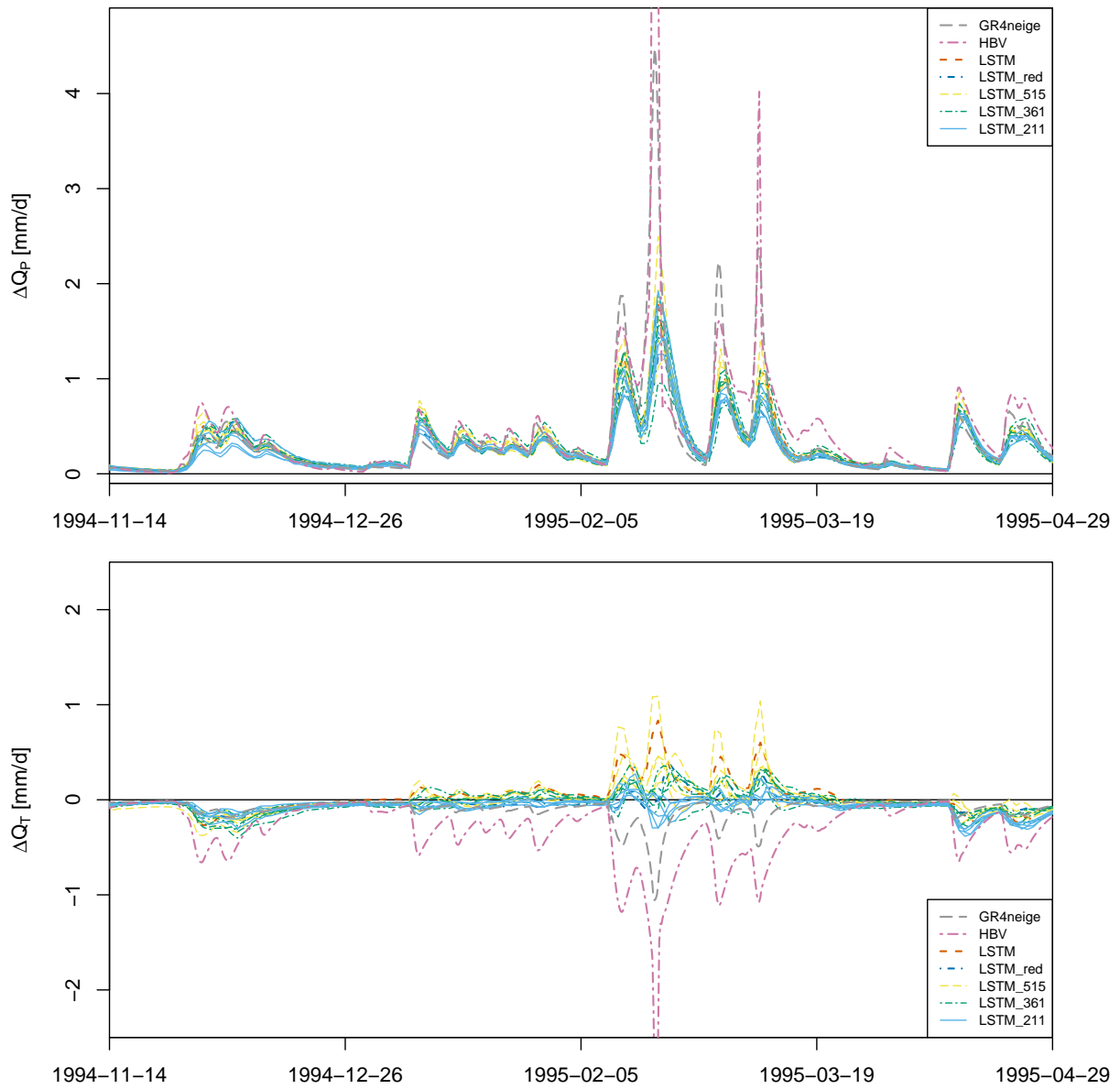
**Figure S56.** Sensitivities for basin 08014500, Nov. 1995 - April 1996 (part of validation). See Fig. 7 for an explanation of the plot panels.



