Supporting Information for

Metamorphic Testing of Machine Learning and Conceptual hydrologic Models

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In this document we provide some additional results to demonstrate that the results shown in section 3 of the main paper represent typical pattern also for other, similar basins.

Metamorphic Testing

Low Altitude Warm Basins

This section provides examples of the modelled response of low altitude, warm basins in addition to the one discussed in section 3.2.1. See section 3.2.1 for explanations.

The Figures SI.1 to SI.4 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.

The Figures SI.5 to SI.8 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.

The Figures SI.9 to SI.12 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.

The Figures SI.13 to SI.16 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.
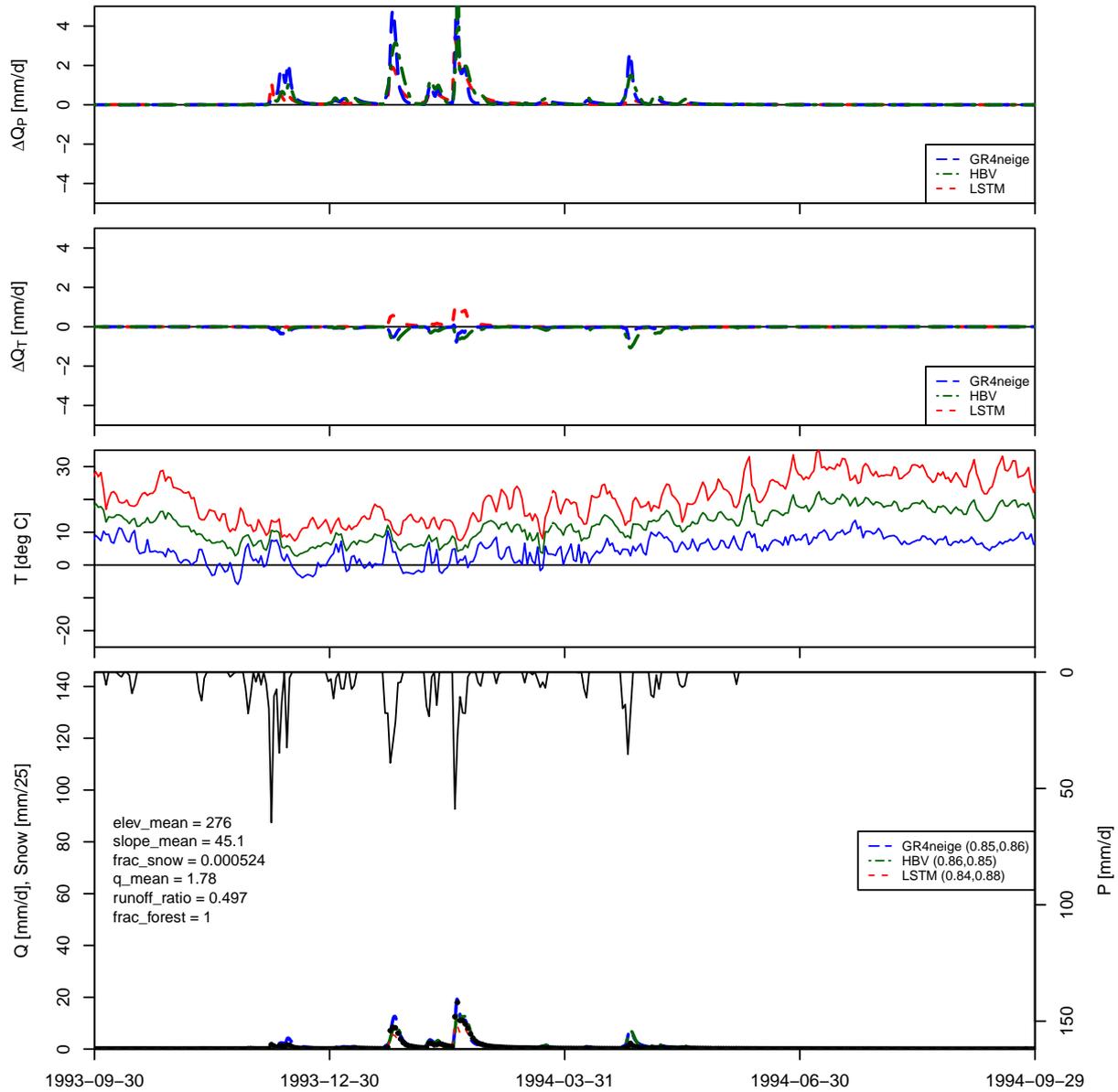
Figure SI.1. Results for basin 11468500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
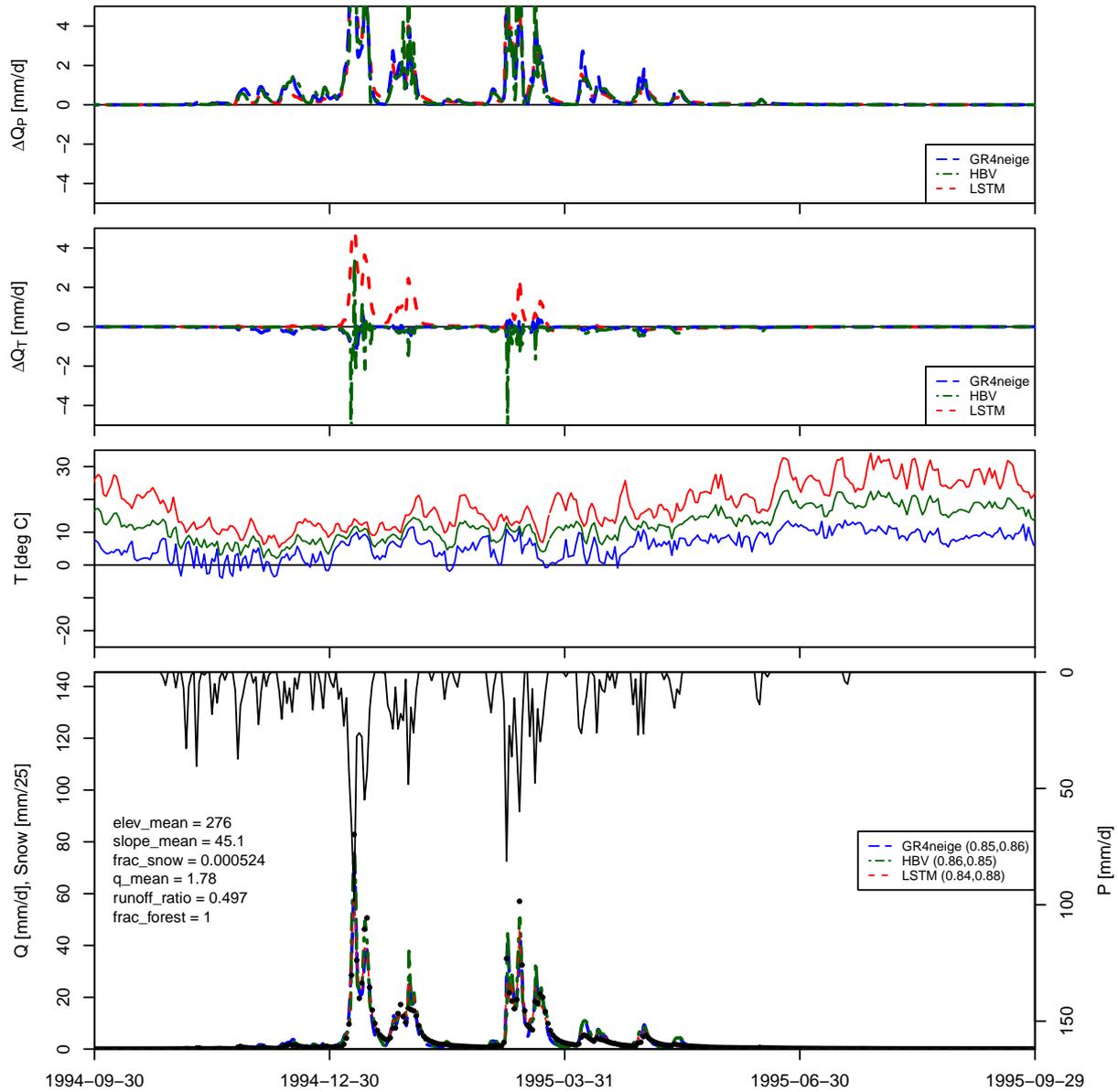
Figure SI.2. Results for basin 11468500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
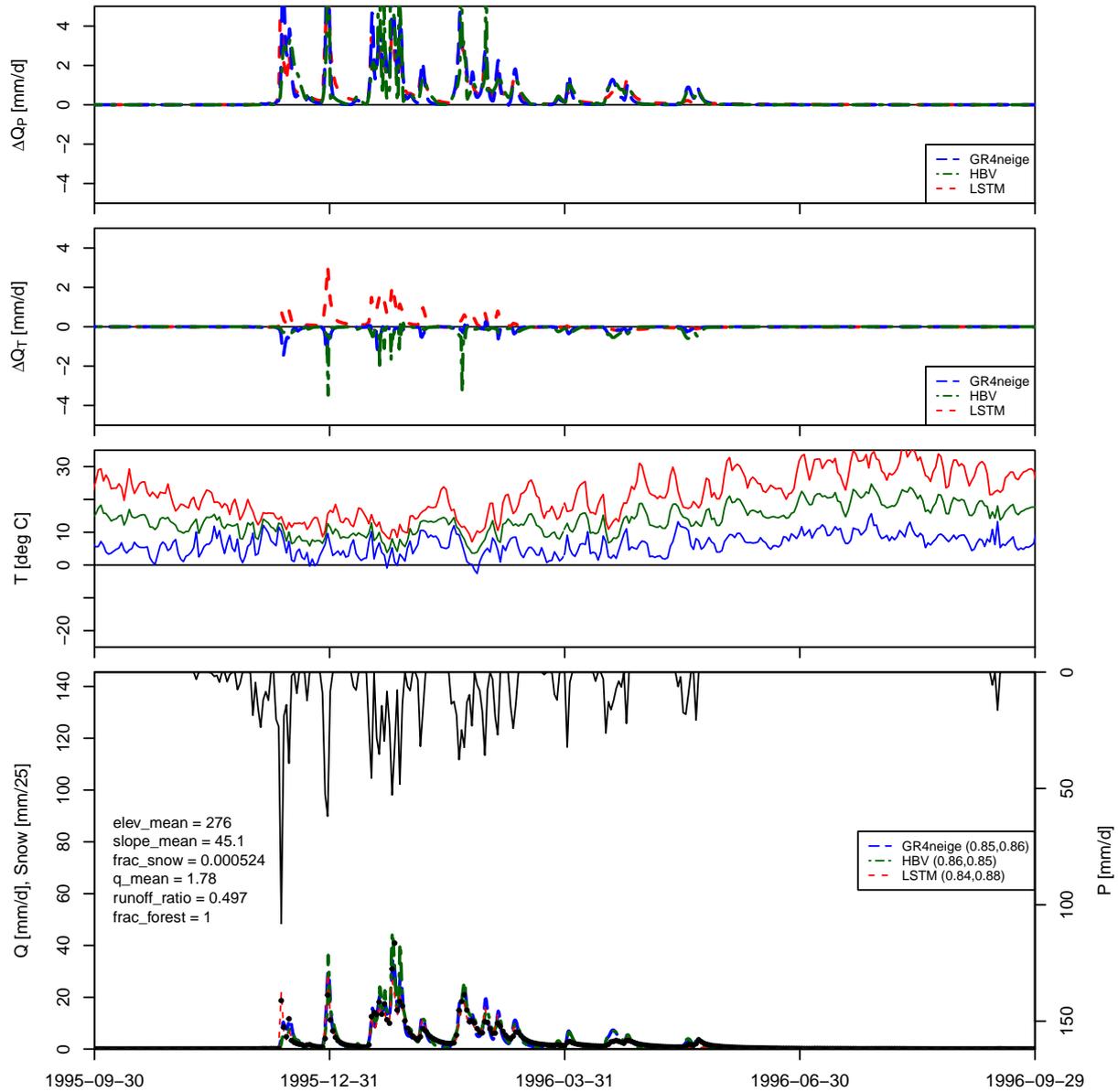
Figure SI.3. Results for basin 11468500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
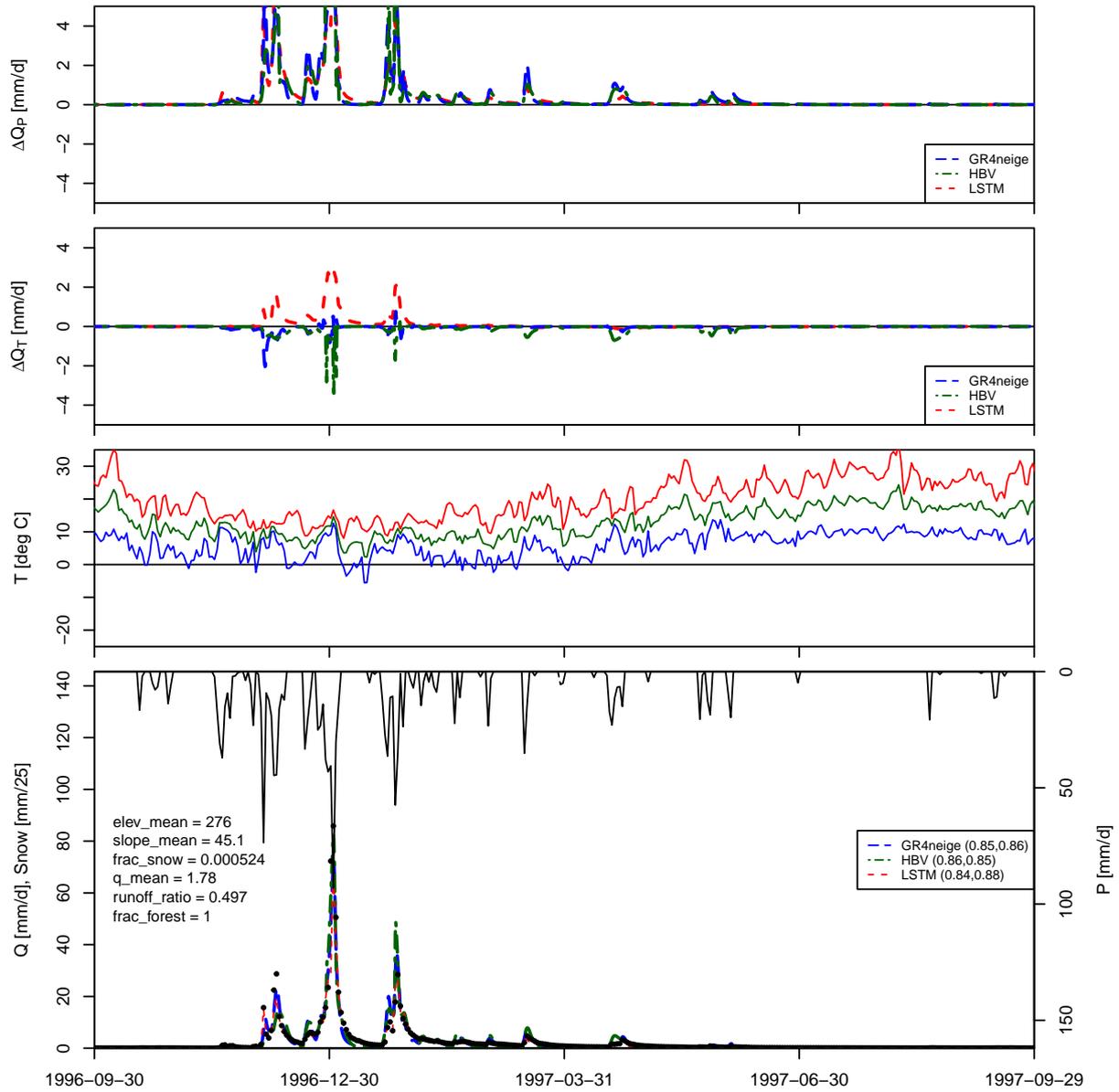
Figure SI.4. Results for basin 11468500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.
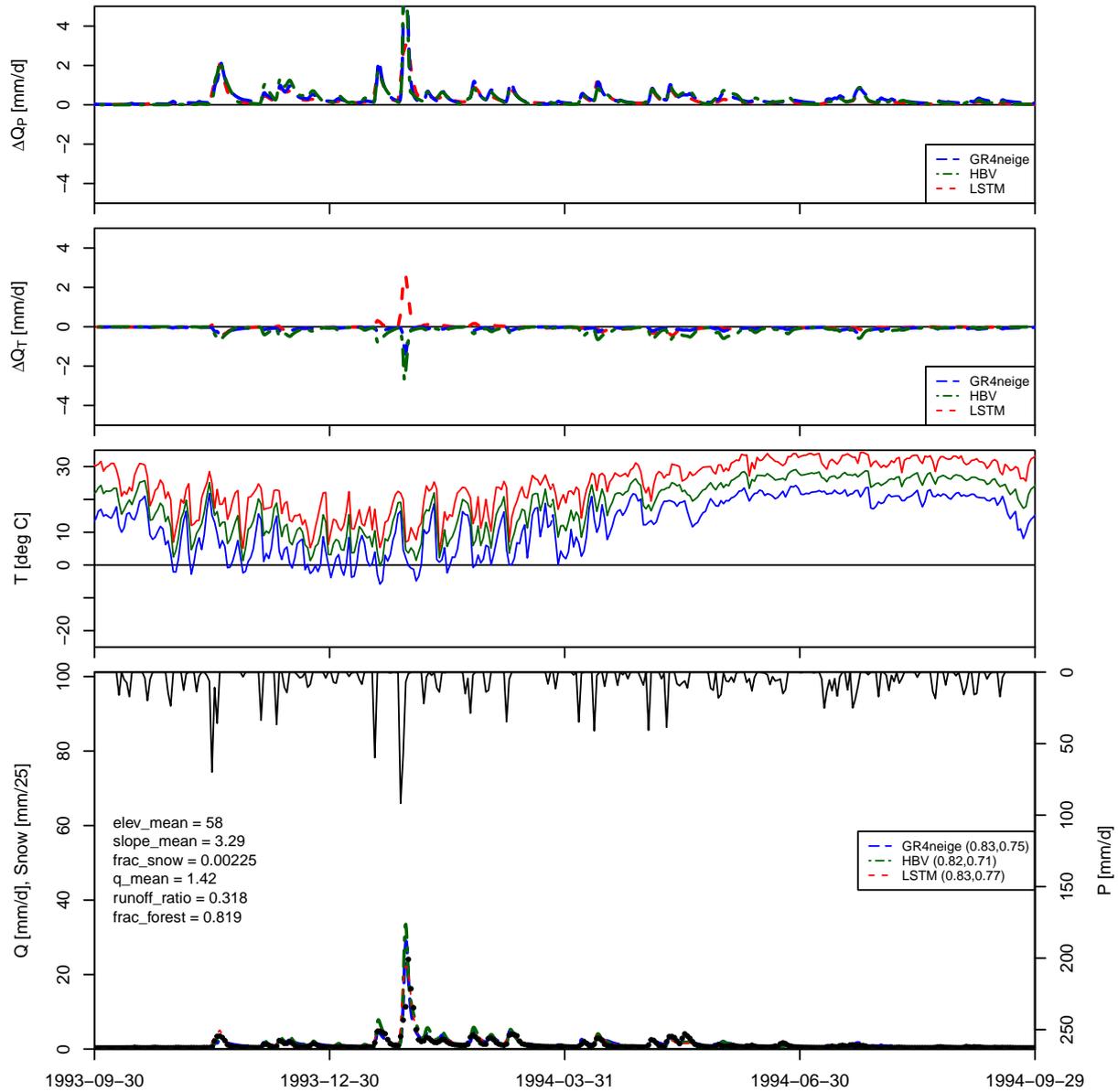
Figure SI.5. Results for basin 08014500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