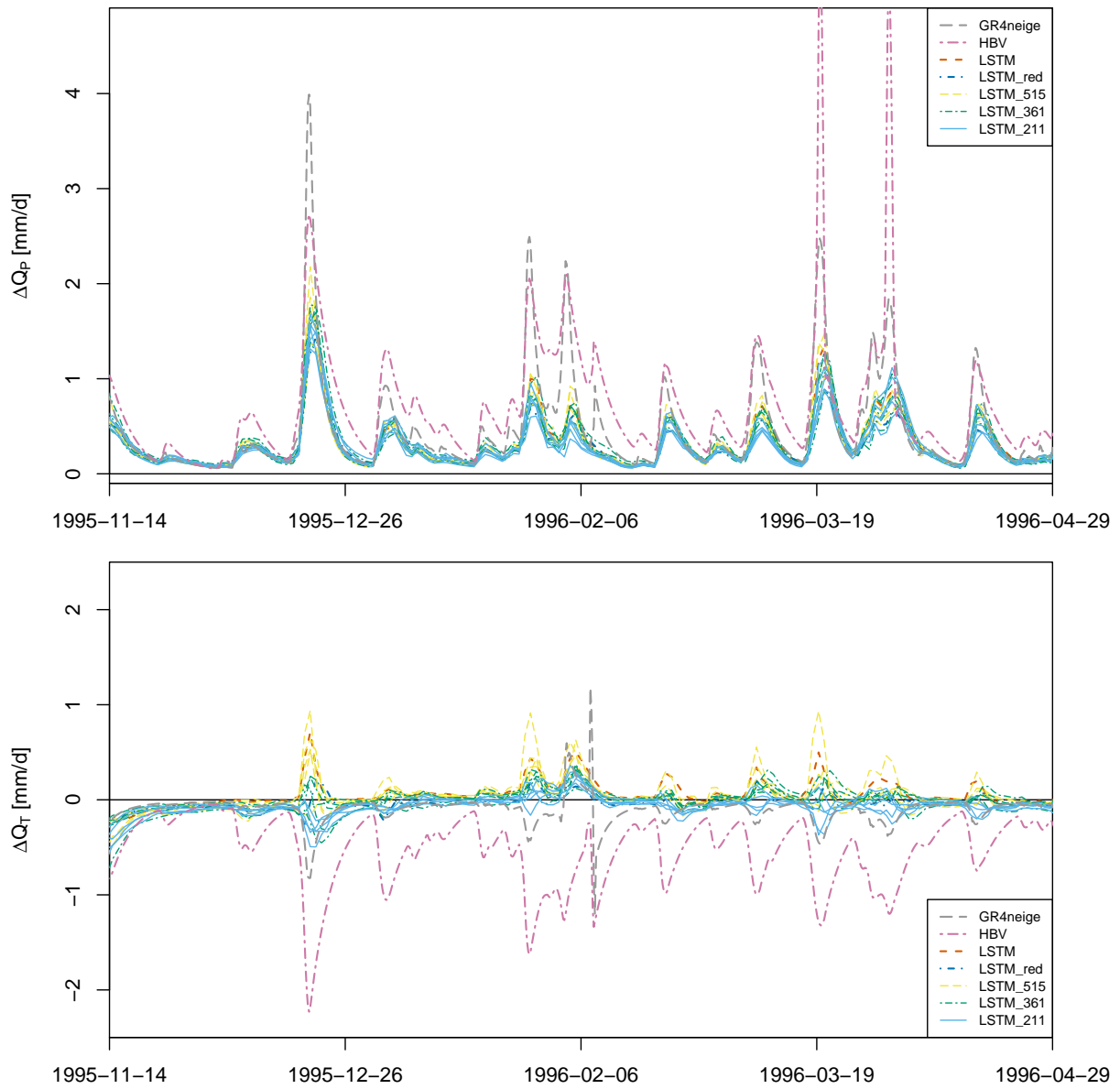
**Figure S57.** Sensitivities for basin 08014500, Nov. 1996 - April 1997 (part of validation). See Fig. 7 for an explanation of the plot panels.



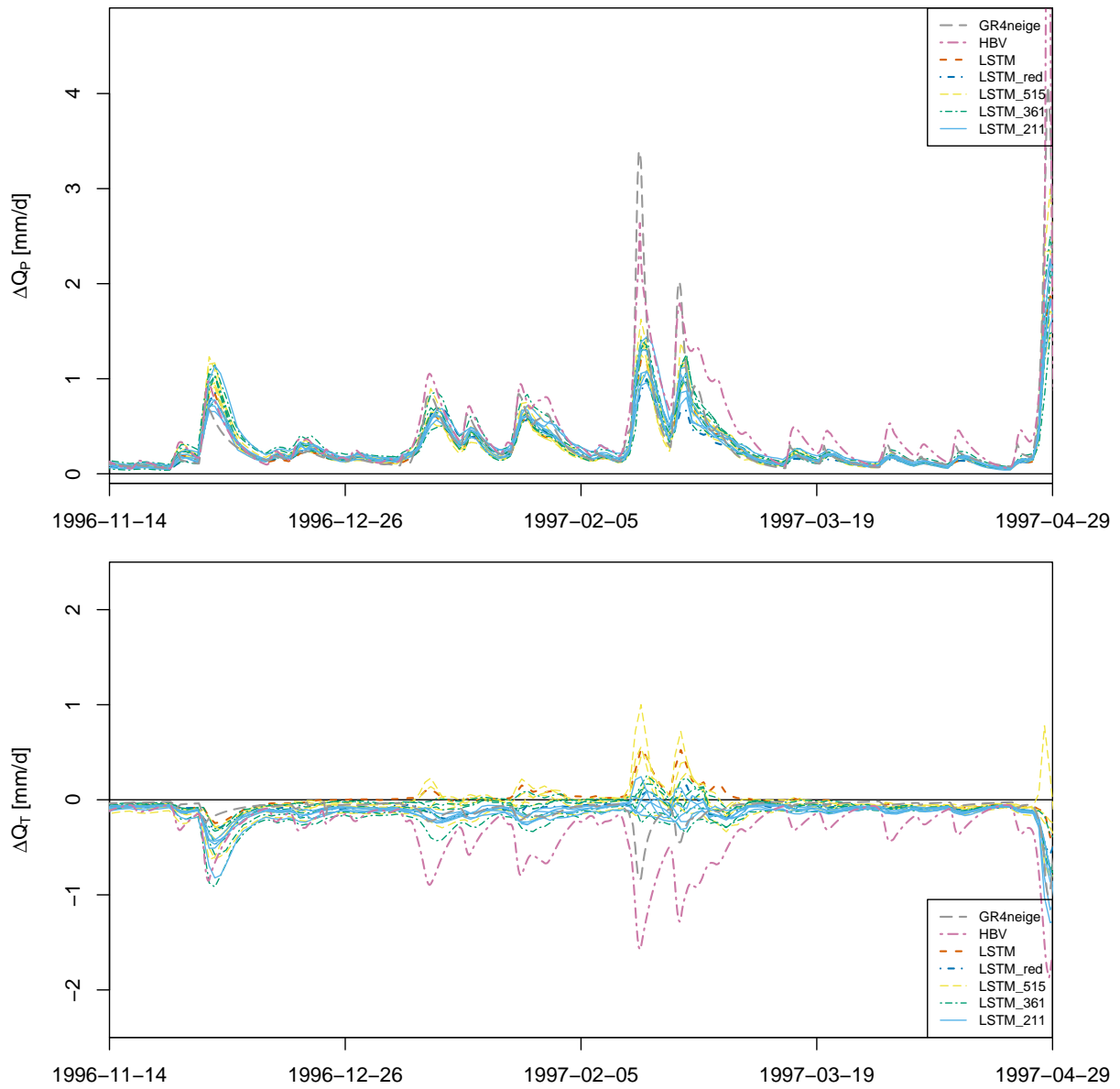
**Figure S58.** Sensitivities for basin 02363000, Nov. 1993 - April 1994 (part of validation). See Fig. 7 for an explanation of the plot panels.