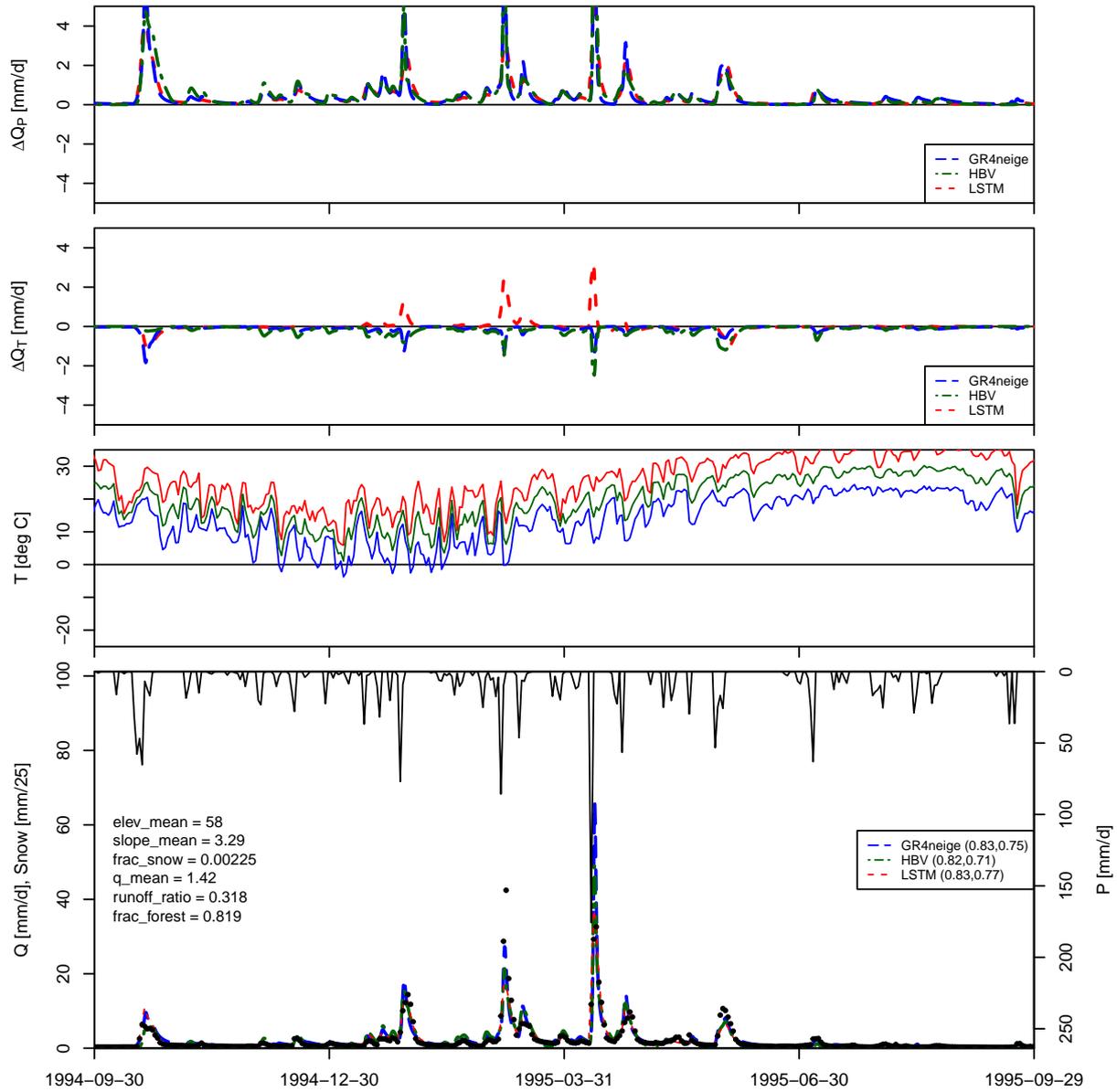
Figure SI.6. Results for basin 08014500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
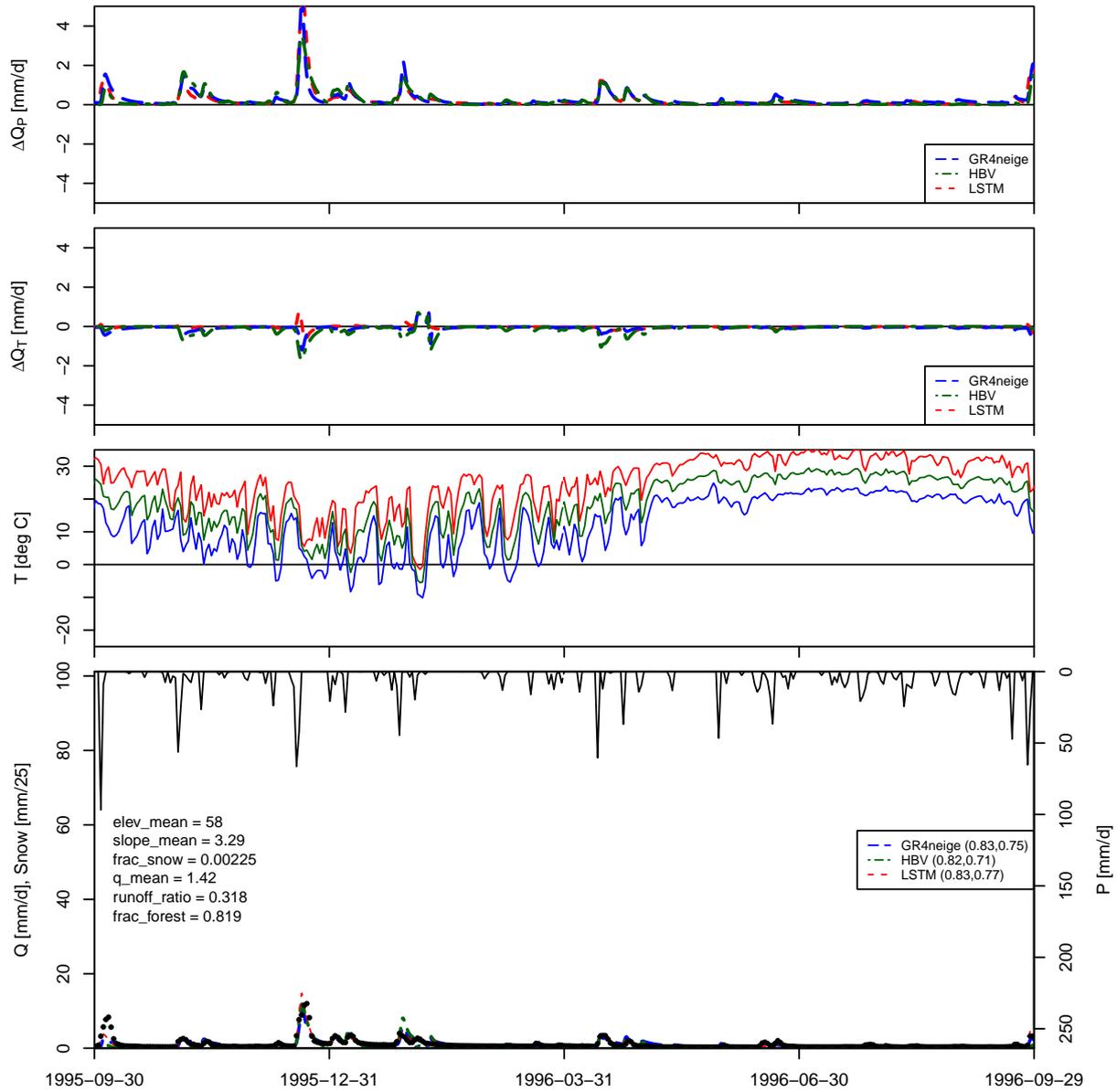
Figure SI.7. Results for basin 08014500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
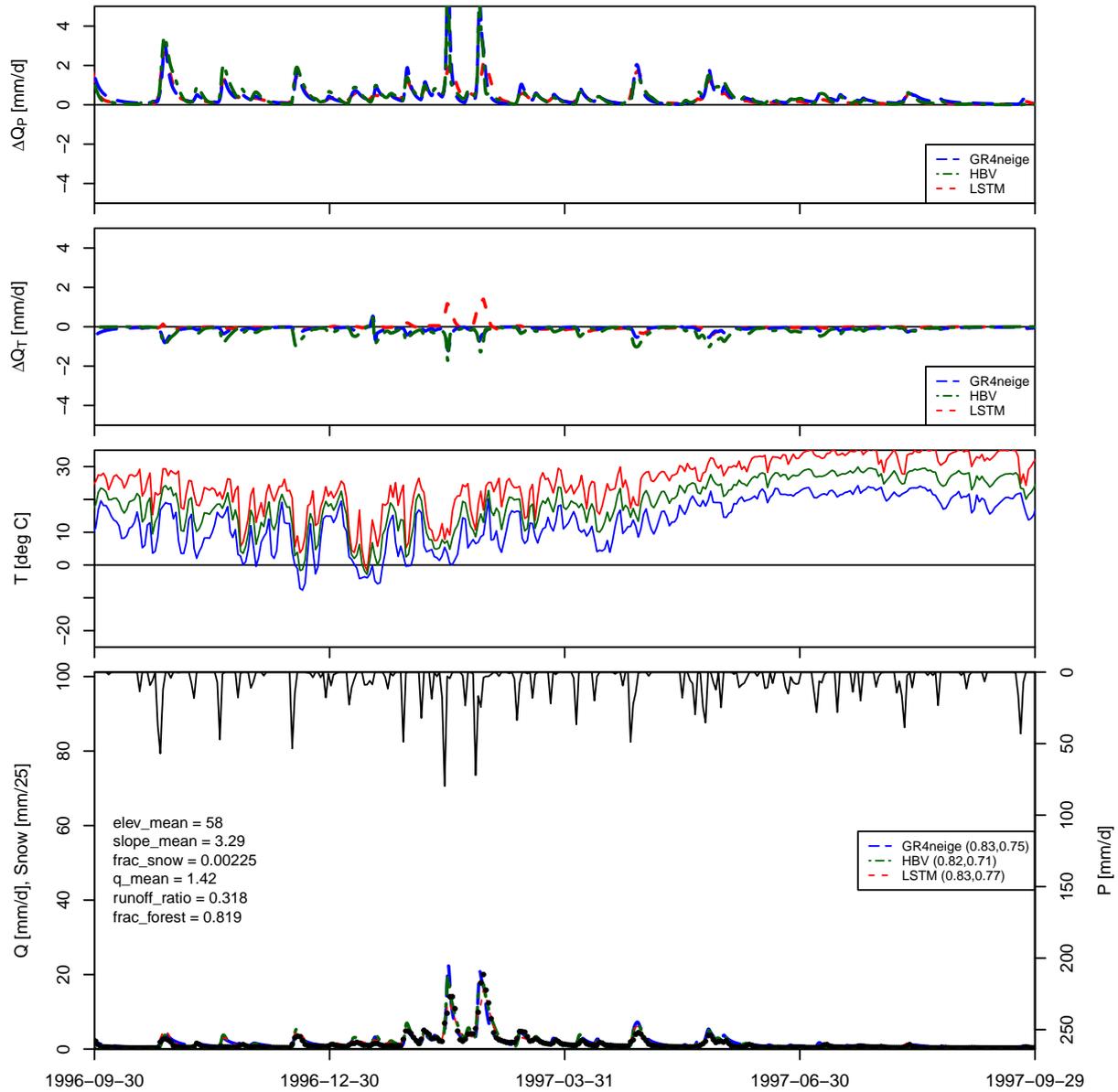
Figure SI.8. Results for basin 08014500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.
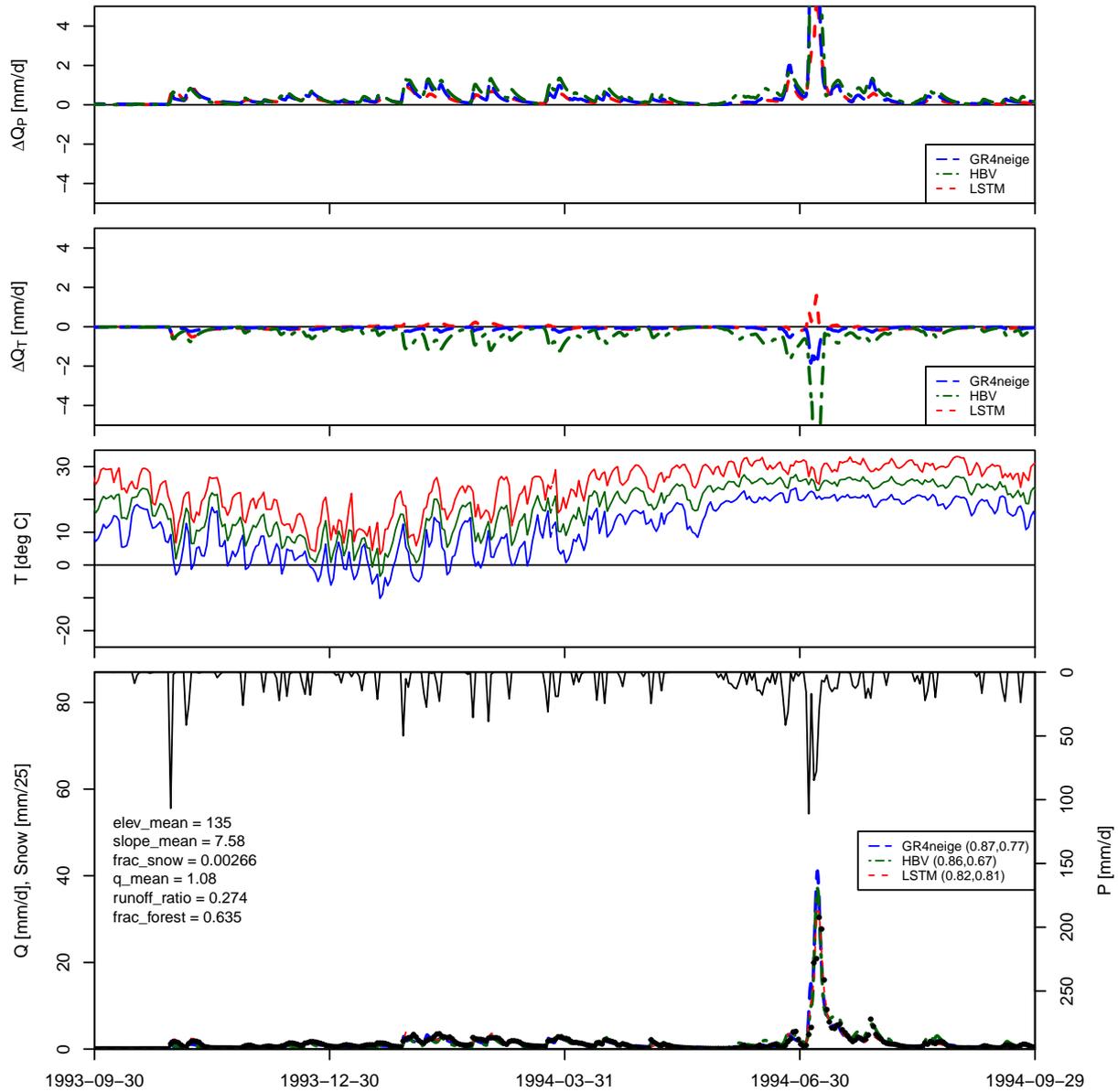
Figure SI.9. Results for basin 02363000, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
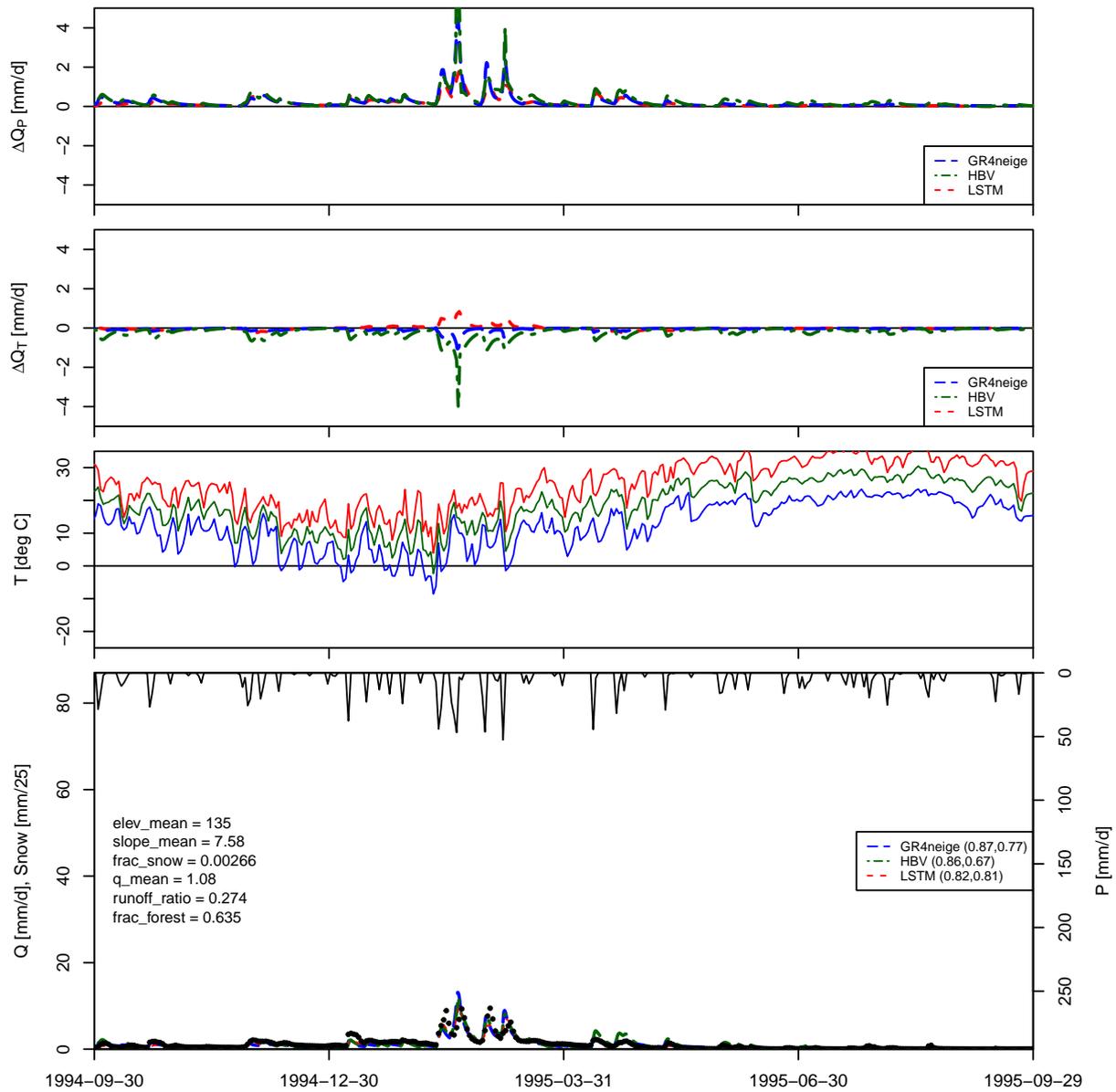
Figure SI.10. Results for basin 02363000, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
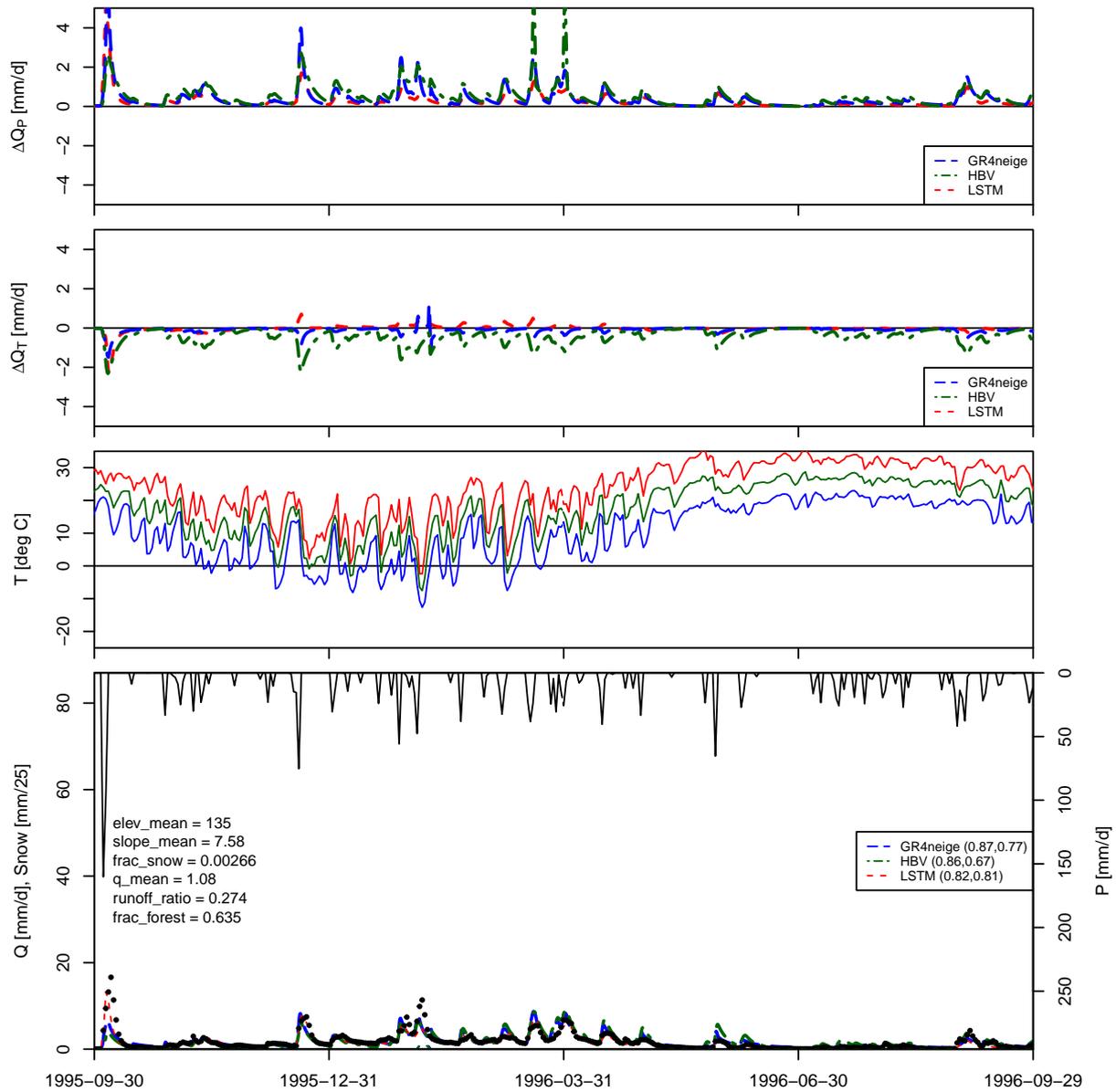
Figure SI.11. Results for basin 02363000, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
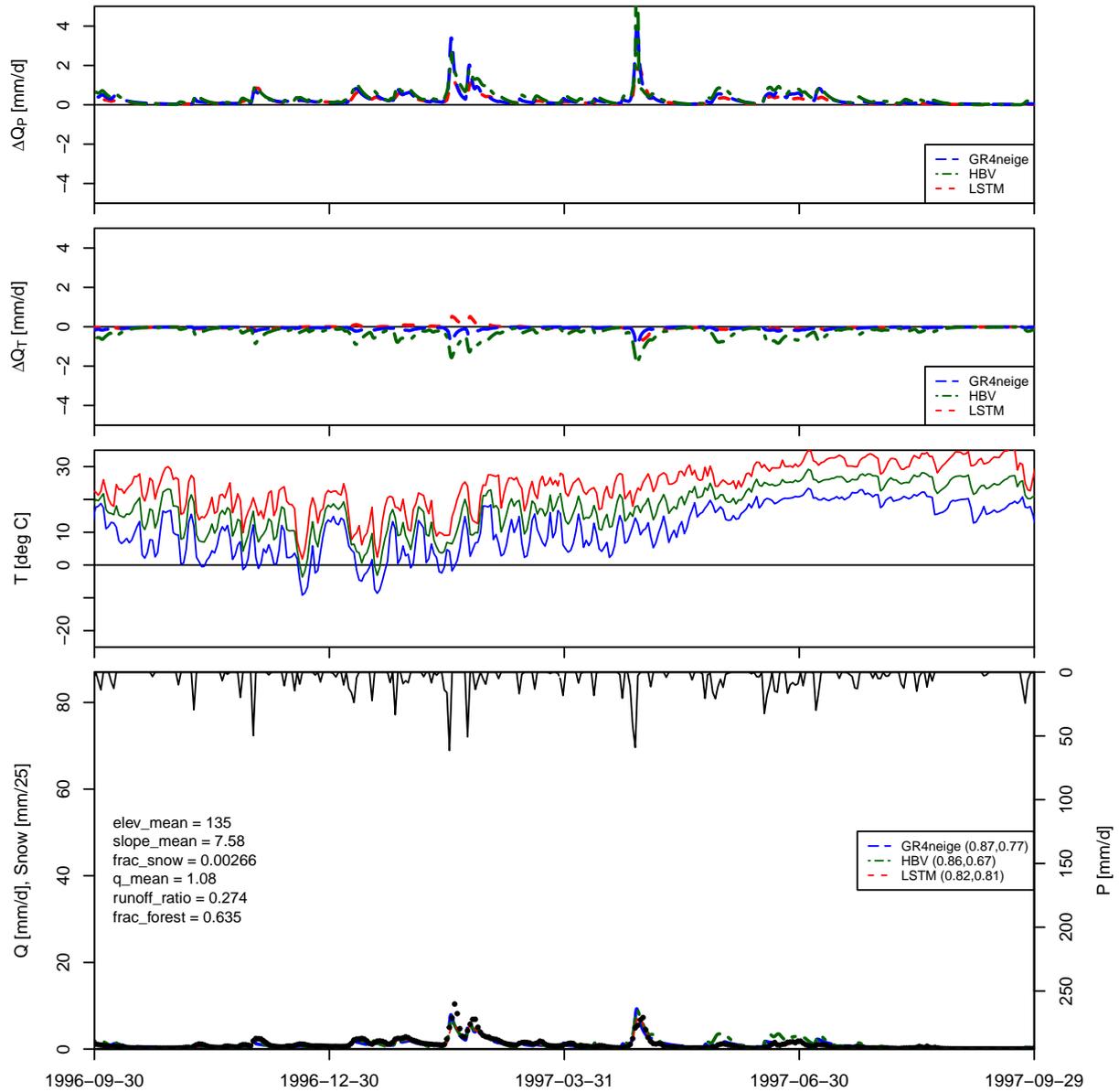
Figure SI.12. Results for basin 02363000, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.
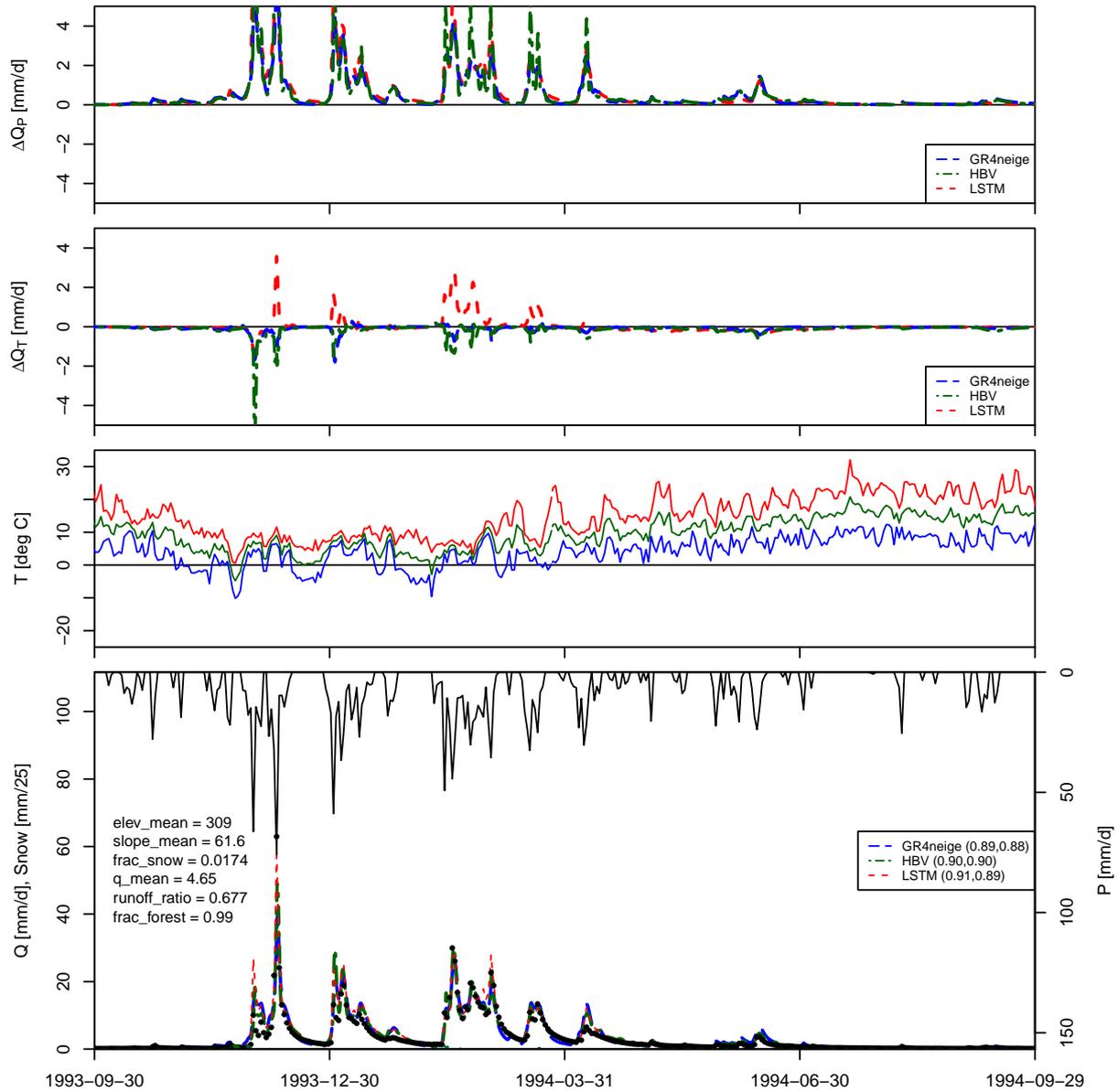
Figure SI.13. Results for basin 12013500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
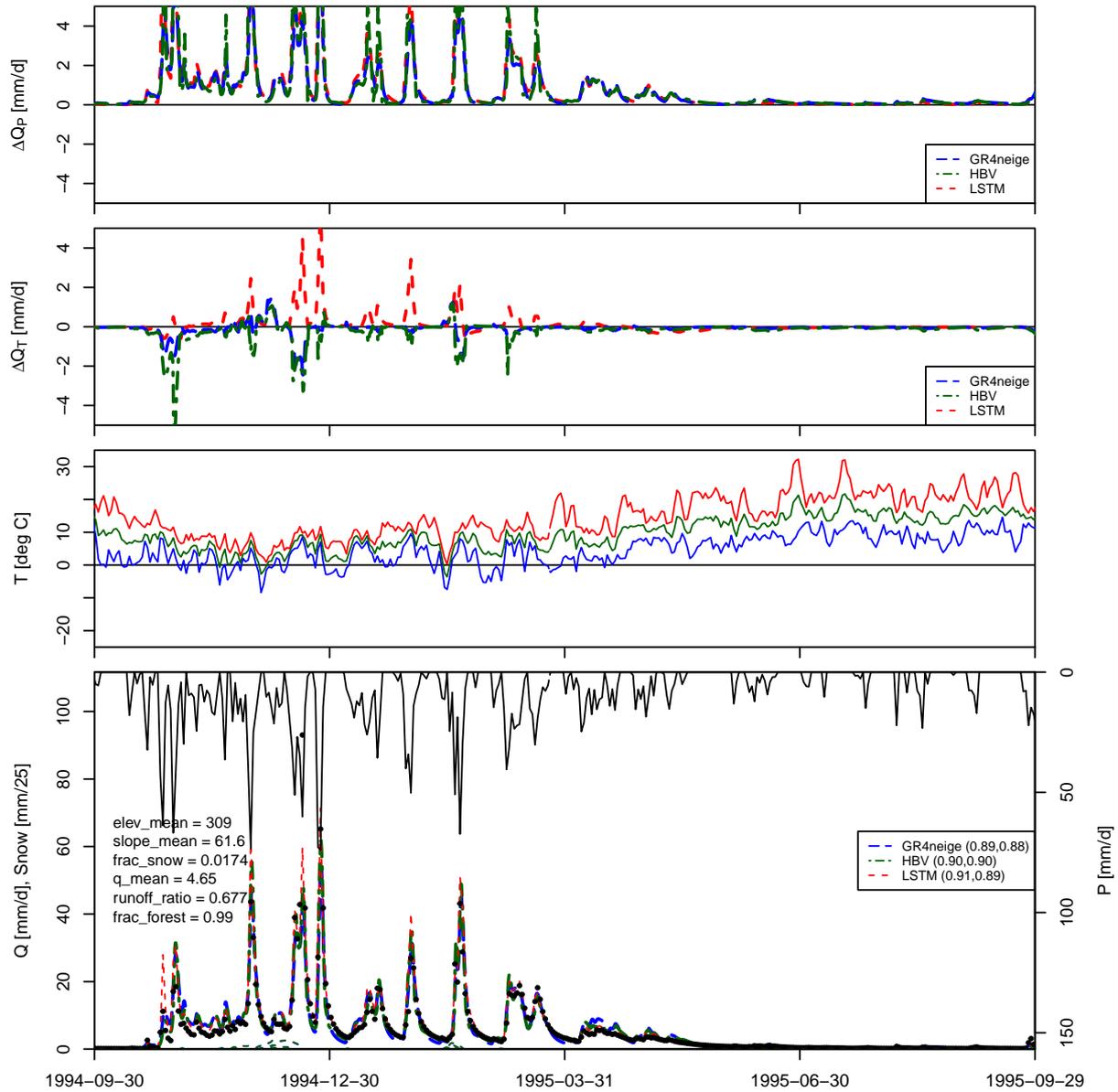
Figure SI.14. Results for basin 12013500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
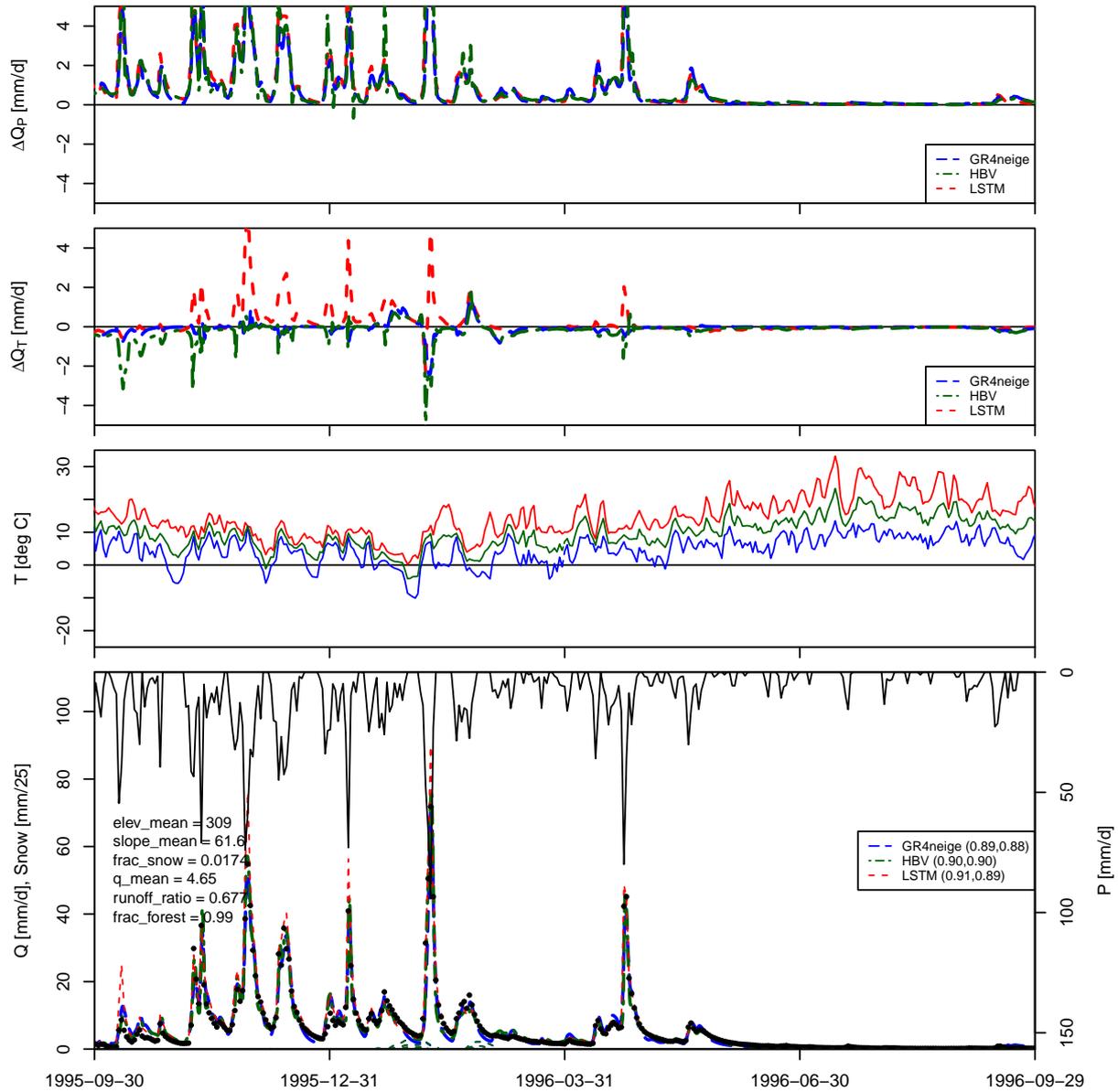
Figure SI.15. Results for basin 12013500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
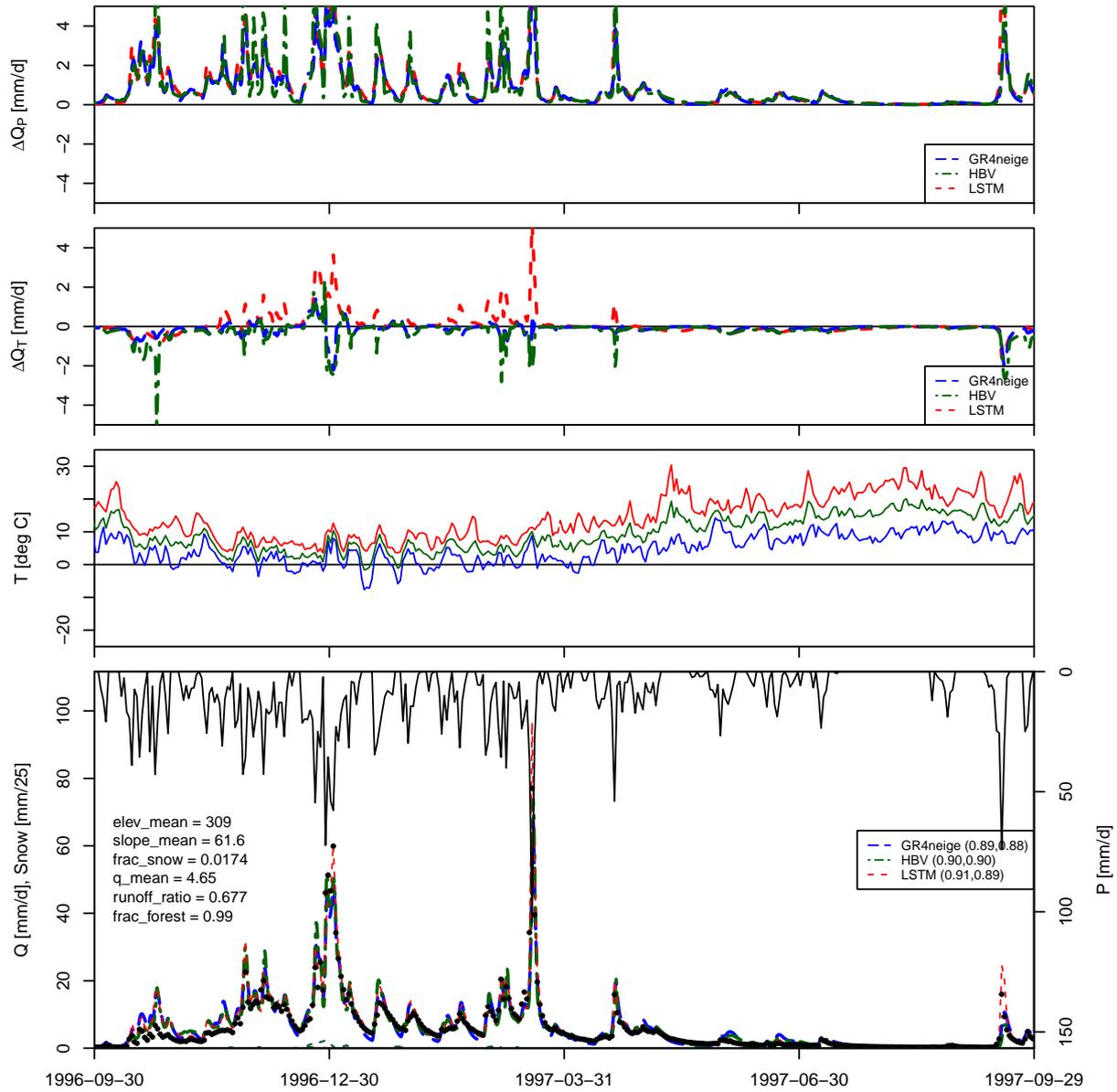
Figure SI.16. Results for basin 12013500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.