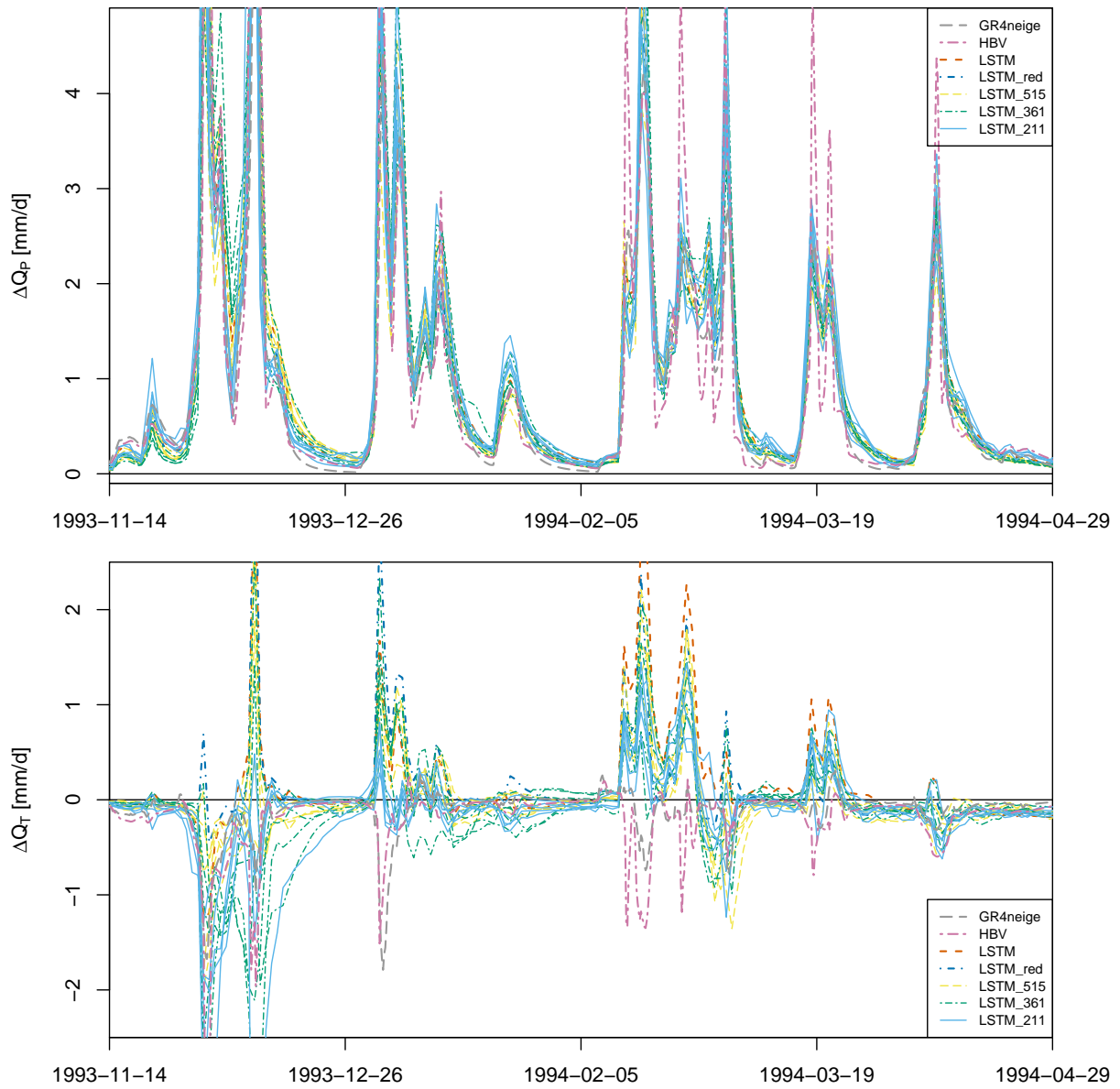
**Figure S59.** Sensitivities for basin 02363000, Nov. 1994 - April 1995 (part of validation). See Fig. 7 for an explanation of the plot panels.