Very High Altitude (Cold) Basins

This section provides examples of the modelled response of very high altitude cold basins in addition to the one discussed in
770   section 3.2.2. See section 3.2.2 for explanations.

The Figures SI.17 to SI.20 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.

775   The Figures SI.21 to SI.24 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.

The Figures SI.25 to SI.28 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.

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The Figures SI.29 to SI.32 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.
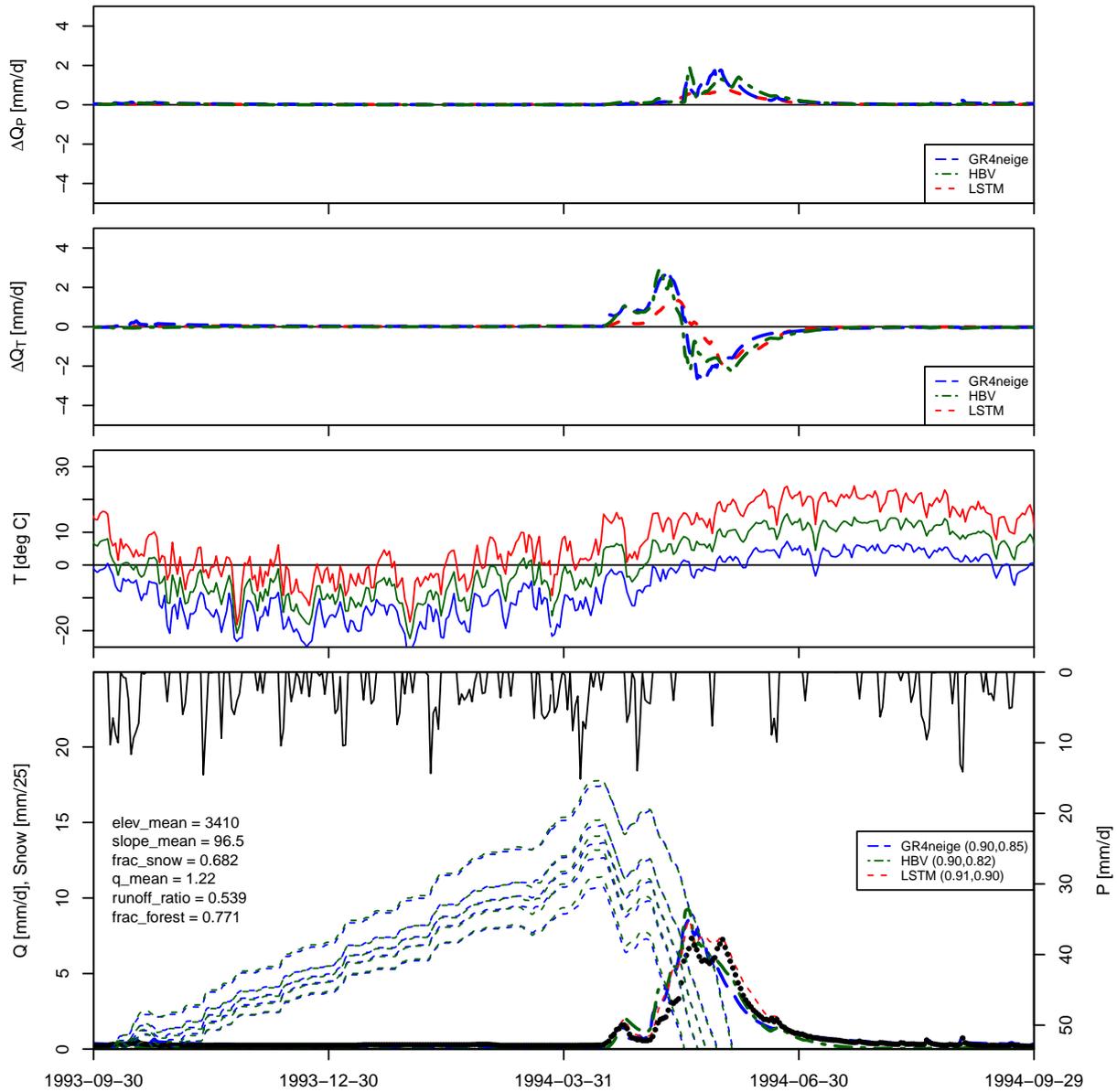
Figure SI.17. Results for basin 09066000, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
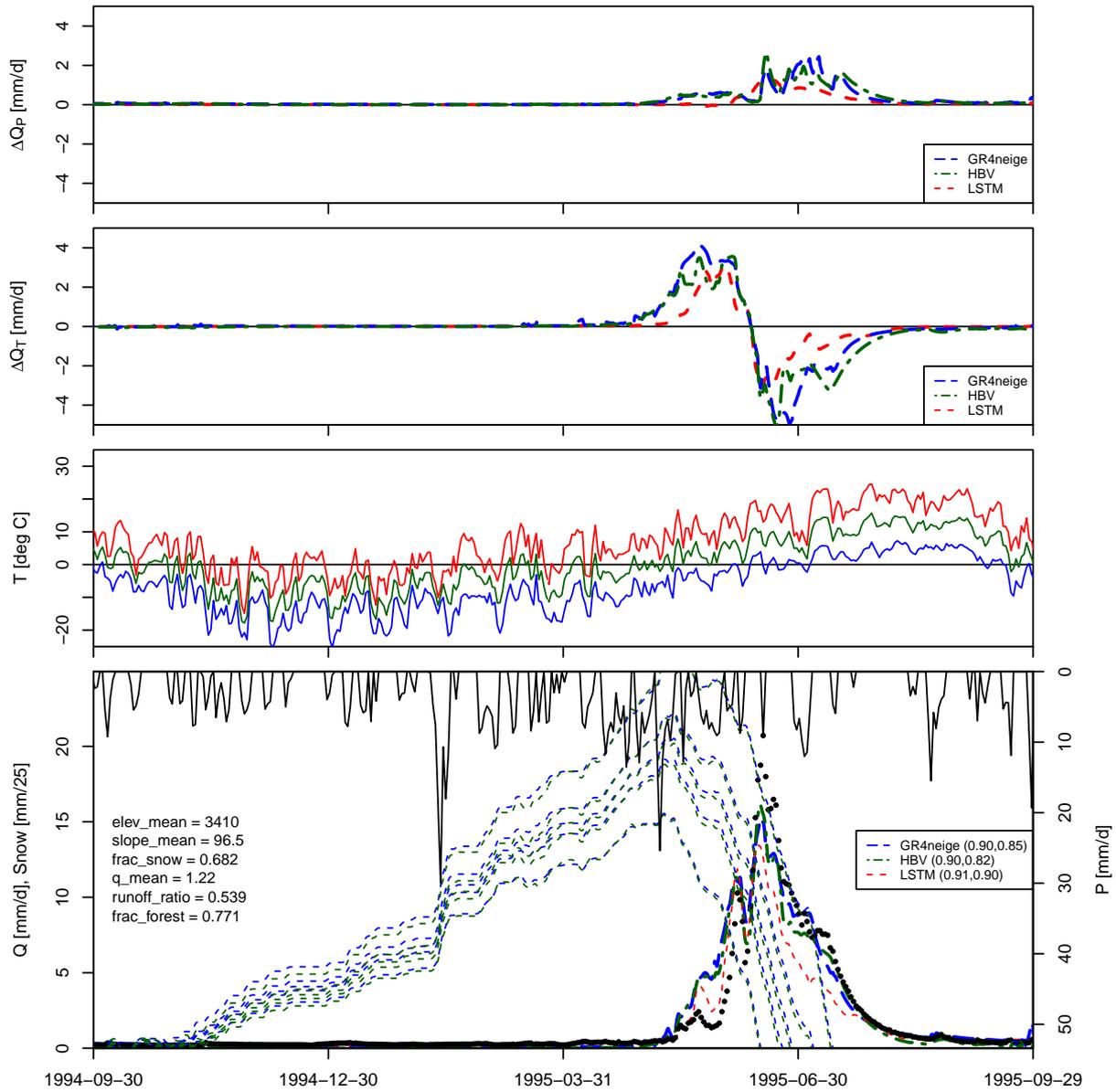
Figure SI.18. Results for basin 09066000, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
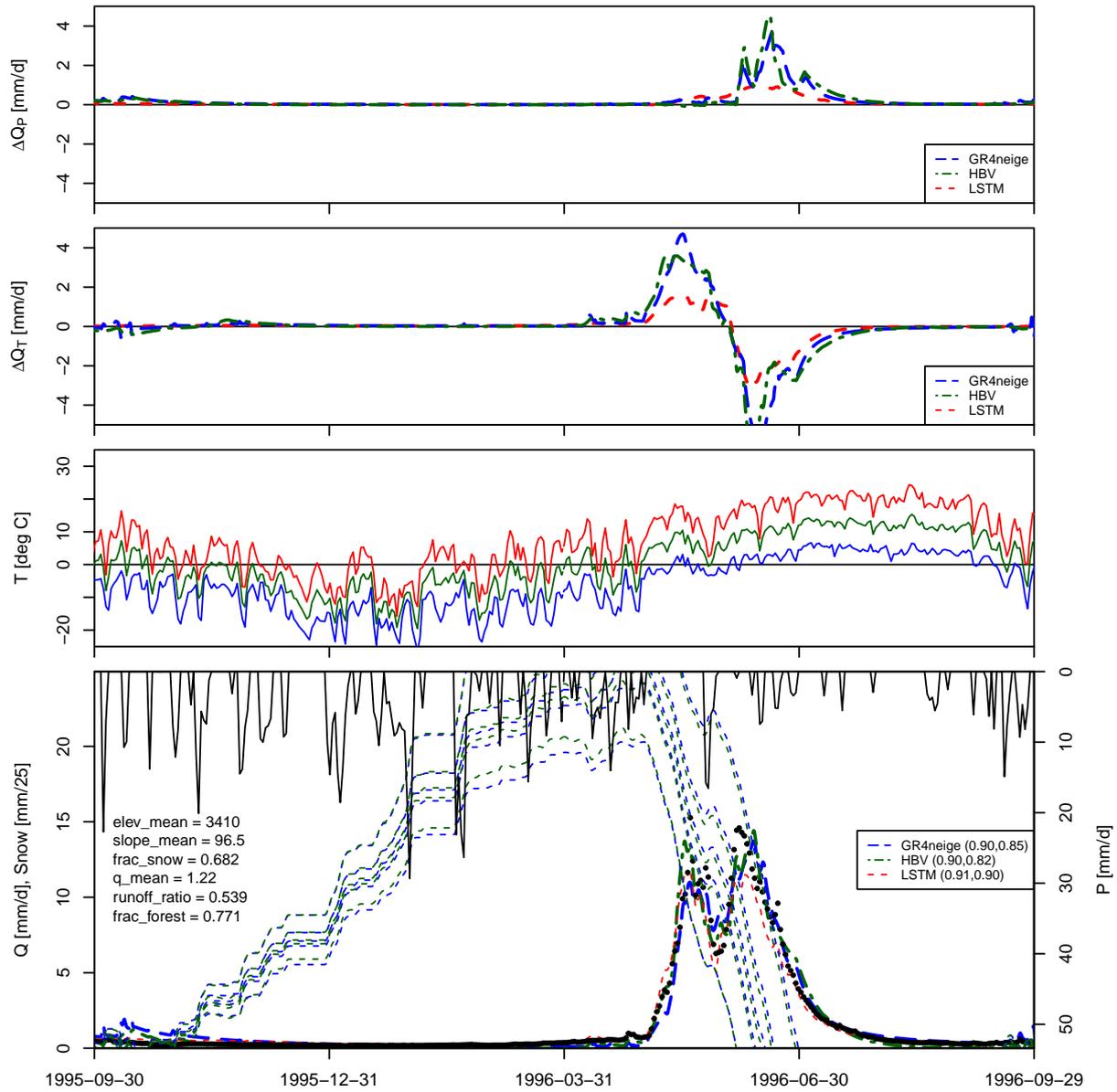
Figure SI.19. Results for basin 09066000, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
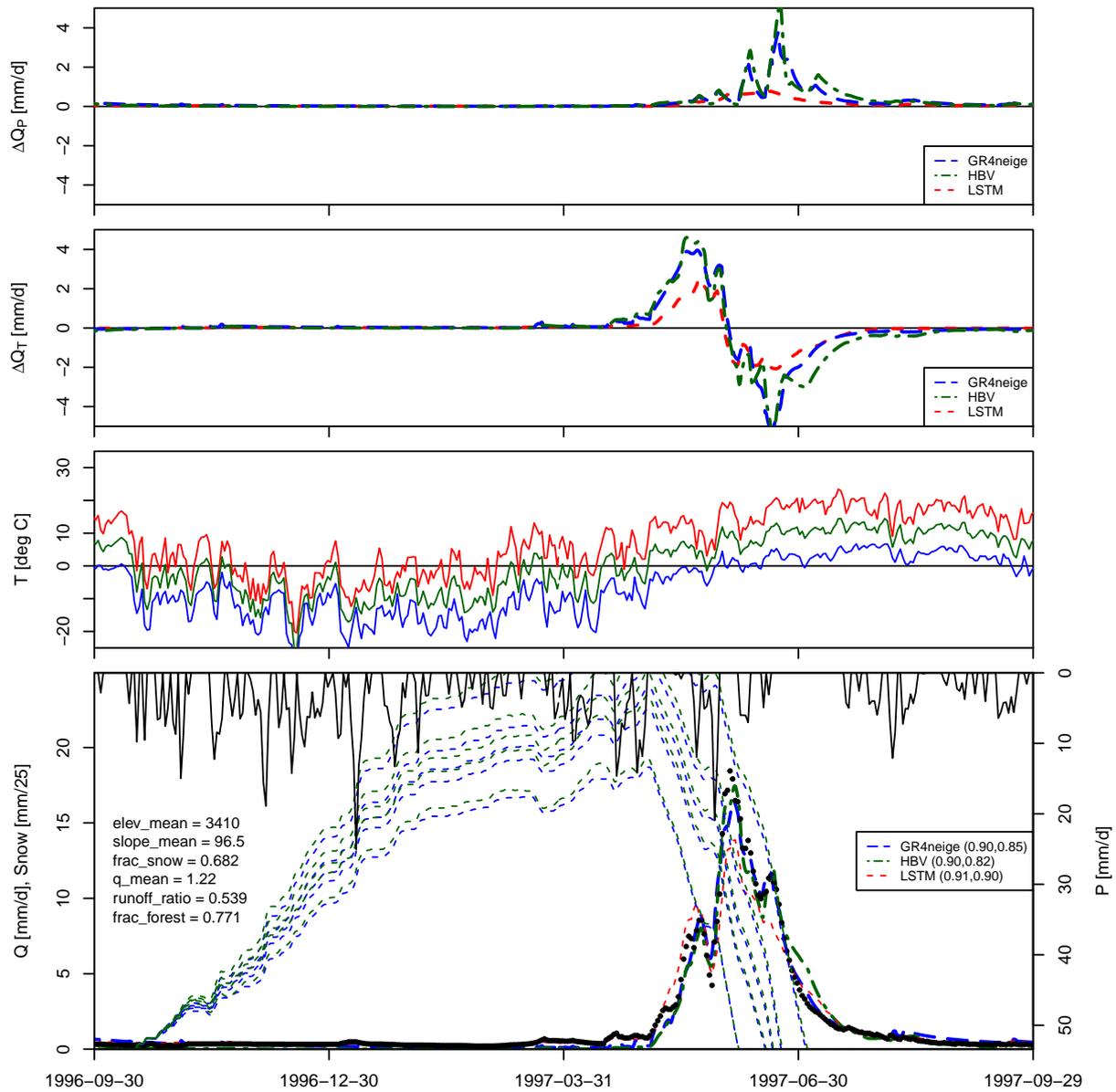
Figure SI.20. Results for basin 09066000, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.
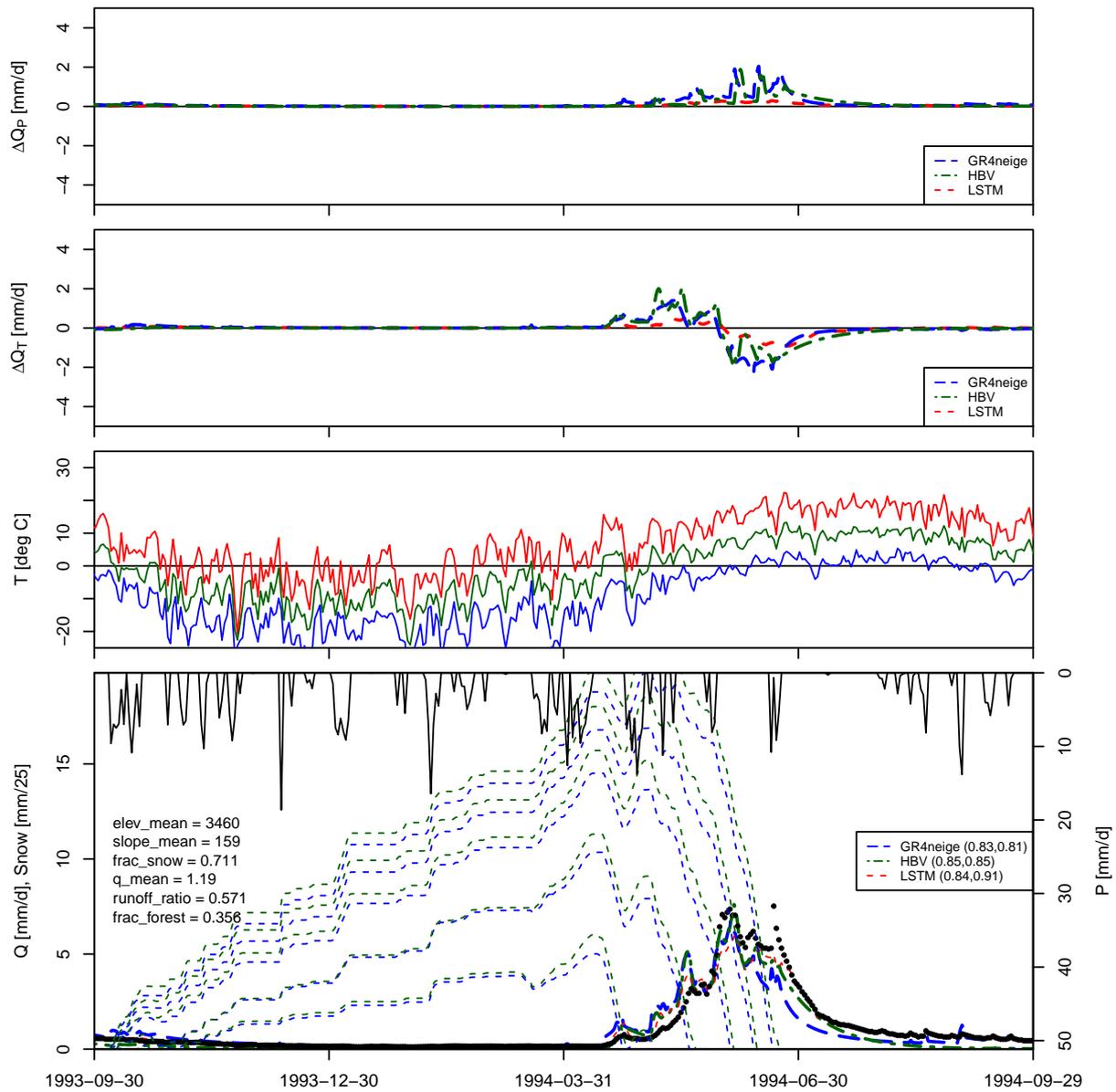
Figure SI.21. Results for basin 07083000, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
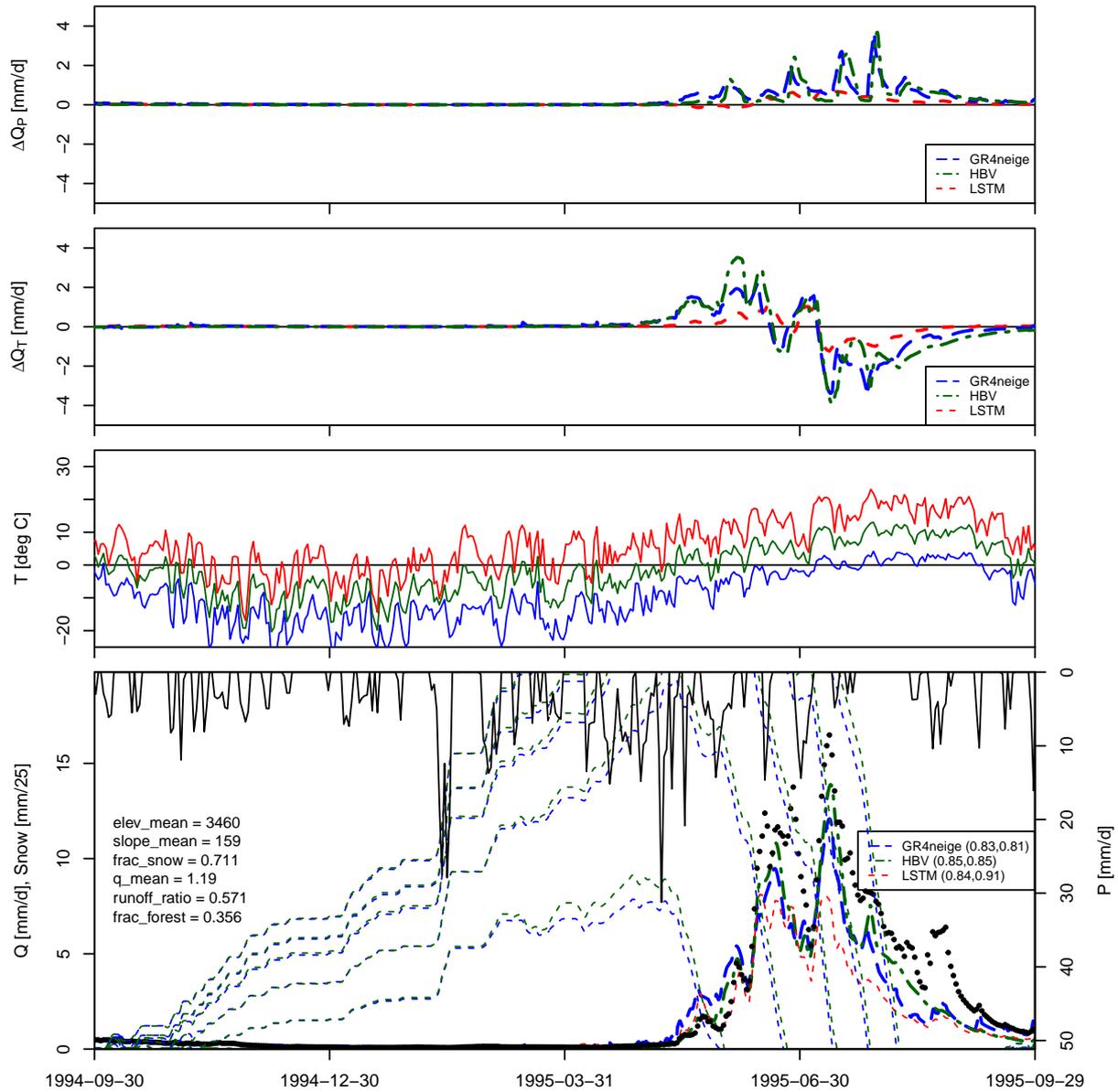
Figure SI.22. Results for basin 07083000, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
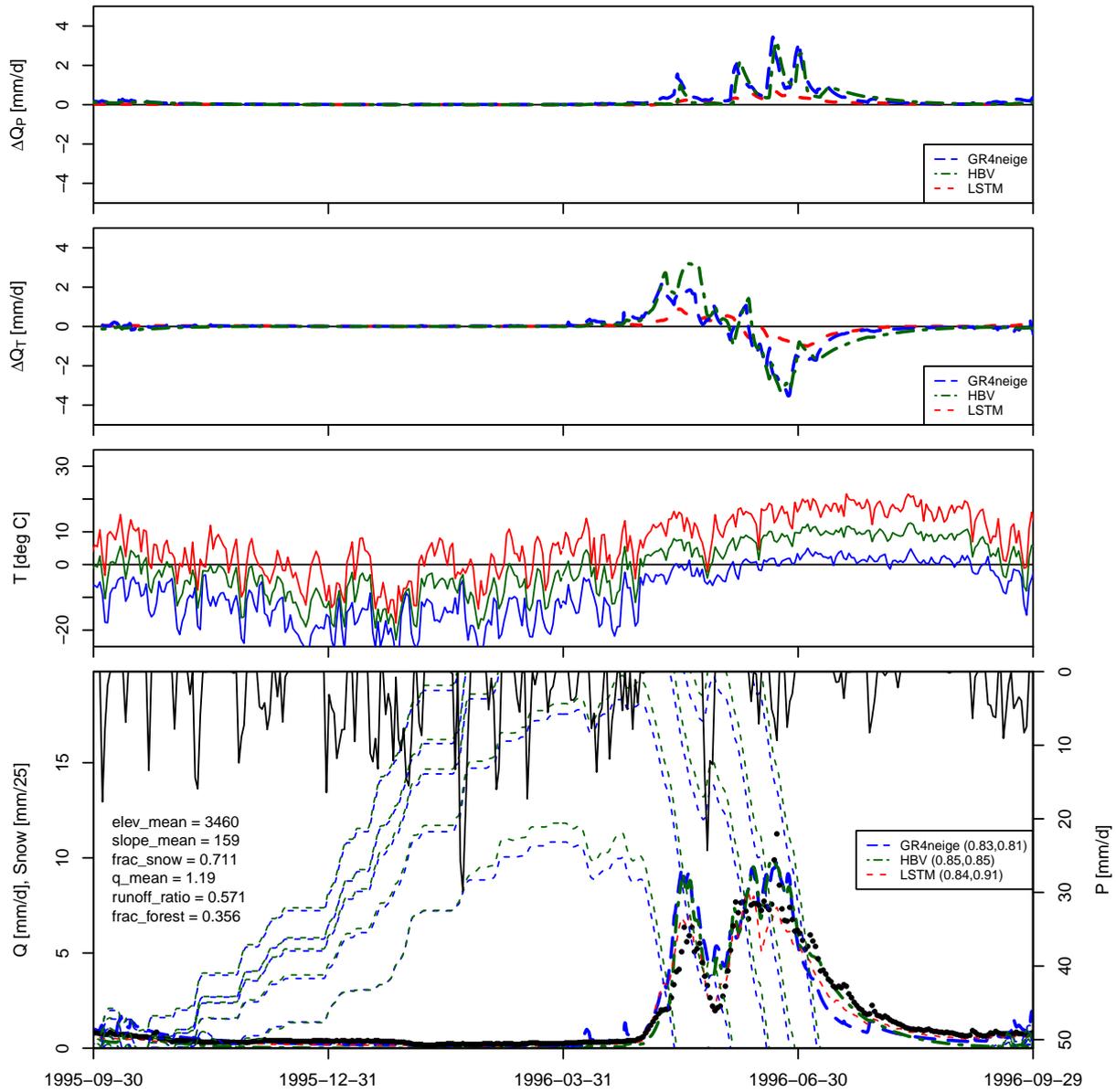
Figure SI.23. Results for basin 07083000, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
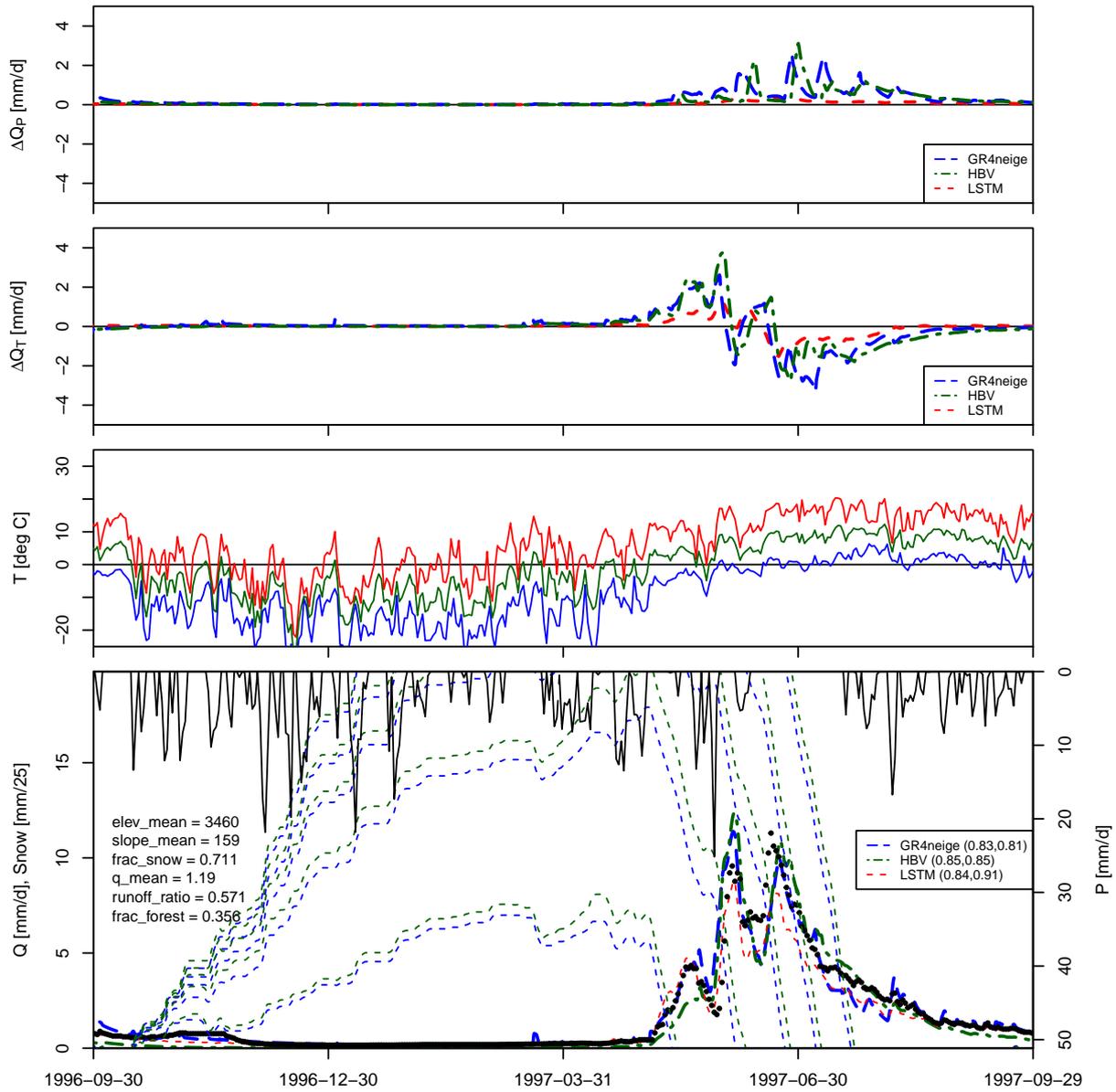
Figure SI.24. Results for basin 07083000, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.
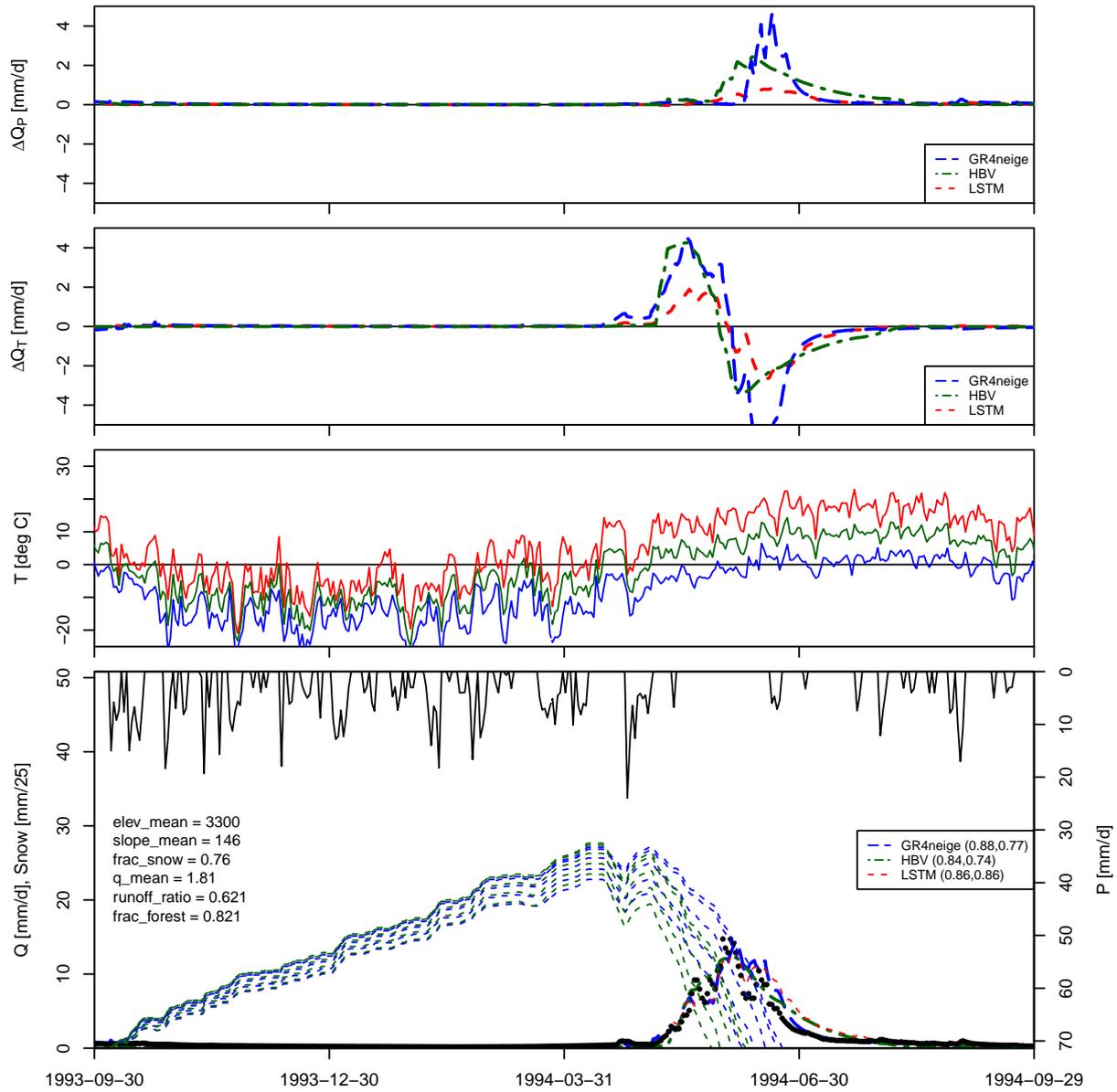
Figure SI.25. Results for basin 06614800, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
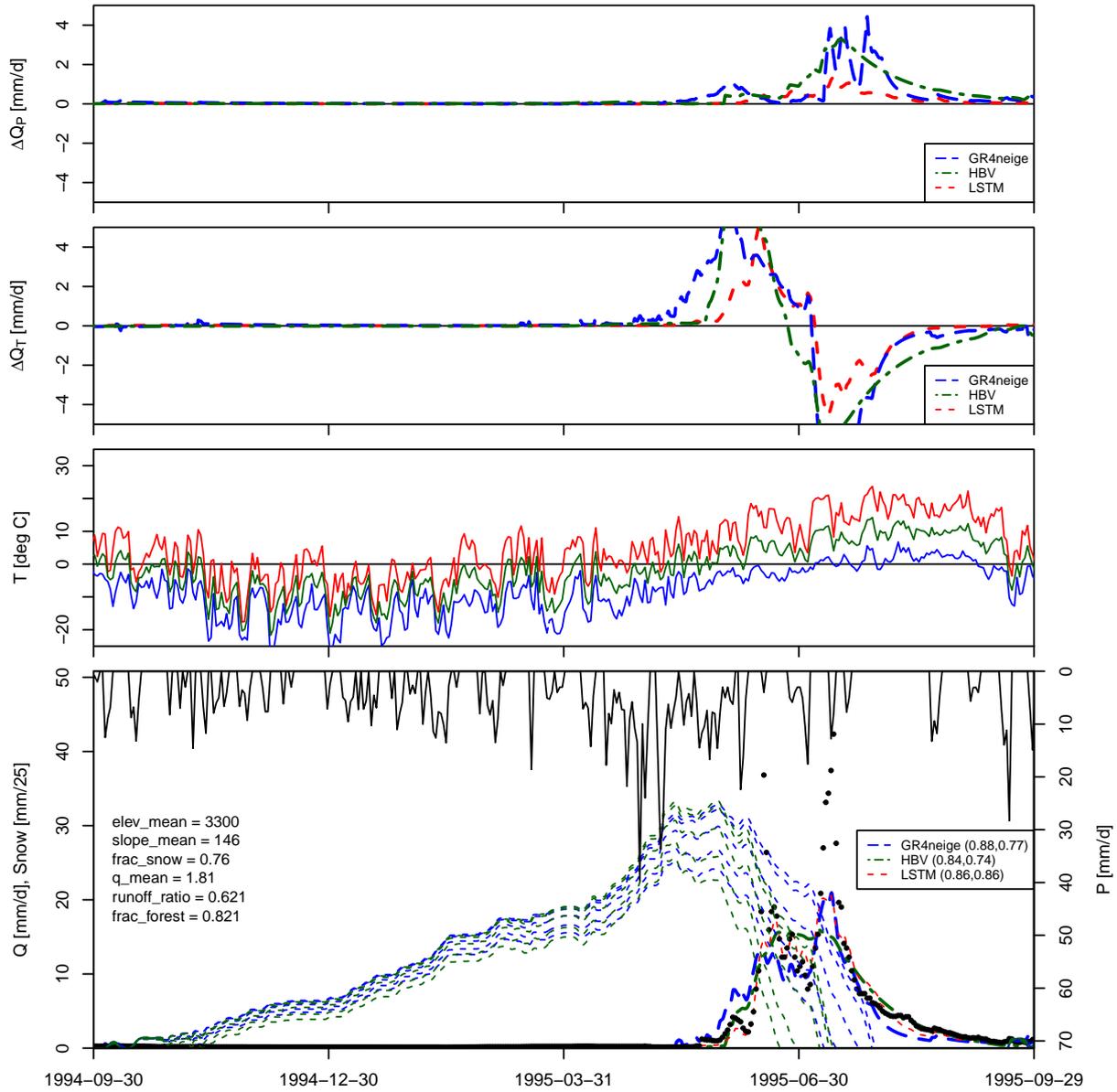
Figure SI.26. Results for basin 06614800, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
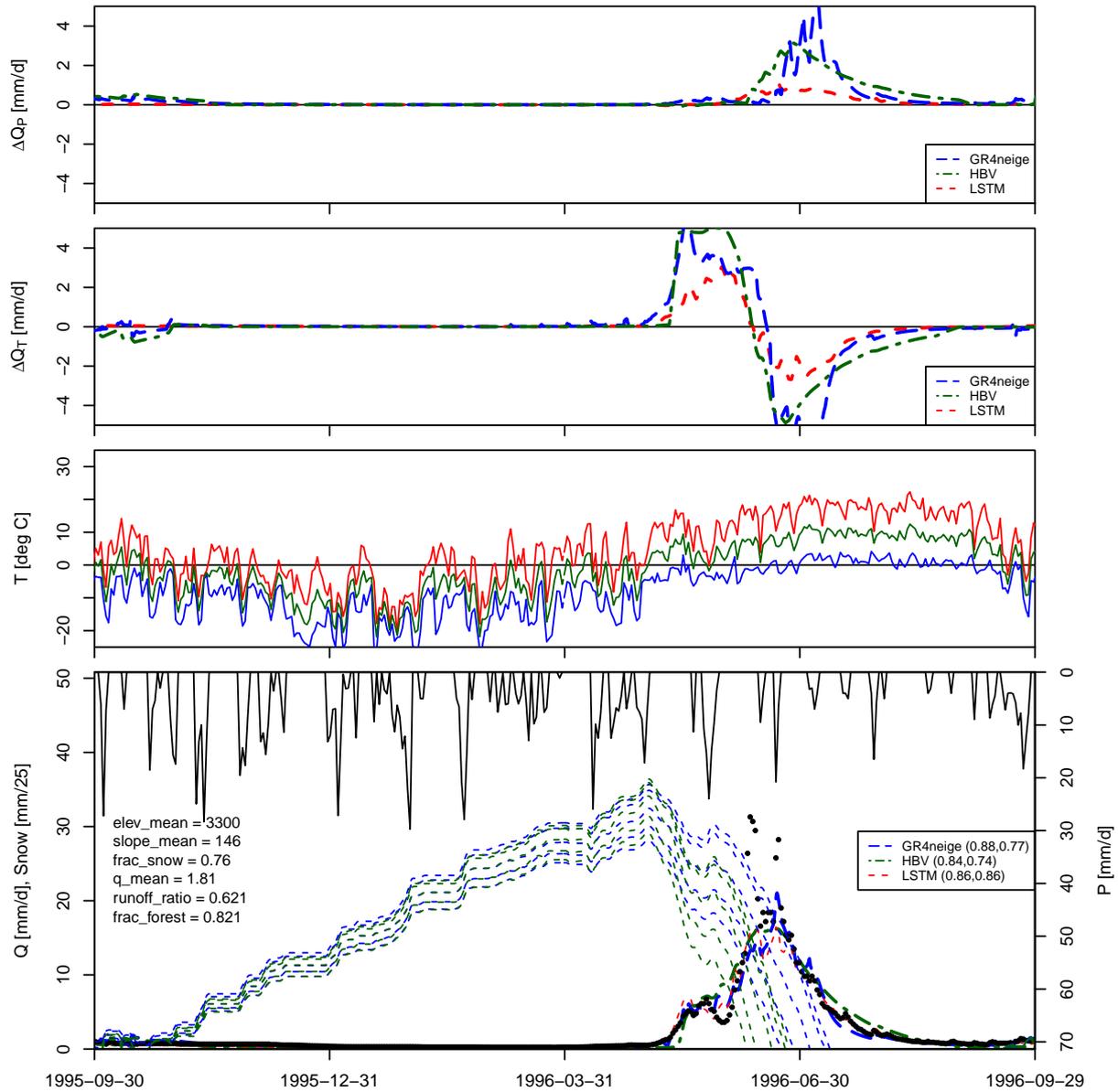
Figure SI.27. Results for basin 06614800, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
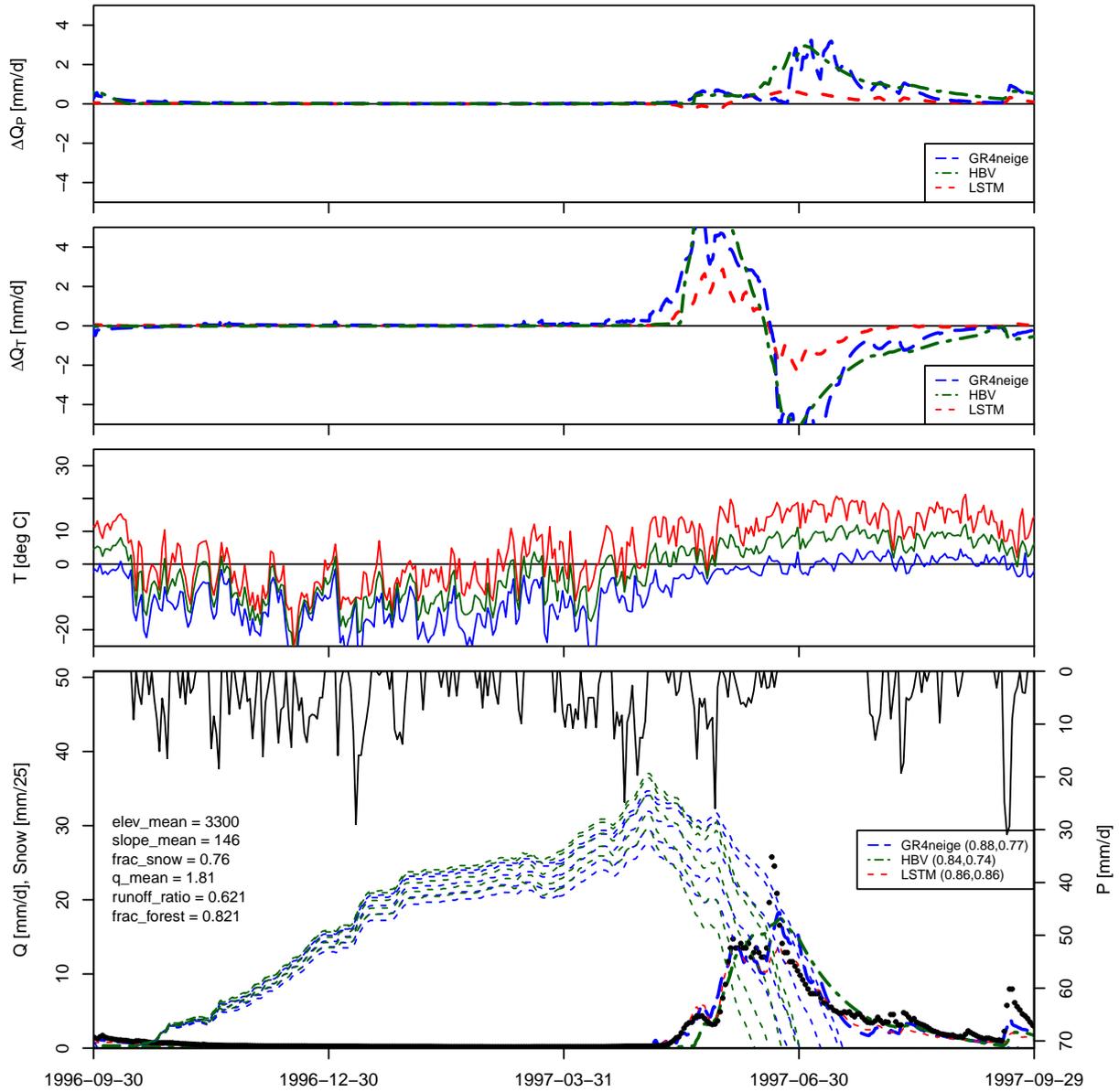
Figure SI.28. Results for basin 06614800, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.
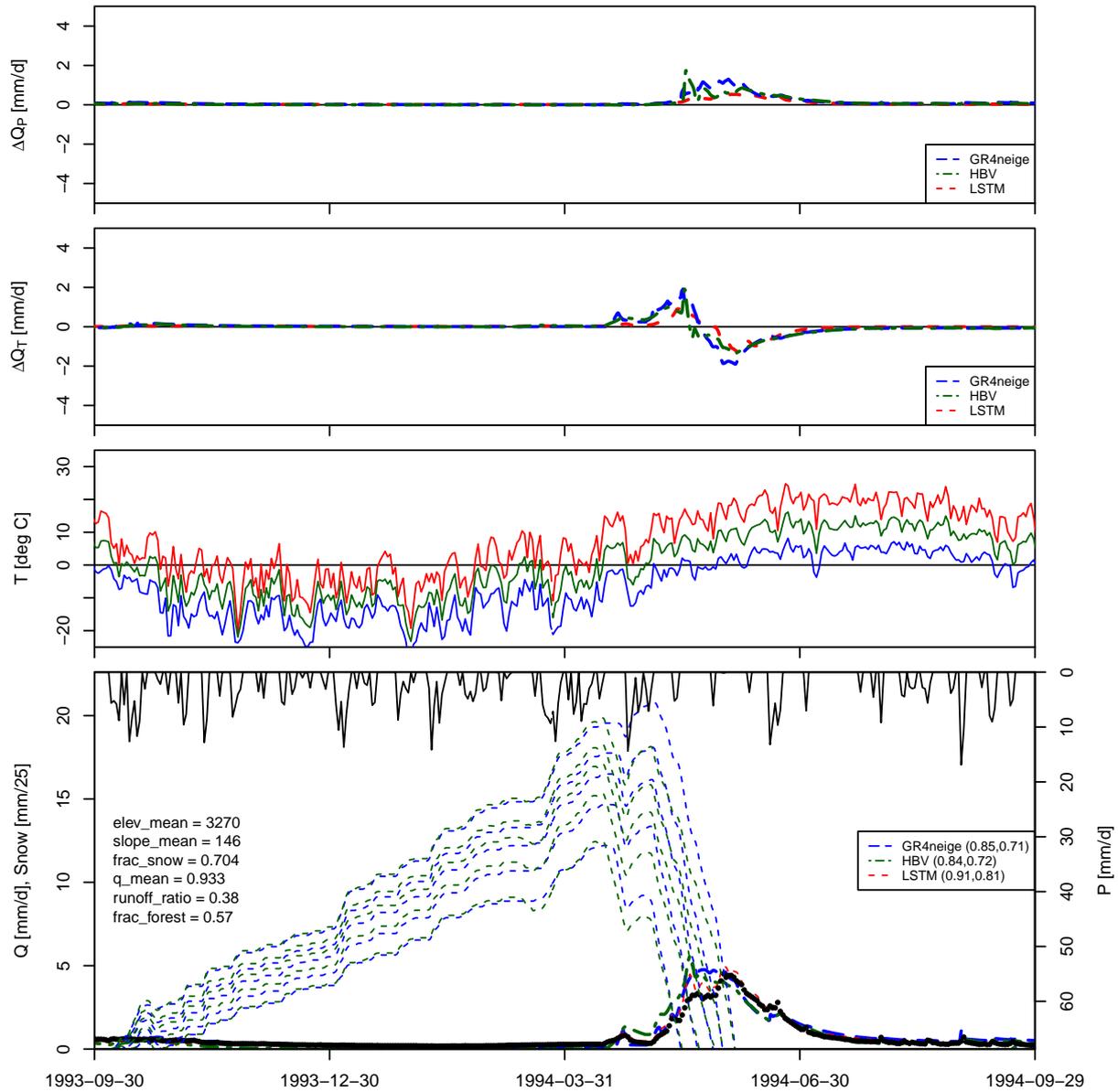
Figure SI.29. Results for basin 09035800, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
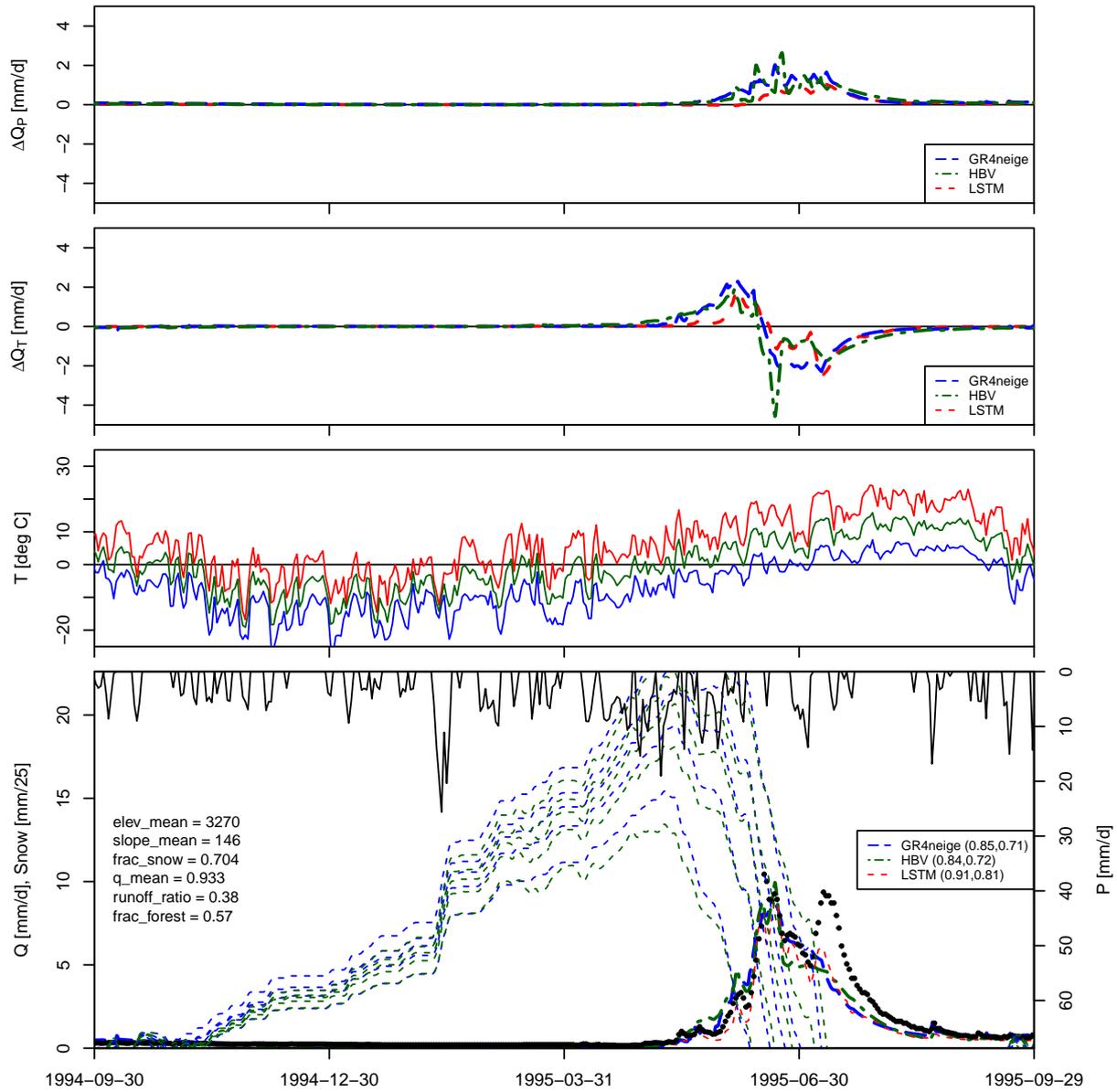
Figure SI.30. Results for basin 09035800, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
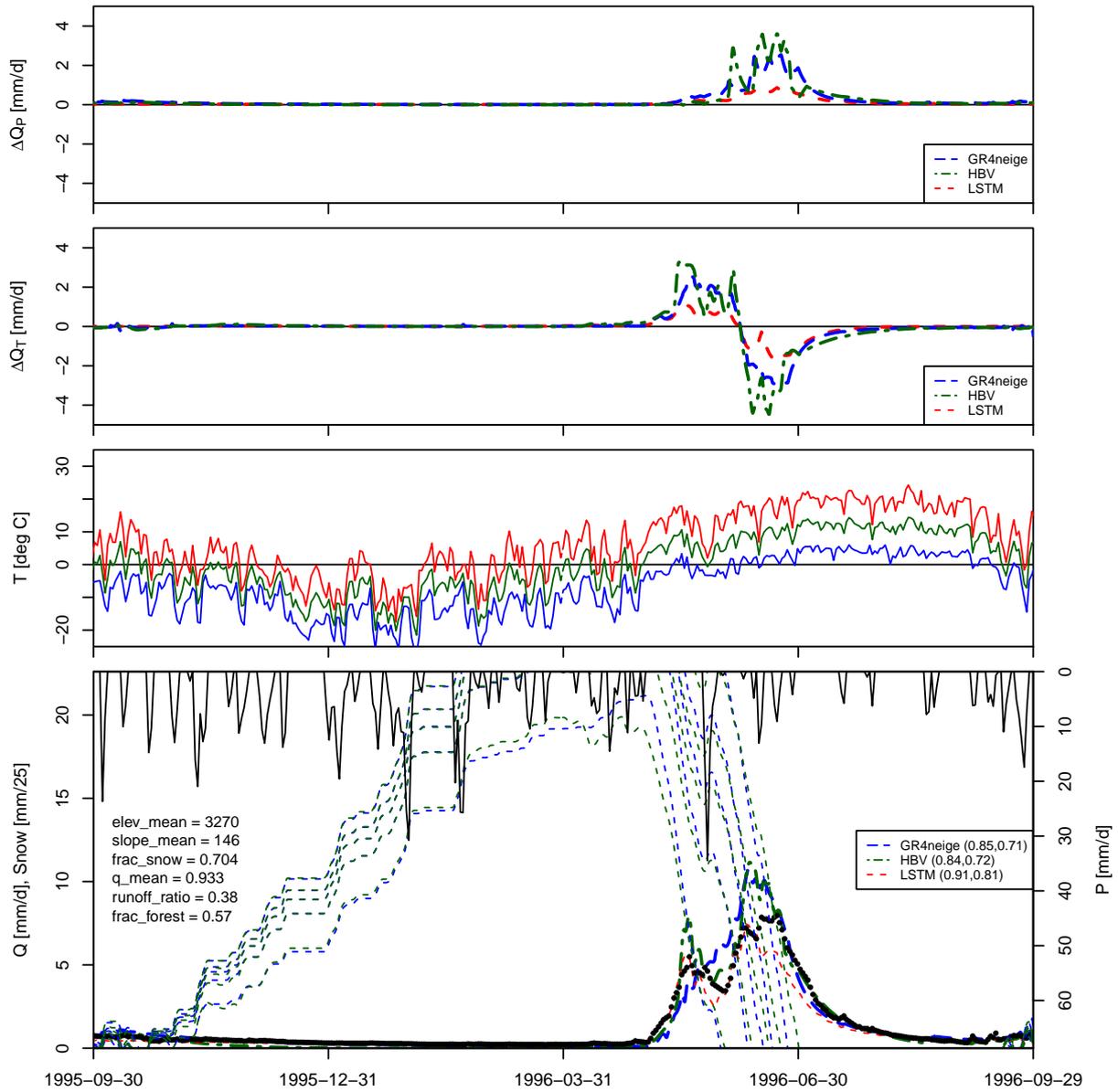
Figure SI.31. Results for basin 09035800, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
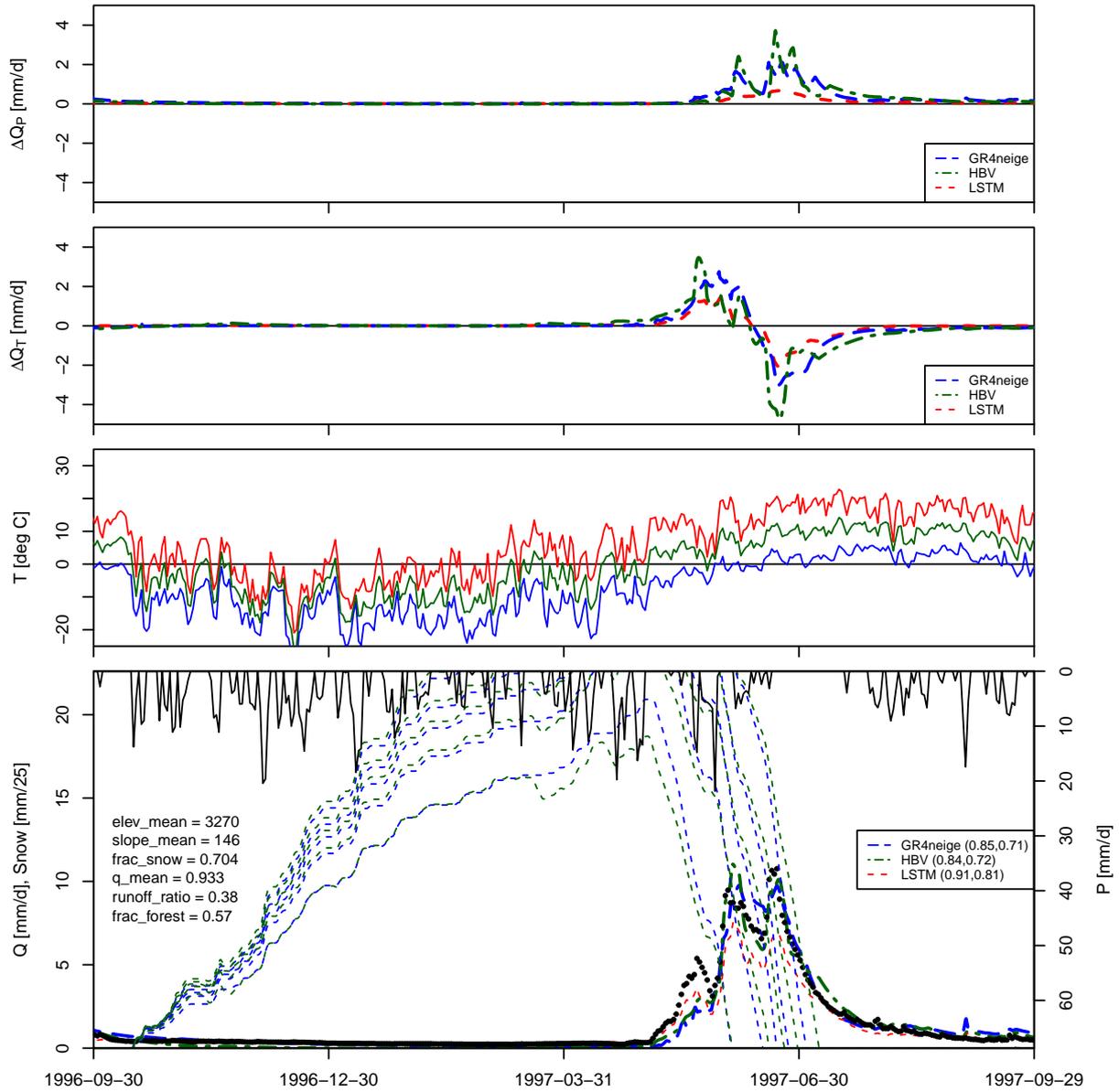
Figure SI.32. Results for basin 09035800, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.