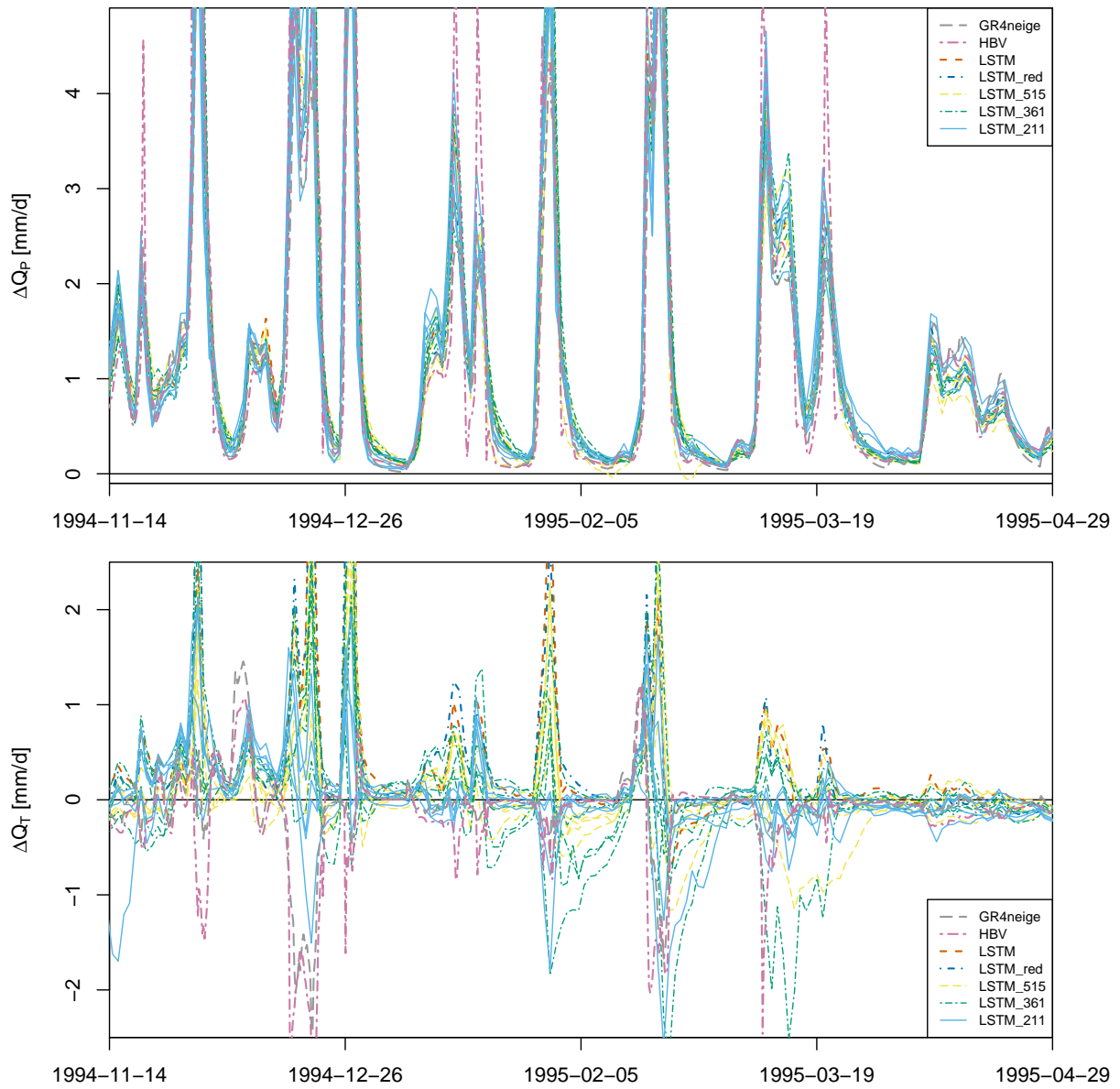
**Figure S60.** Sensitivities for basin 02363000, Nov. 1995 - April 1996 (part of validation). See Fig. 7 for an explanation of the plot panels.



**Figure S61.** Sensitivities for basin 02363000, Nov. 1996 - April 1997 (part of validation). See Fig. 7 for an explanation of the plot panels.