Intermediate Altitude Basins

This section provides examples of the modelled response of intermediate altitude basins in addition to the one discussed in section 3.2.3. See section 3.2.3 for explanations.

The Figures SI.33 to SI.36 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.

The Figures SI.37 to SI.40 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.

The Figures SI.41 to SI.44 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.

The Figures SI.45 to SI.48 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.
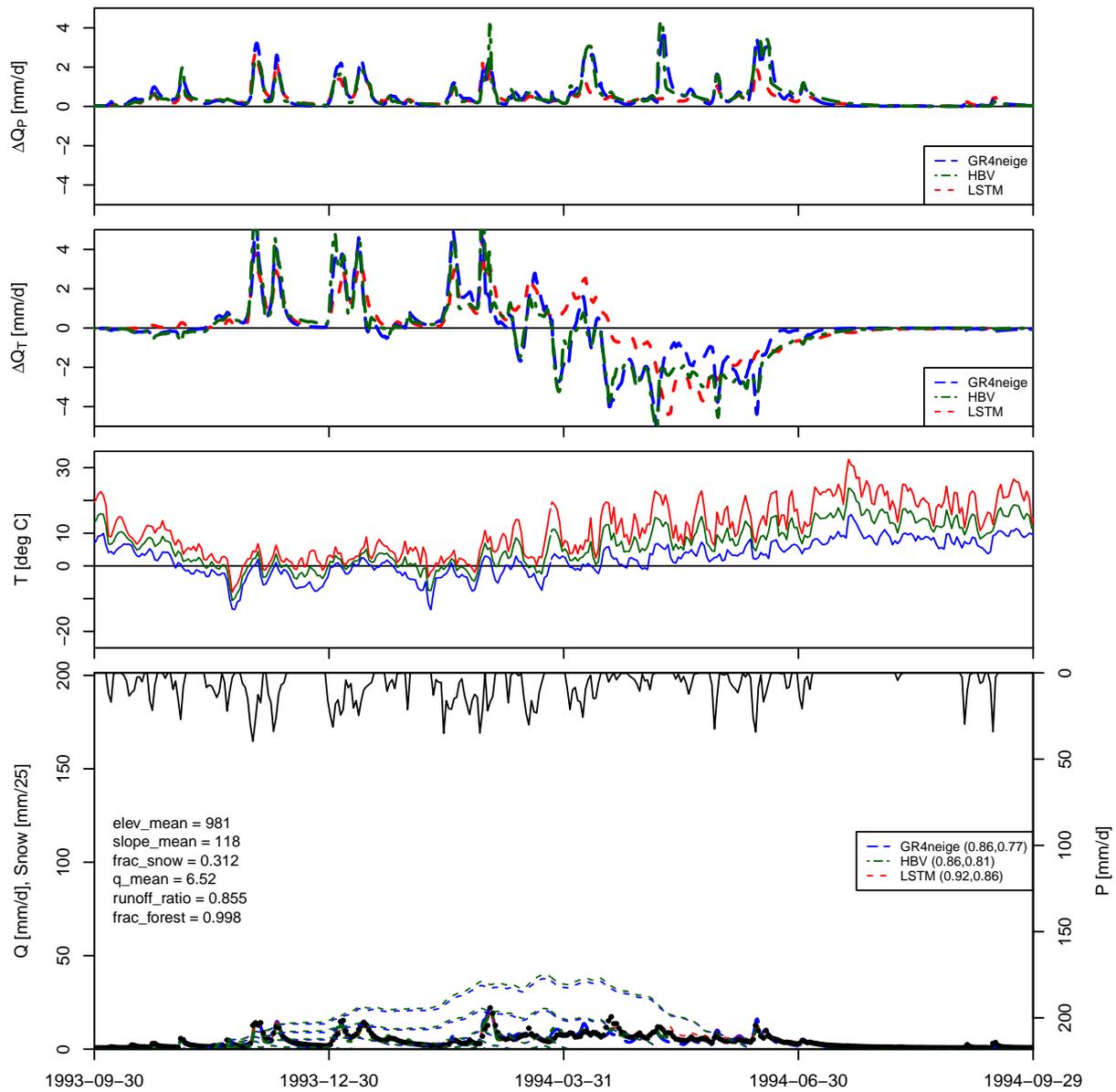
Figure SI.33. Results for basin 12143600, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
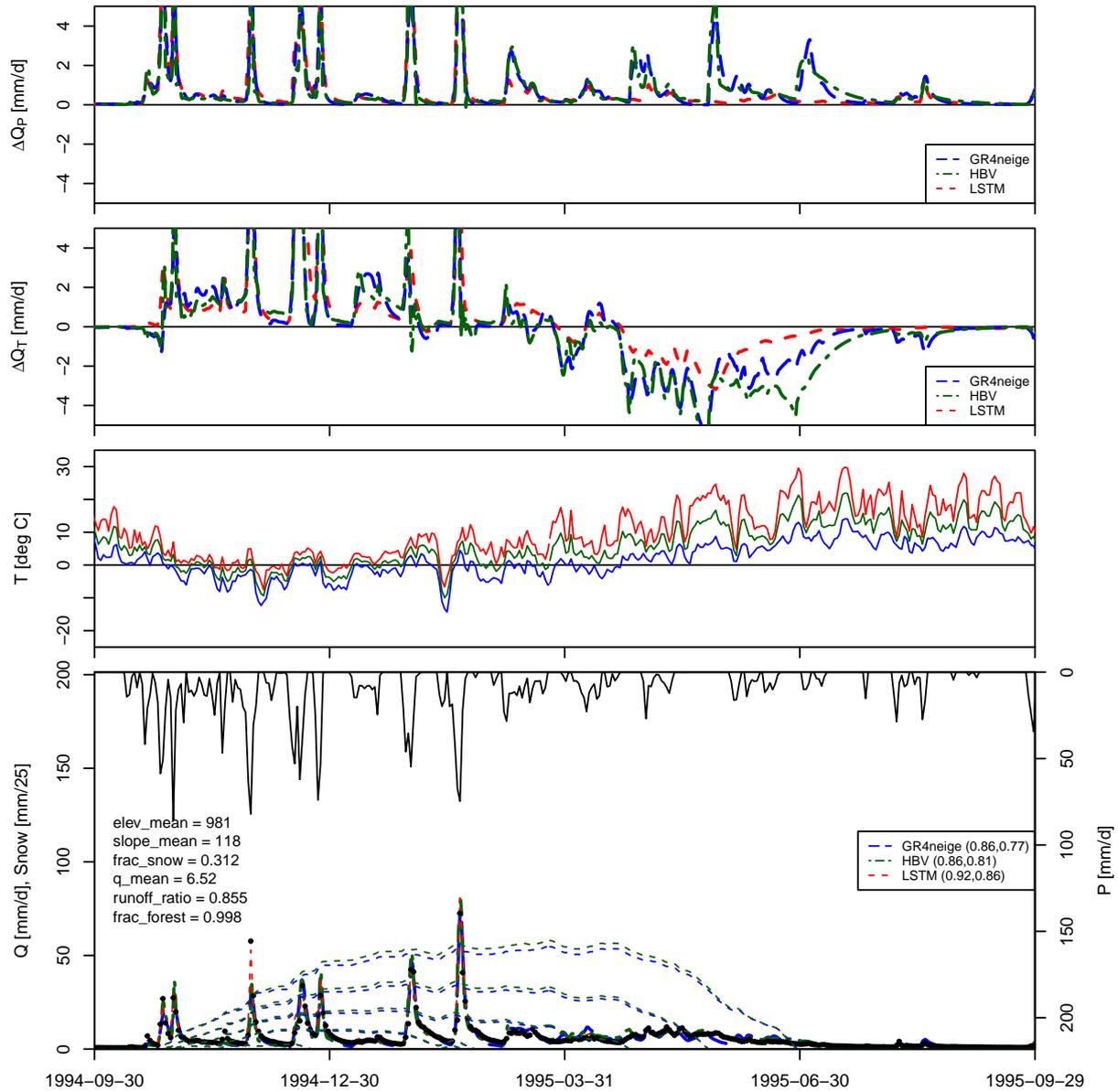
Figure SI.34. Results for basin 12143600, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
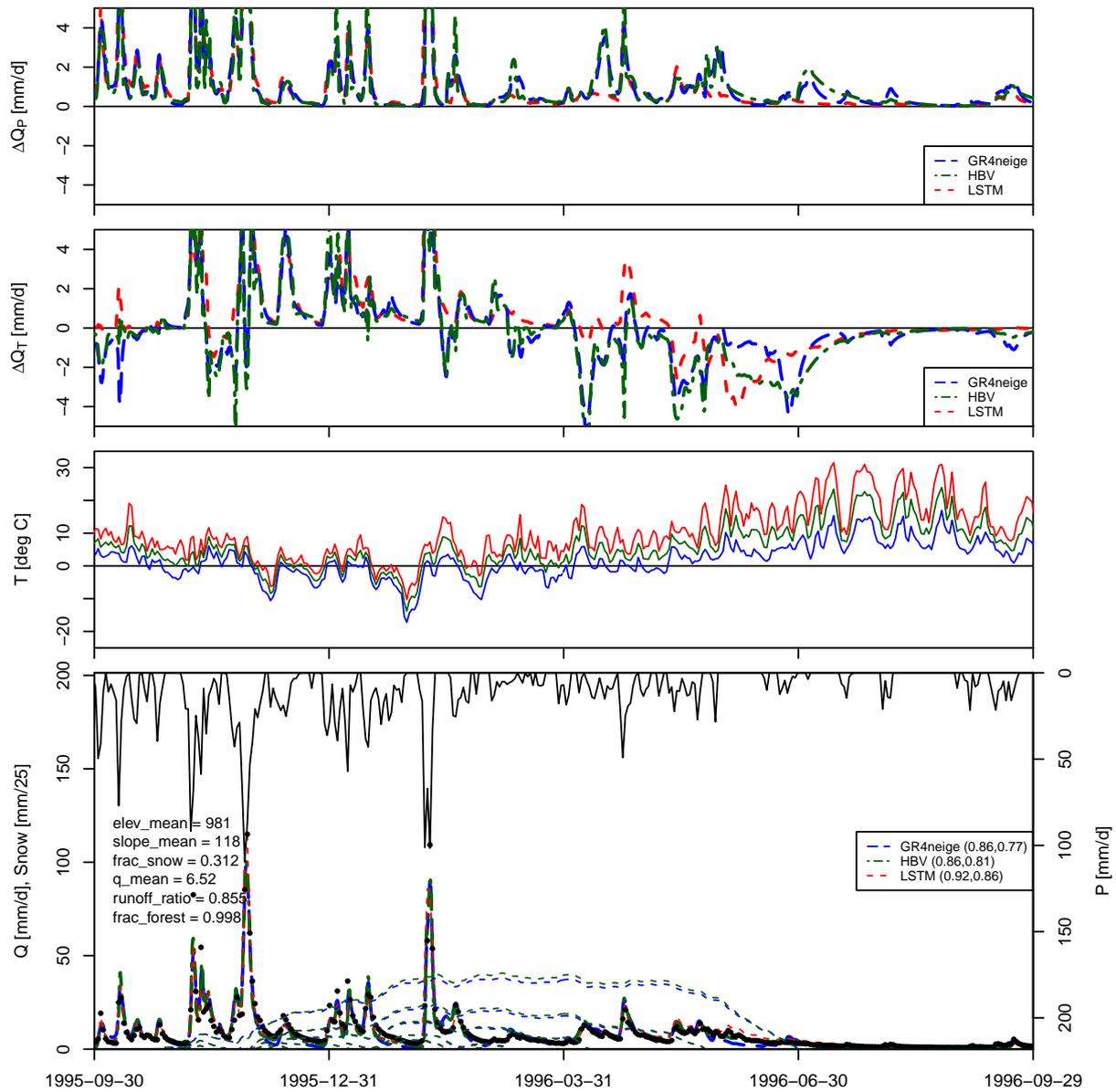
Figure SI.35. Results for basin 12143600, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
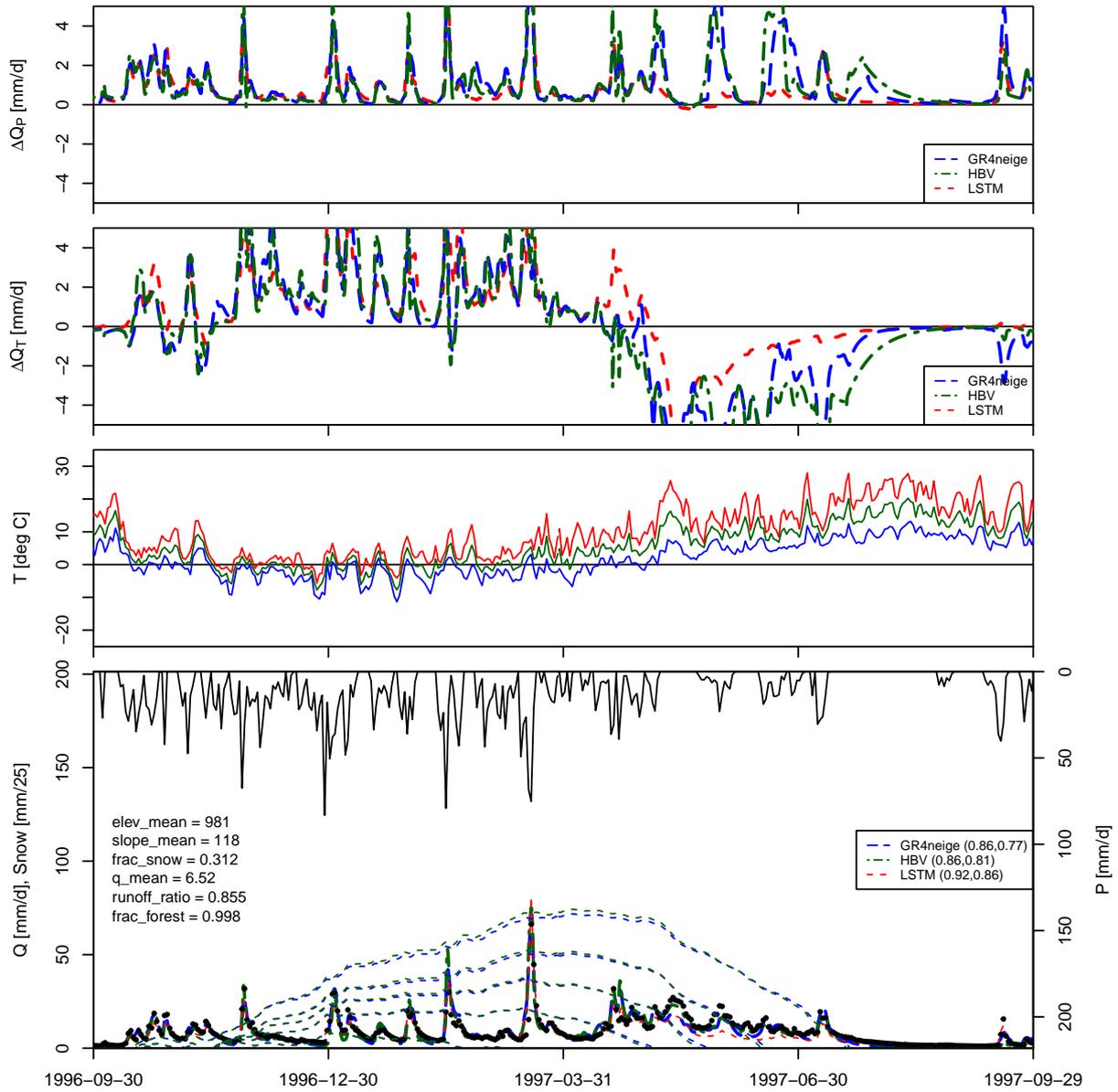
Figure SI.36. Results for basin 12143600, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.
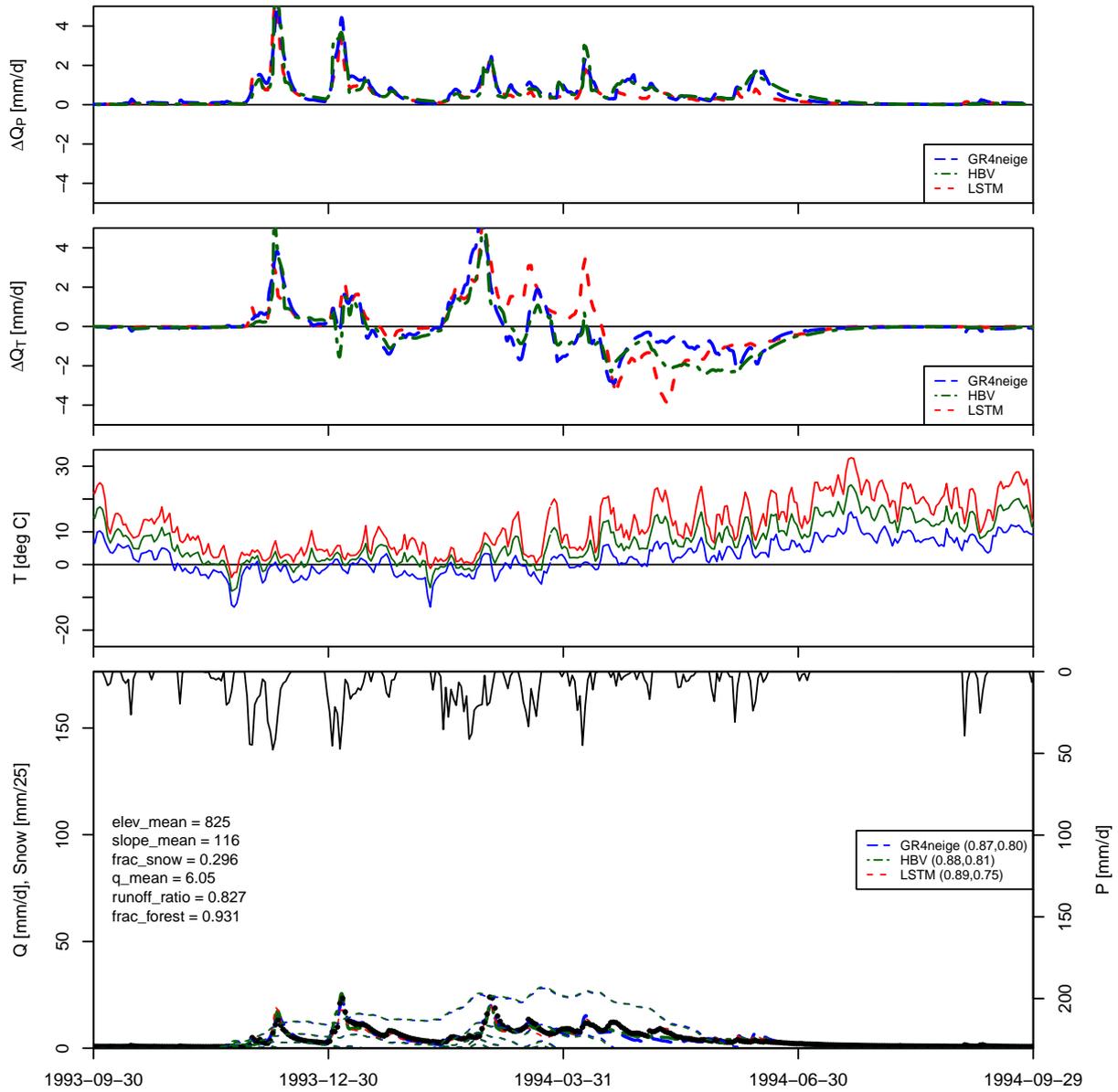
Figure SI.37. Results for basin 14216500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
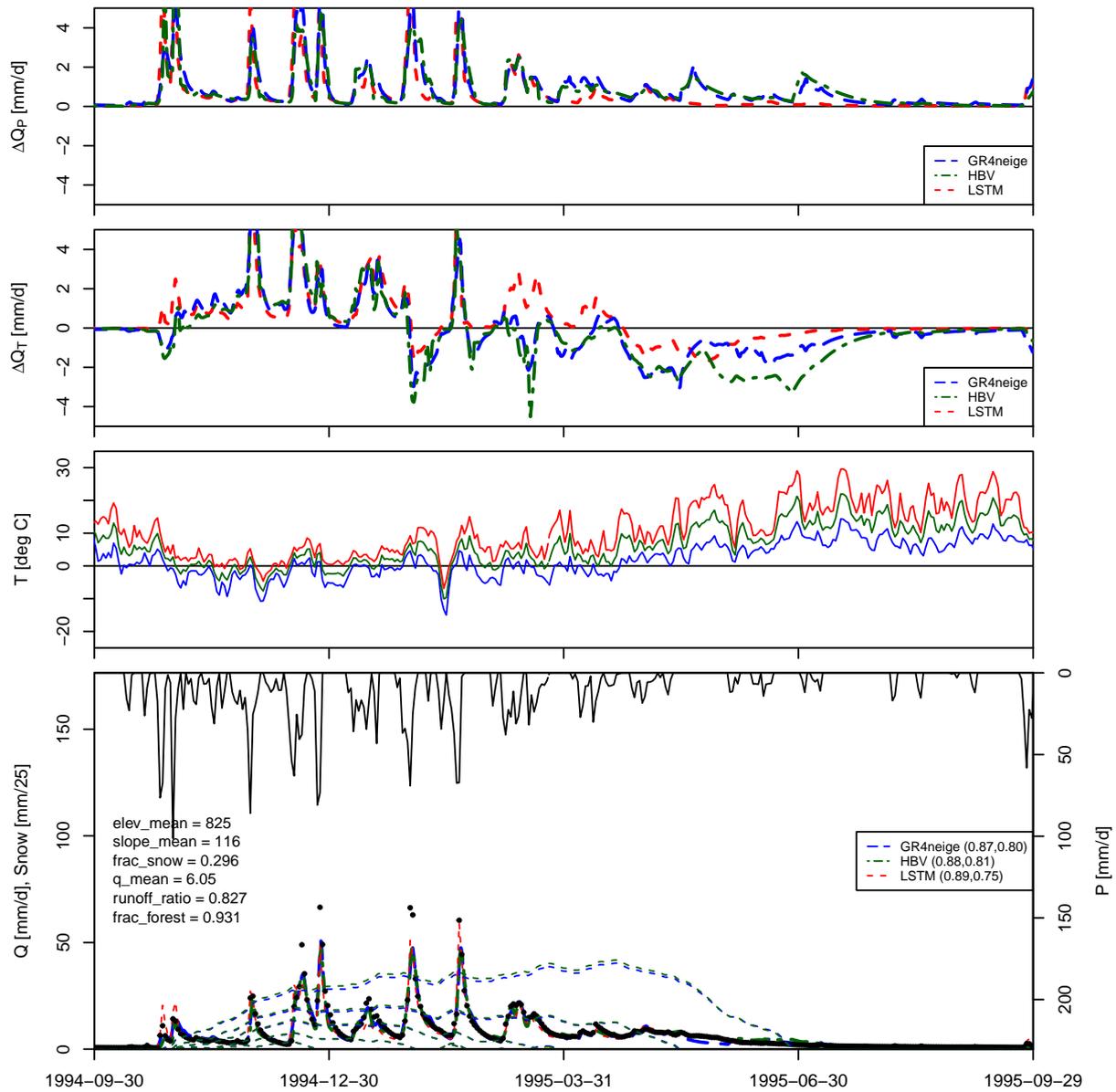
Figure SI.38. Results for basin 14216500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
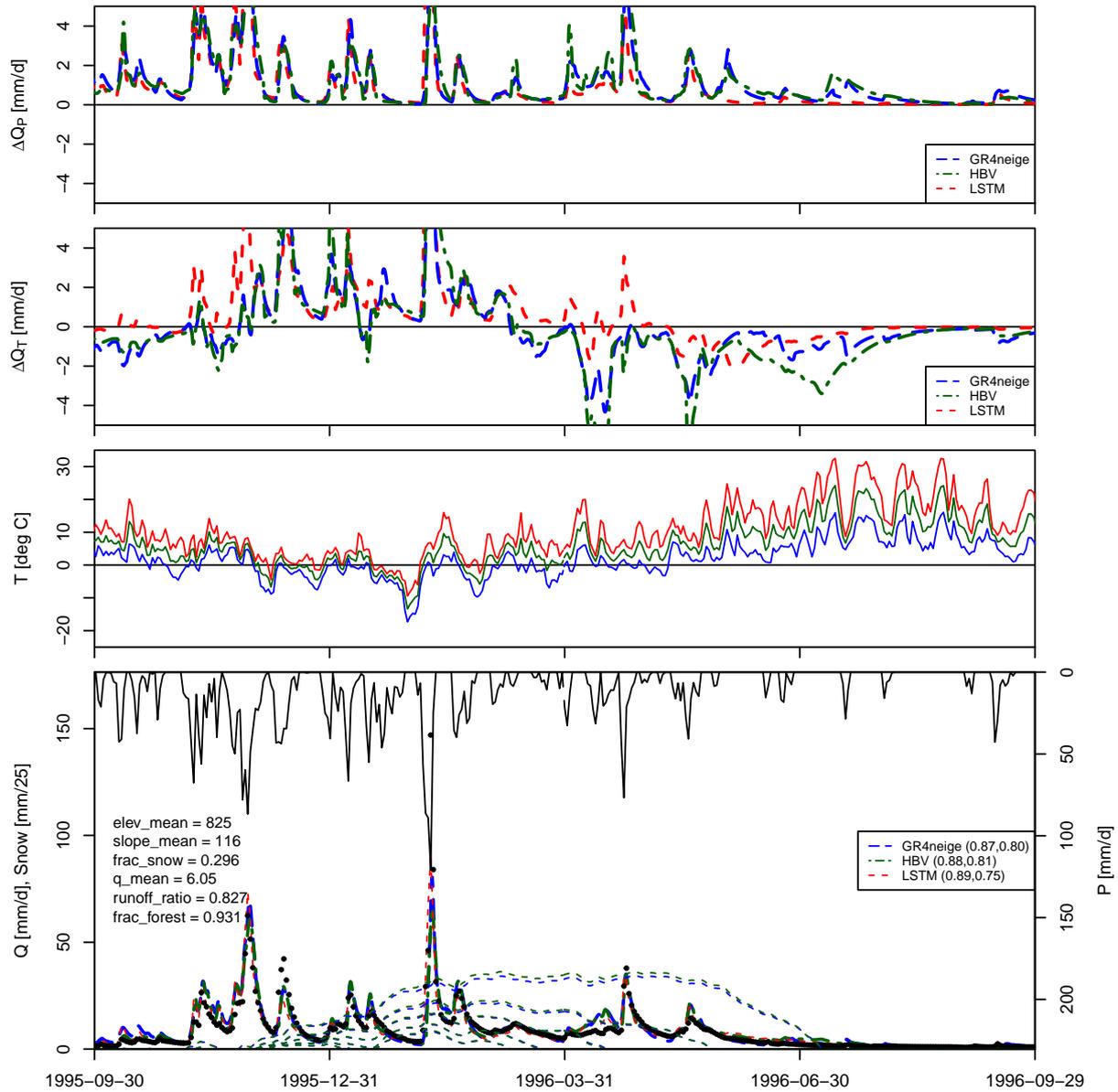
Figure SI.39. Results for basin 14216500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
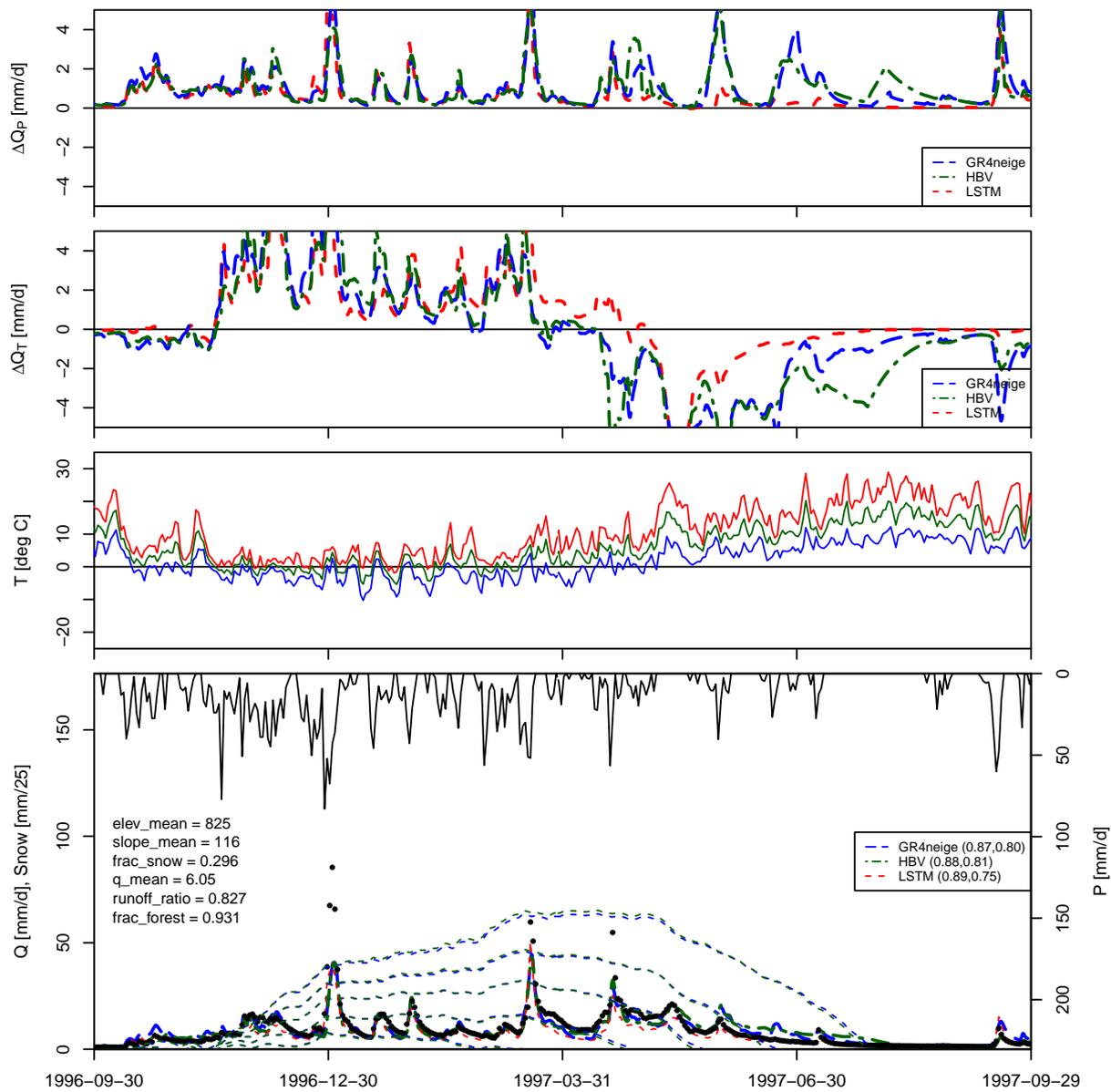
Figure SI.40. Results for basin 14216500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.
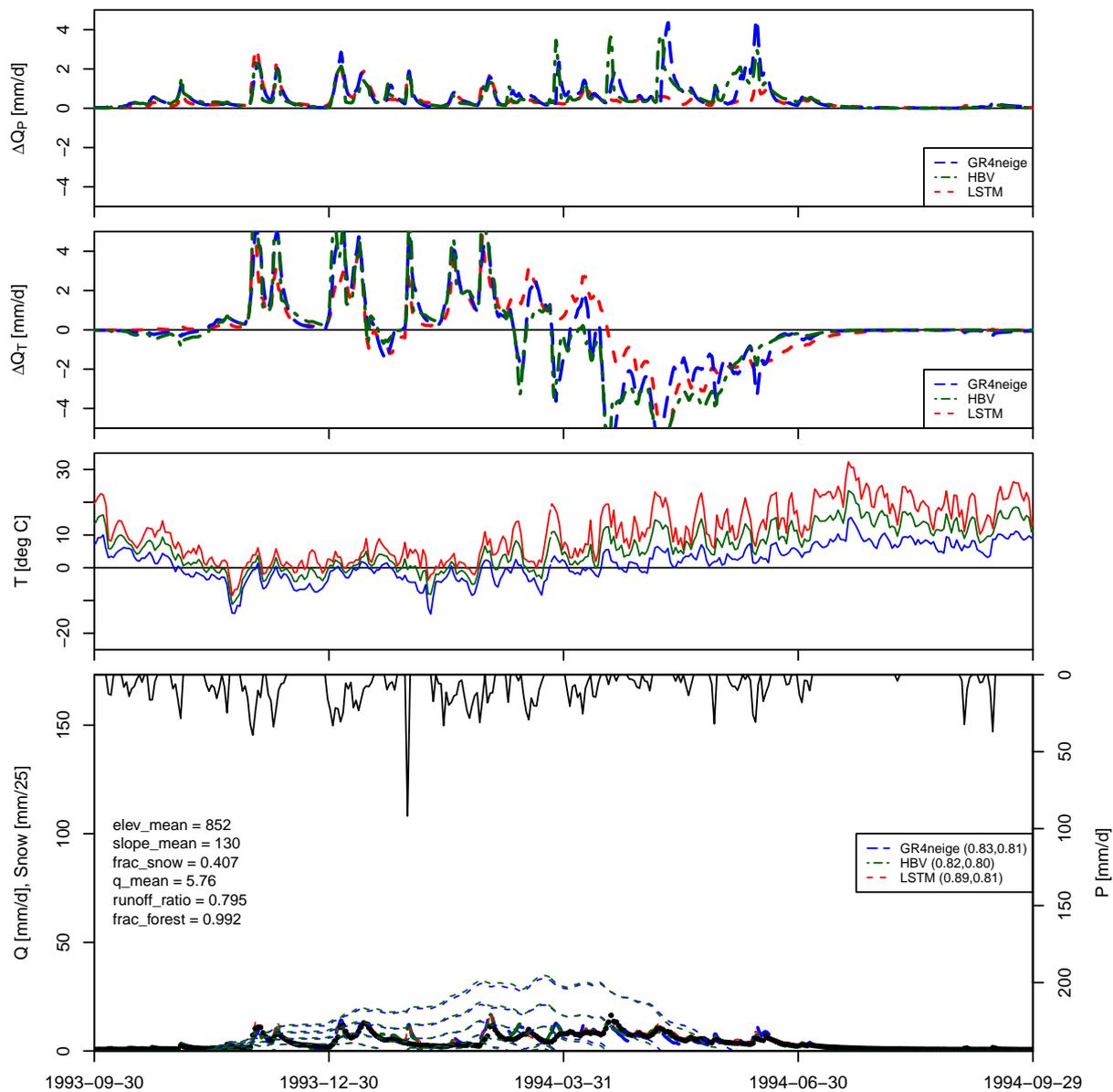
Figure SI.41. Results for basin 12114500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
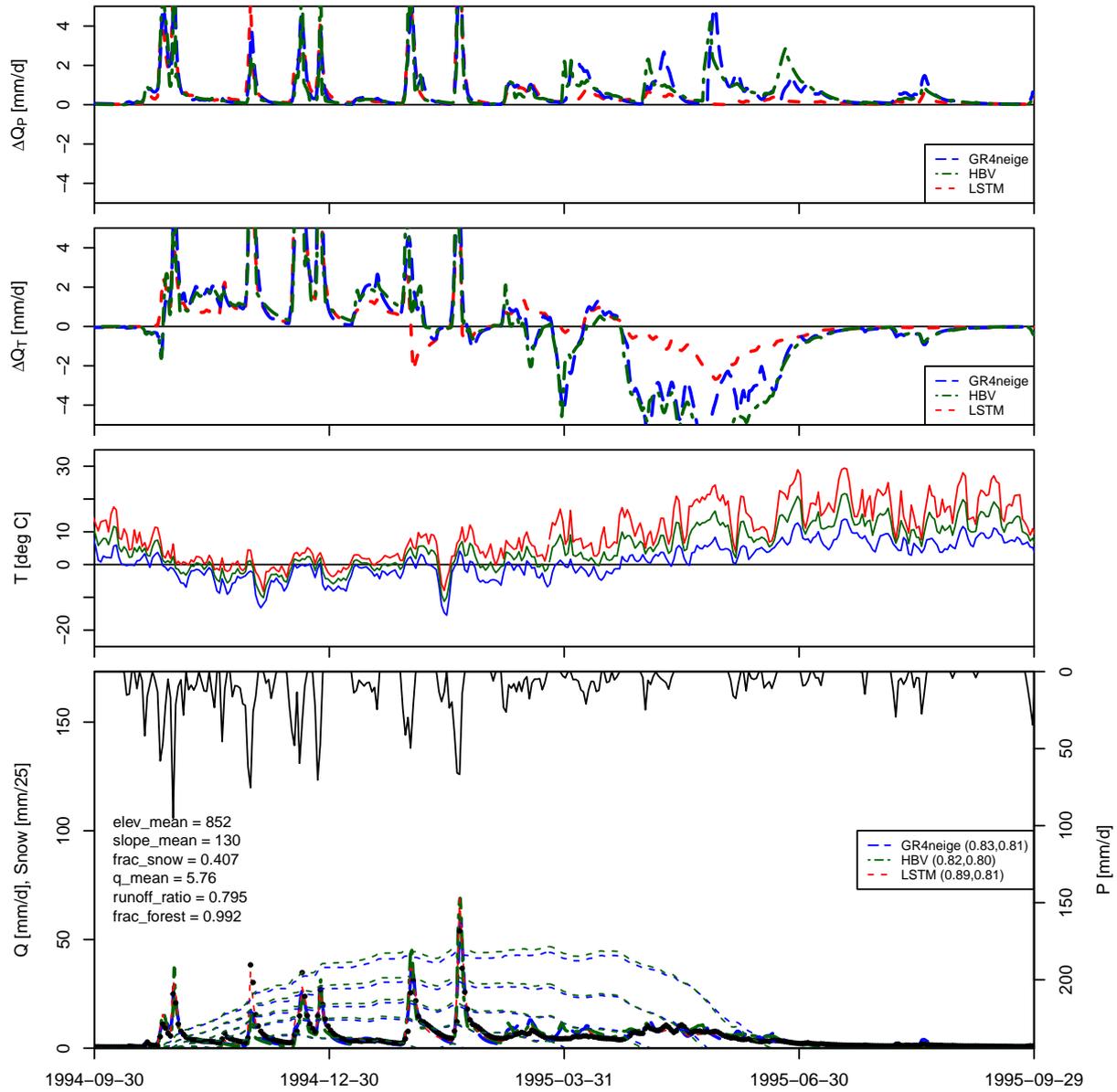
Figure SI.42. Results for basin 12114500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
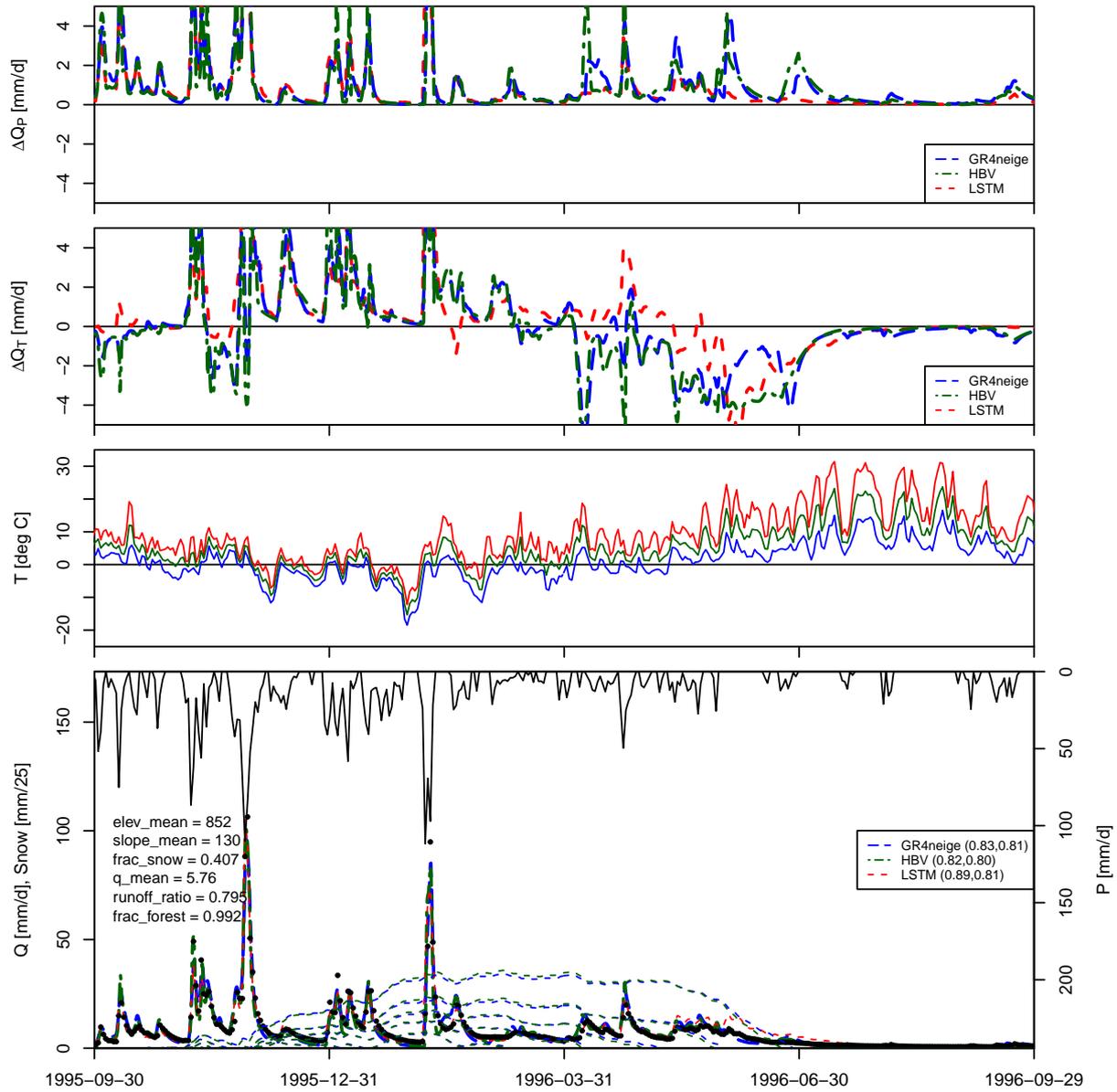