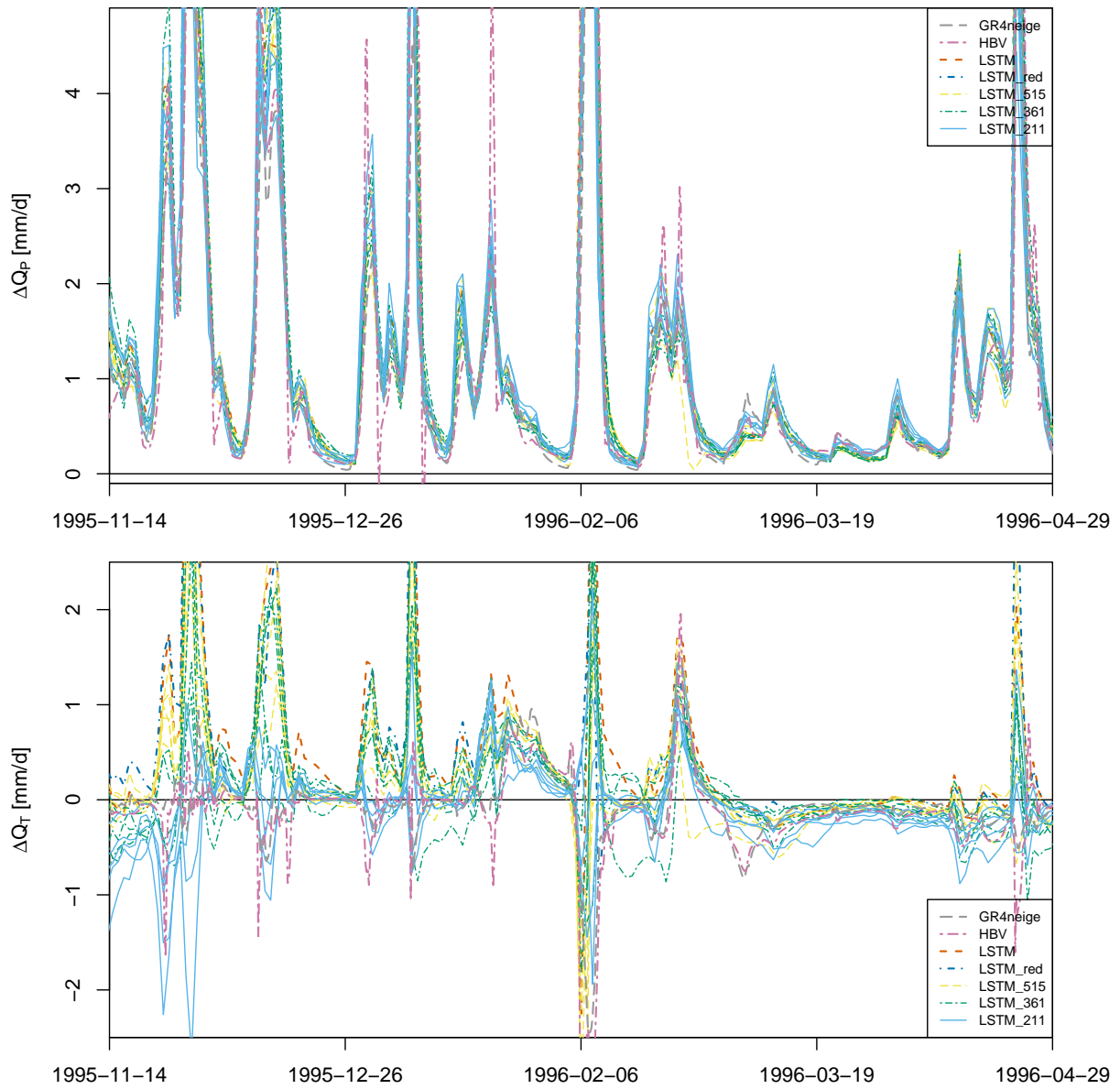


**Figure S62.** Sensitivities for basin 12013500, Nov. 1993 - April 1994 (part of validation). See Fig. 7 for an explanation of the plot panels.