Figure SI.43. Results for basin 12114500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
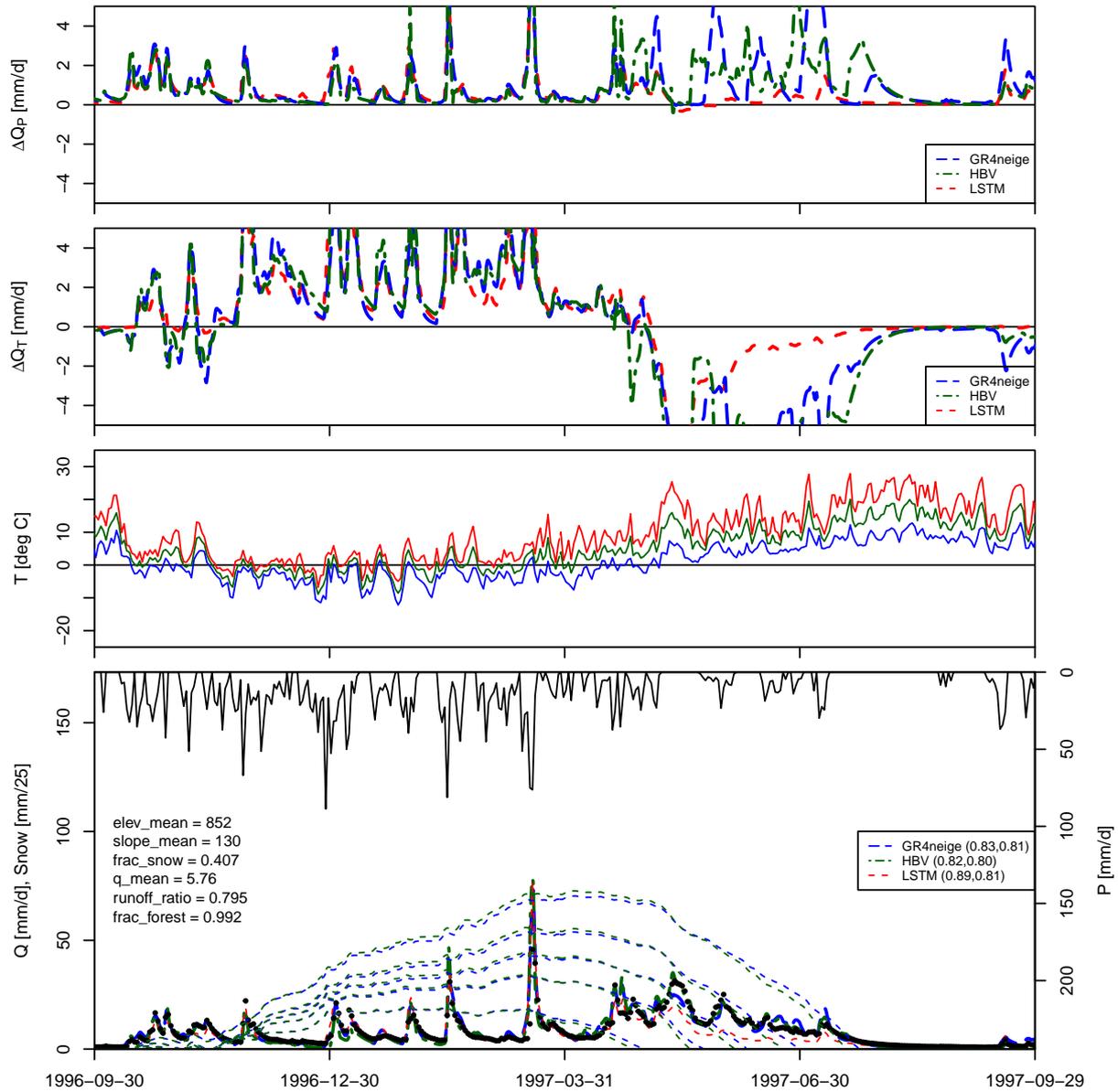
Figure SI.44. Results for basin 12114500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.
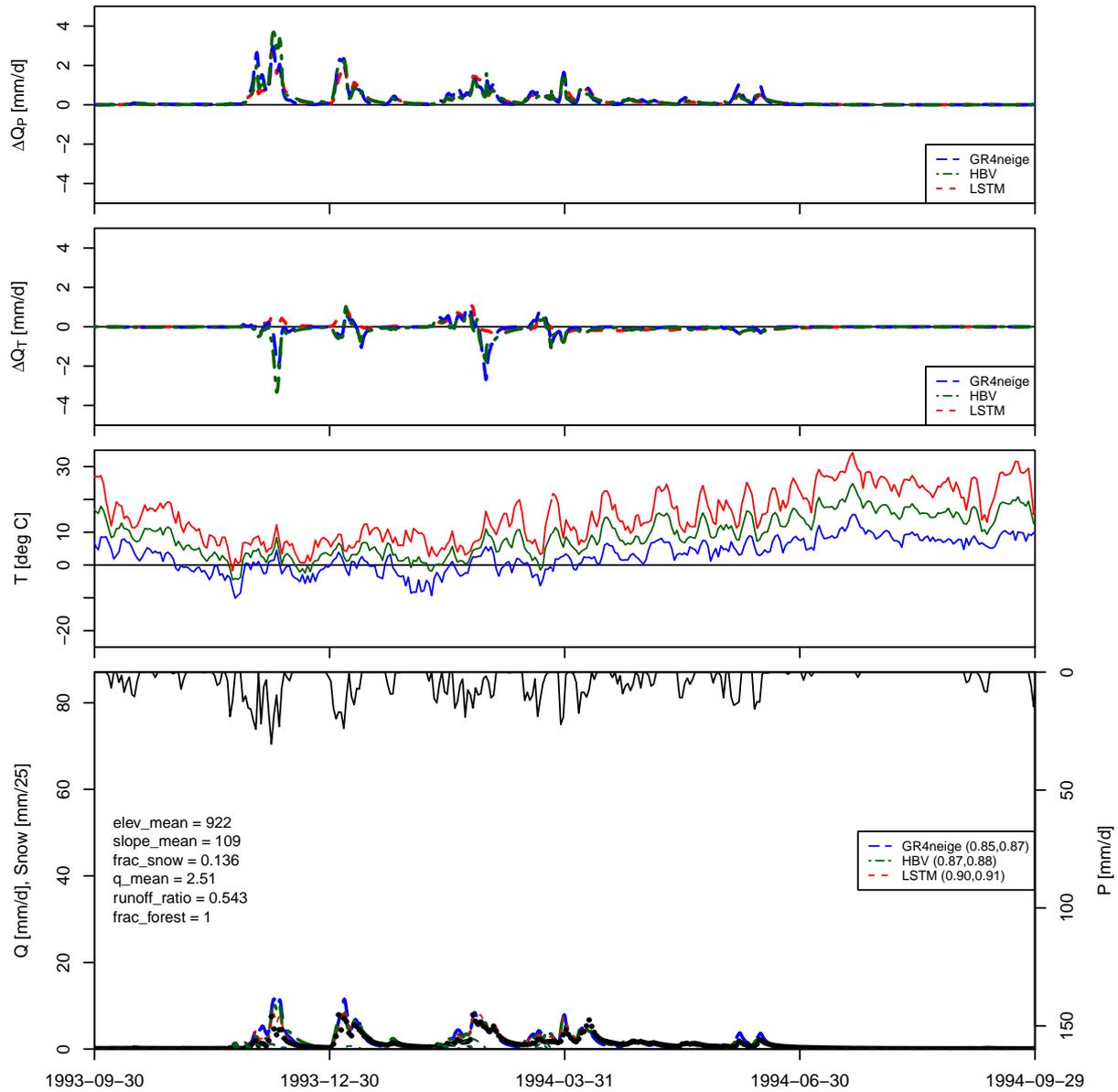
Figure SI.45. Results for basin 14154500, Oct. 1993 - Sept. 1994 (part of calibration). See Fig. 3 for an explanation of the plot panels.
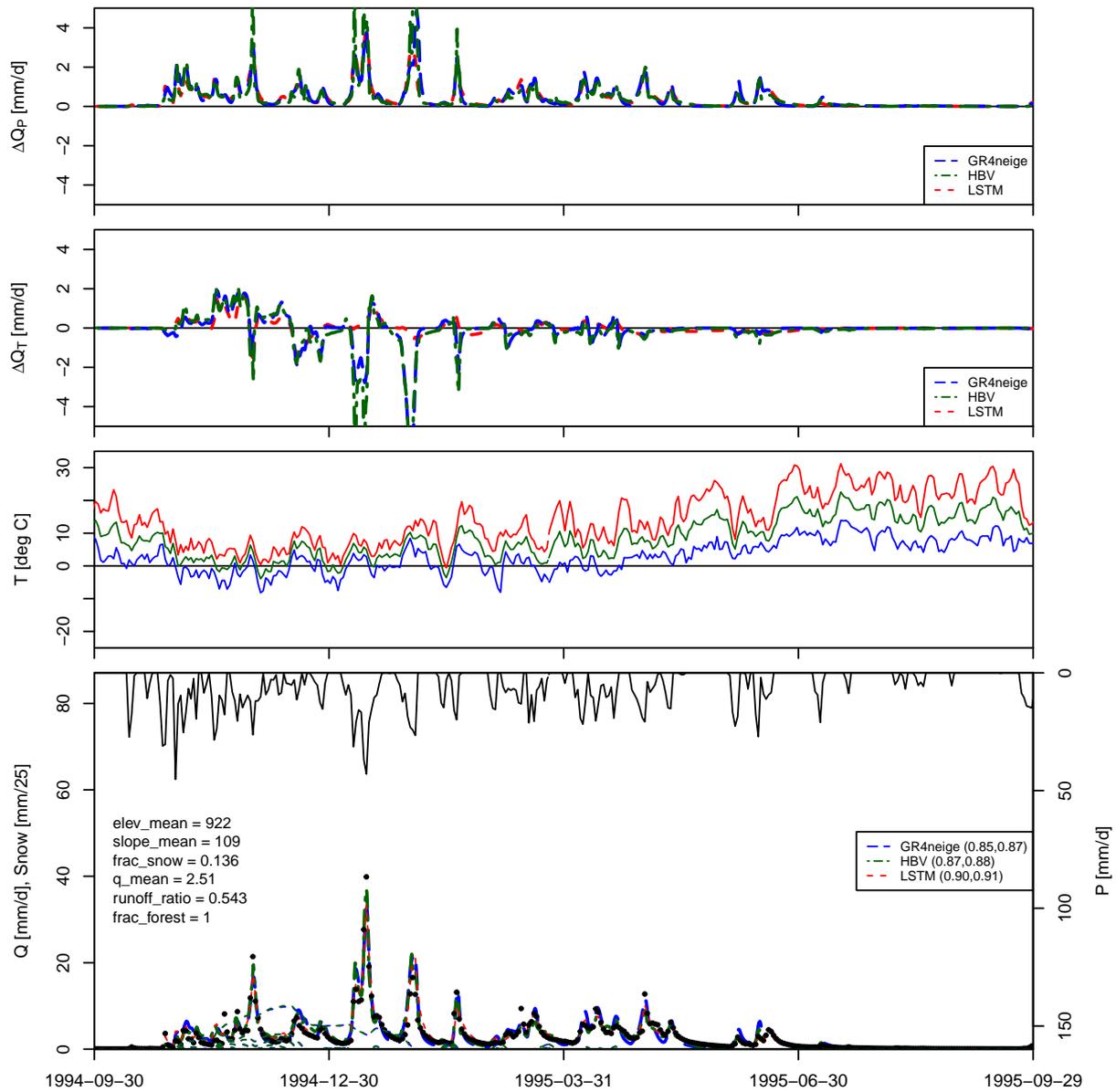
Figure SI.46. Results for basin 14154500, Oct. 1994 - Sept. 1995 (part of calibration). See Fig. 3 for an explanation of the plot panels.
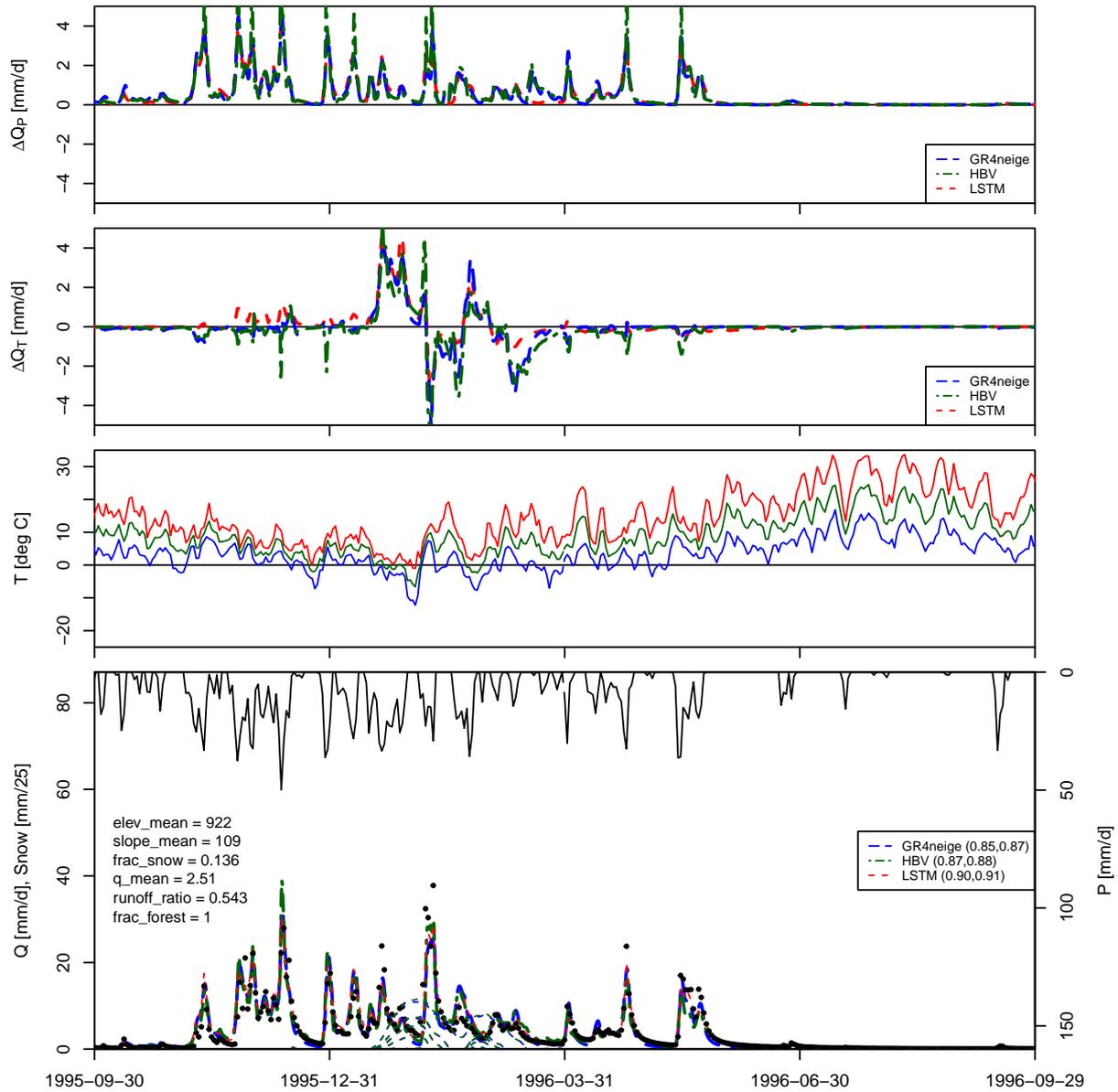
Figure SI.47. Results for basin 14154500, Oct. 1995 - Sept. 1996 (part of validation). See Fig. 3 for an explanation of the plot panels.
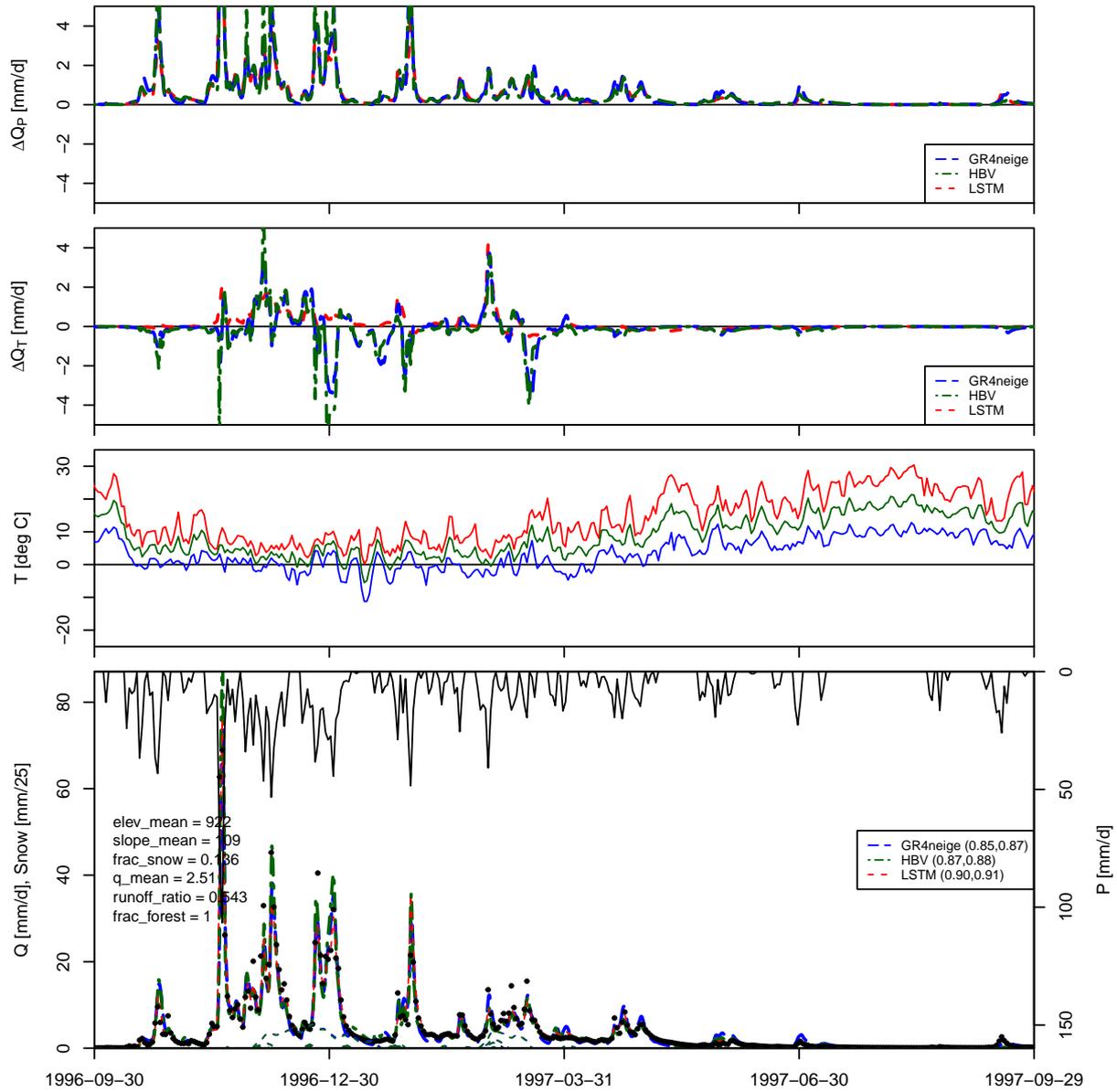
Figure SI.48. Results for basin 14154500, Oct. 1996 - Sept. 1997 (part of validation). See Fig. 3 for an explanation of the plot panels.