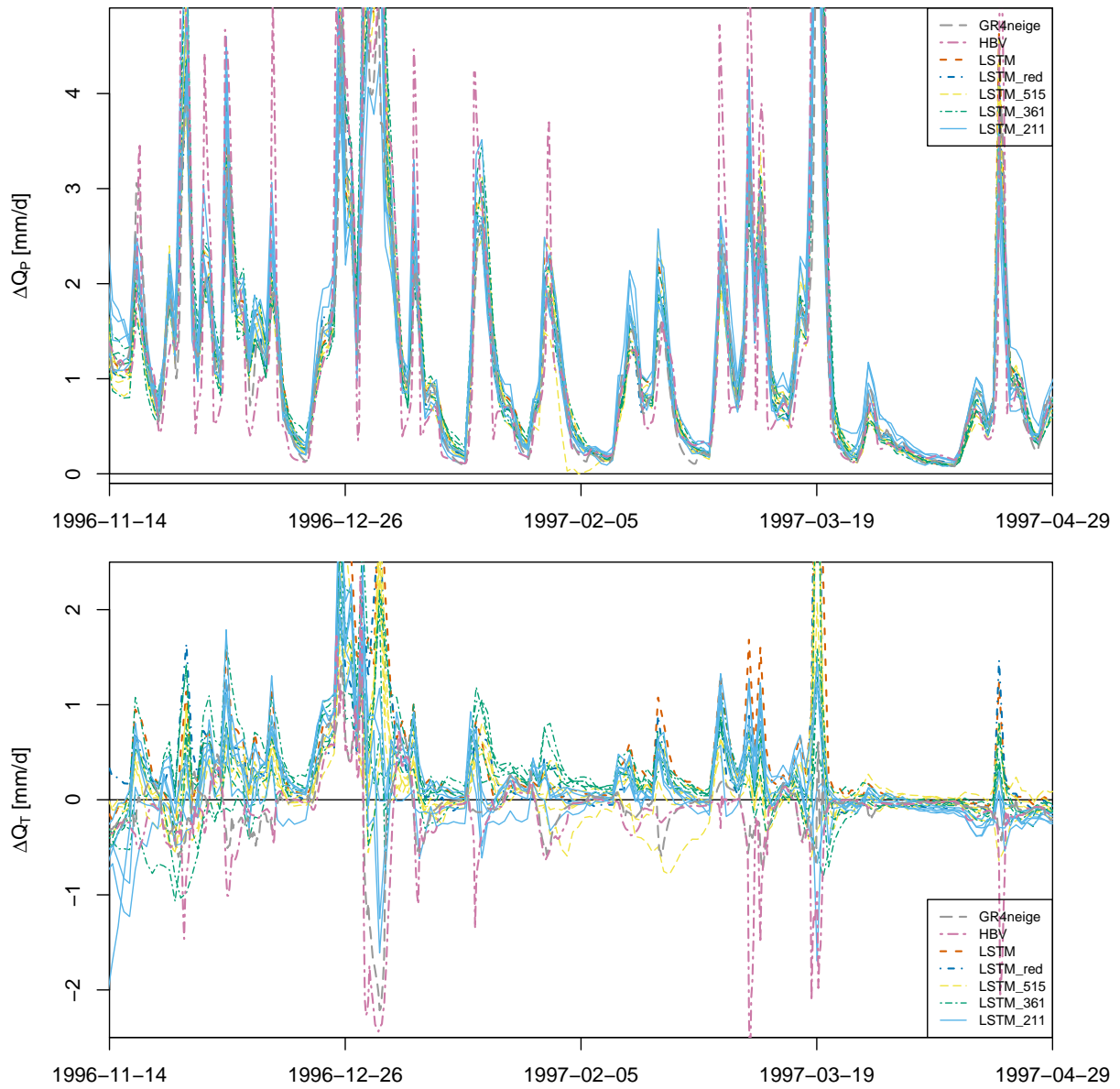


**Figure S63.** Sensitivities for basin 12013500, Nov. 1994 - April 1995 (part of validation). See Fig. 7 for an explanation of the plot panels.





**Figure S64.** Sensitivities for basin 12013500, Nov. 1995 - April 1996 (part of validation). See Fig. 7 for an explanation of the plot panels.



**Figure S65.** Sensitivities for basin 12013500, Nov. 1996 - April 1997 (part of validation). See Fig. 7 for an explanation of the plot panels.