 Sensitivity Analysis for Low Altitude Warm Basins

This section provides examples of the modelled sensitivities of low altitude, warm basins in addition to the one discussed in section 3.3. See section 3.3 for explanations.

805 The Figures SI.49 to SI.52 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.

The Figures SI.53 to SI.56 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.

810 The Figures SI.57 to SI.60 show results within the last two years of the calibration period and within the first two years of the validation period for the basin 02363000.

The Figures SI.61 to SI.64 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.

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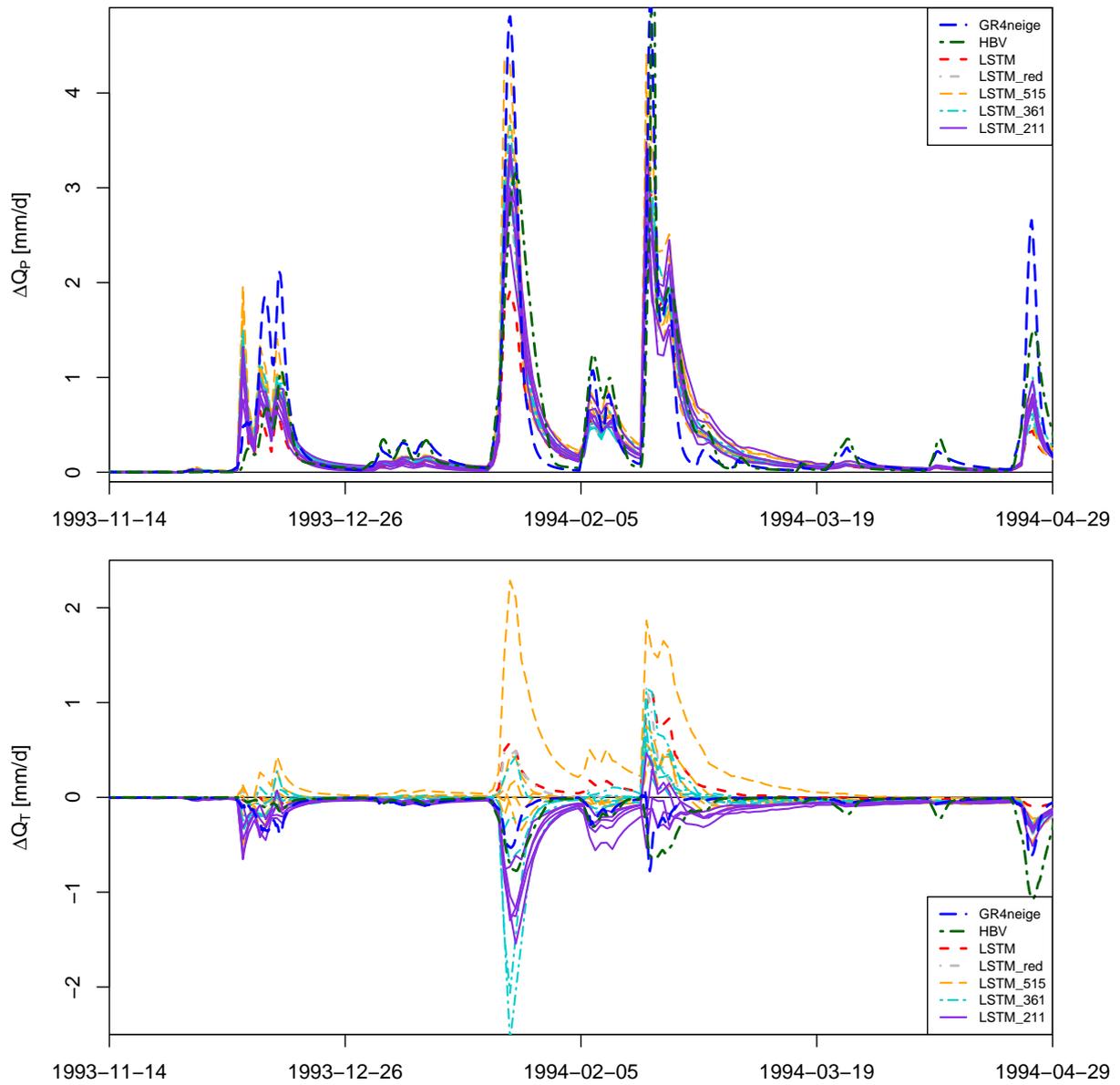
Figure SI.49. Sensitivities for basin 14154500, Nov. 1993 - April 1994 (part of validation). See Fig. 6 for an explanation of the plot panels.
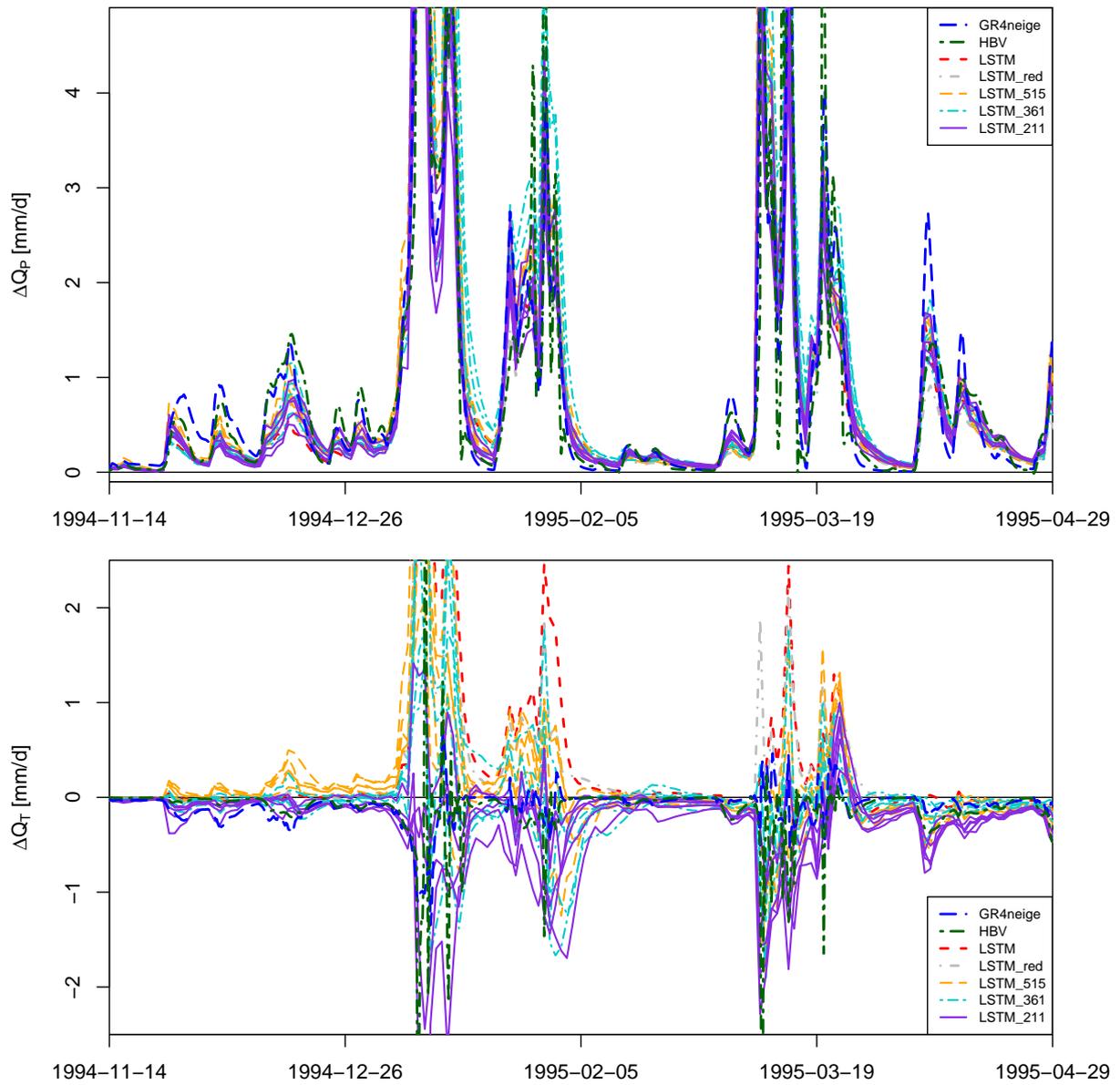
Figure SI.50. Sensitivities for basin 14154500, Nov. 1994 - April 1995 (part of validation). See Fig. 6 for an explanation of the plot panels.
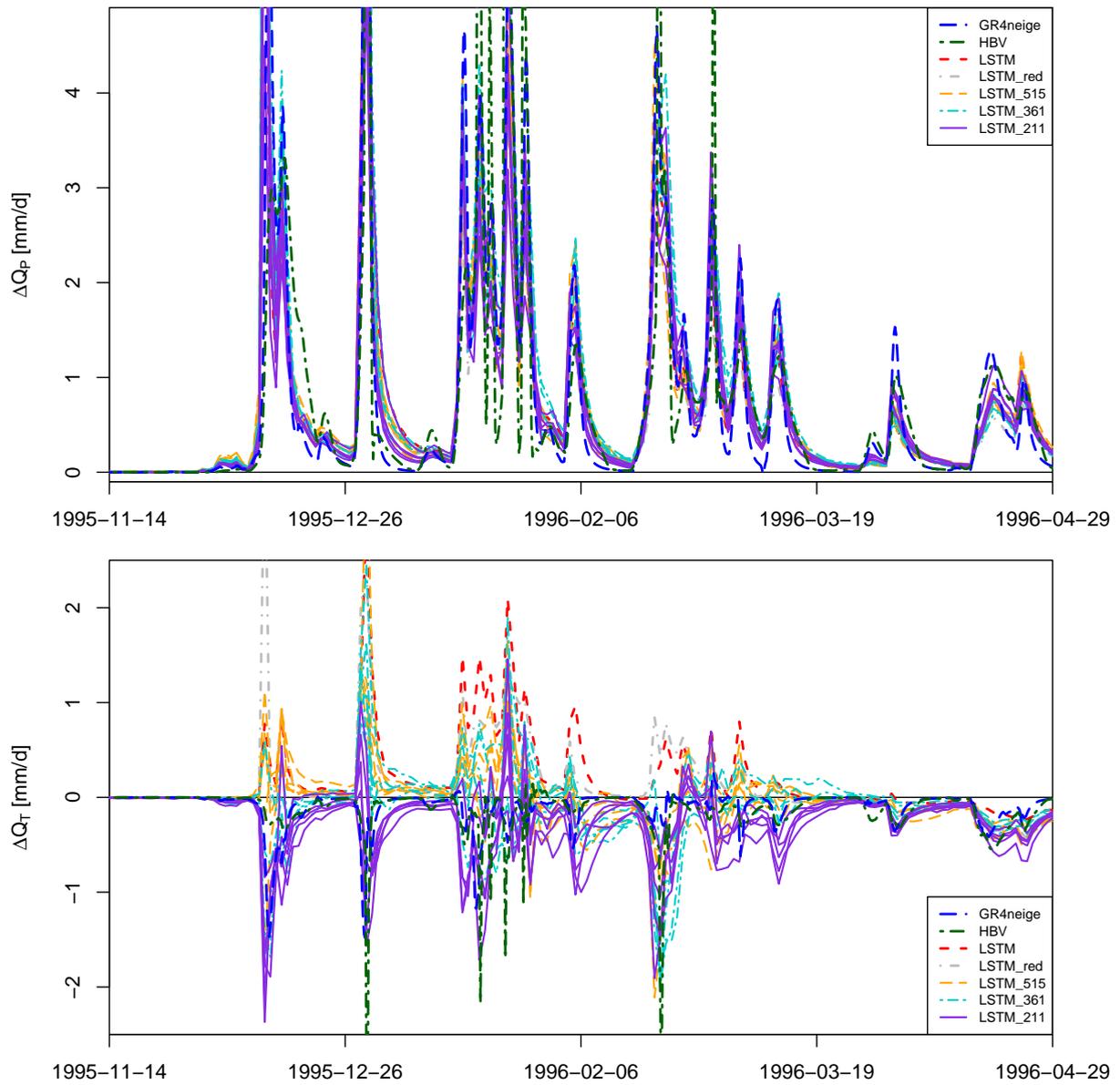
Figure SI.51. Sensitivities for basin 14154500, Nov. 1995 - April 1996 (part of validation). See Fig. 6 for an explanation of the plot panels.
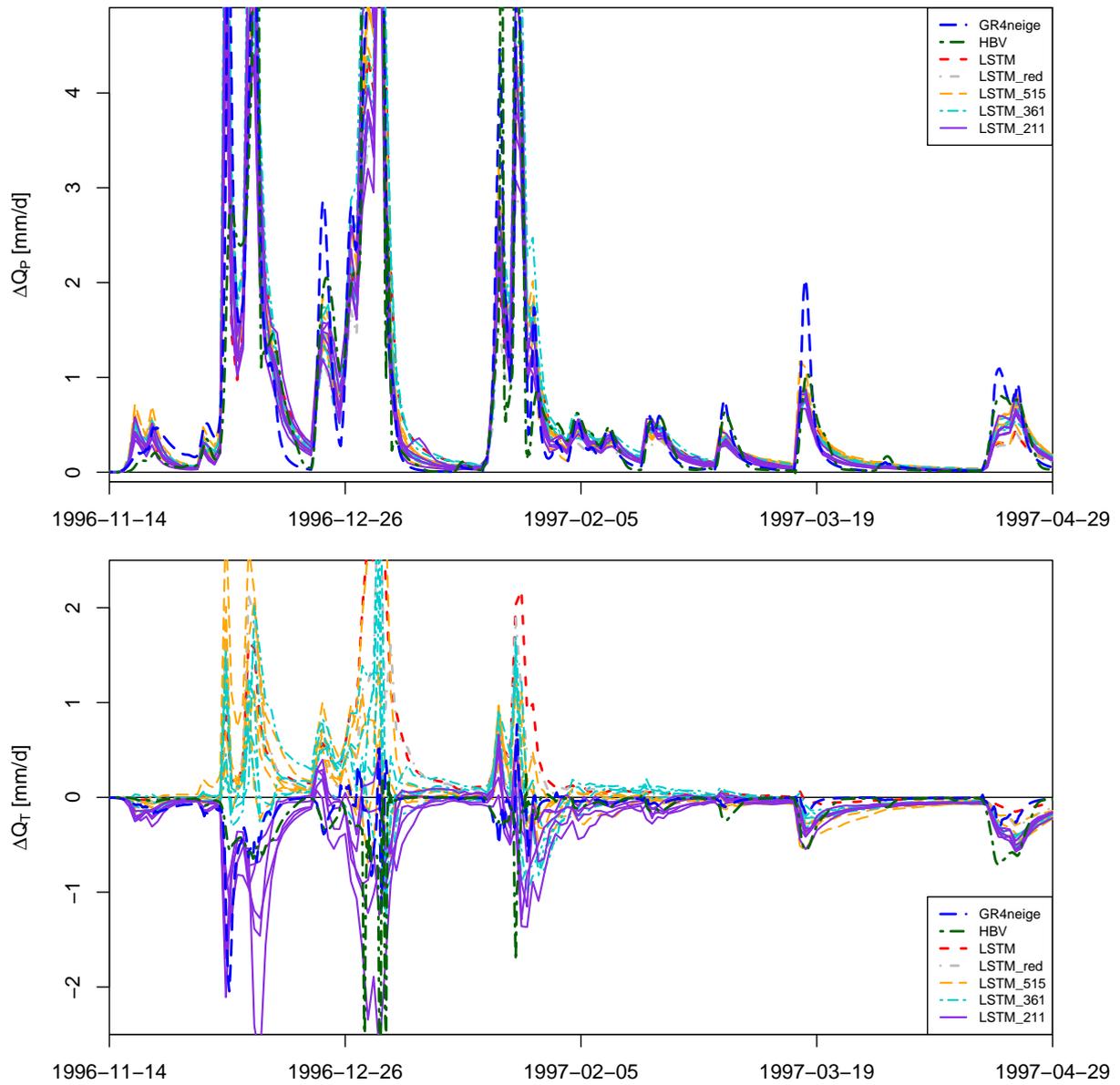
Figure SI.52. Sensitivities for basin 14154500, Nov. 1996 - April 1997 (part of validation). See Fig. 6 for an explanation of the plot panels.
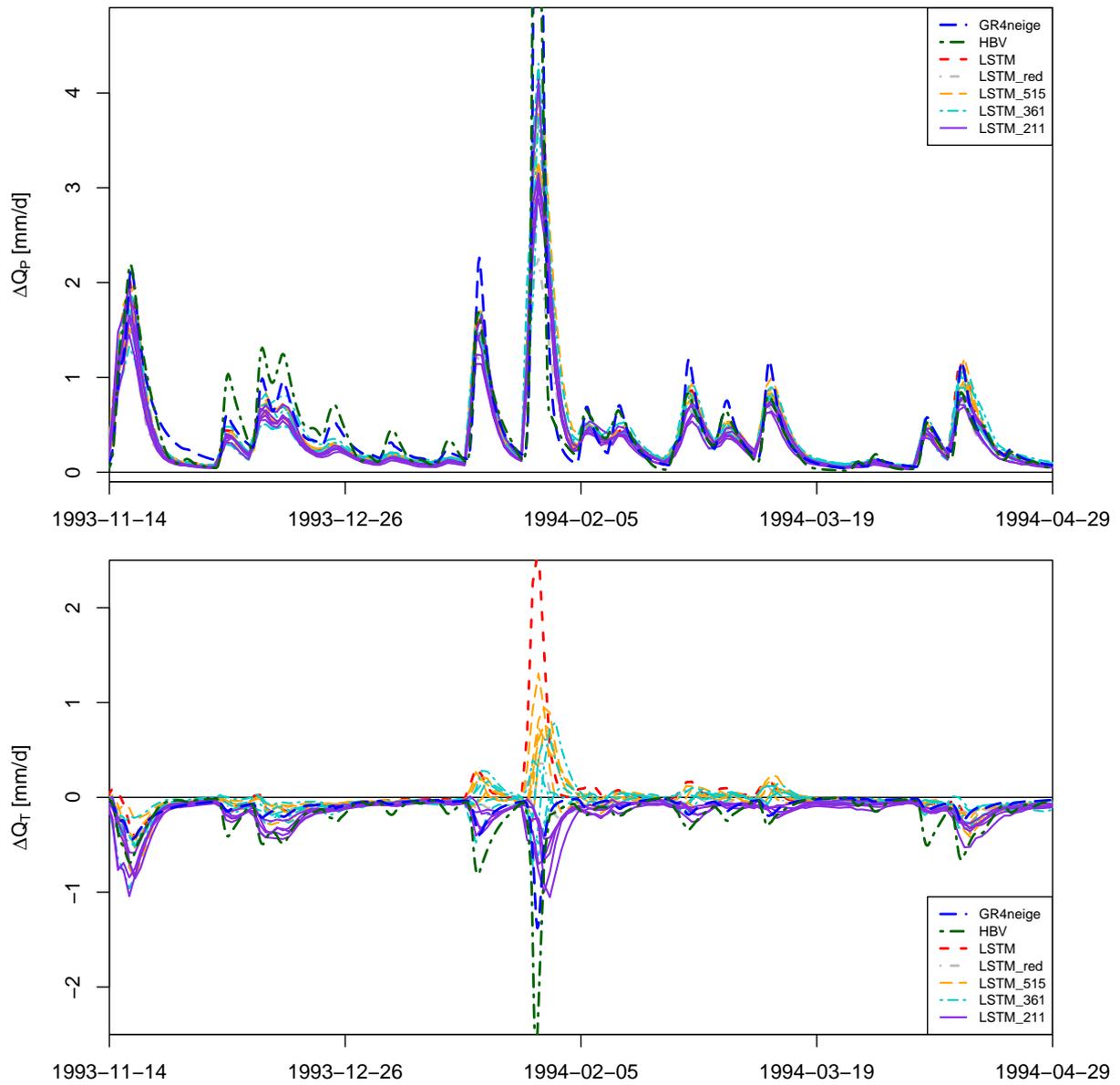
Figure SI.53. Sensitivities for basin 08014500, Nov. 1993 - April 1994 (part of validation). See Fig. 6 for an explanation of the plot panels.
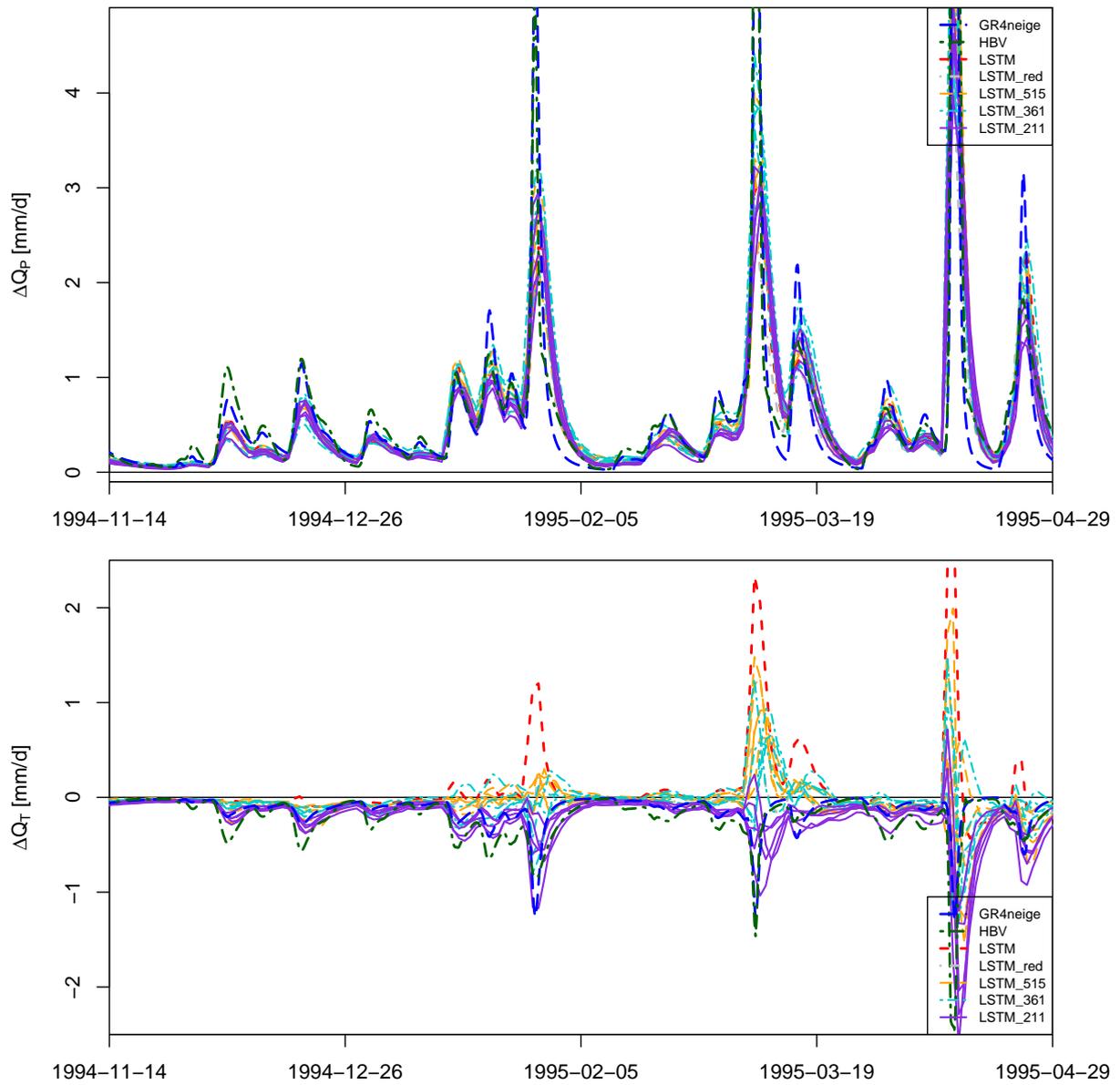
Figure SI.54. Sensitivities for basin 08014500, Nov. 1994 - April 1995 (part of validation). See Fig. 6 for an explanation of the plot panels.
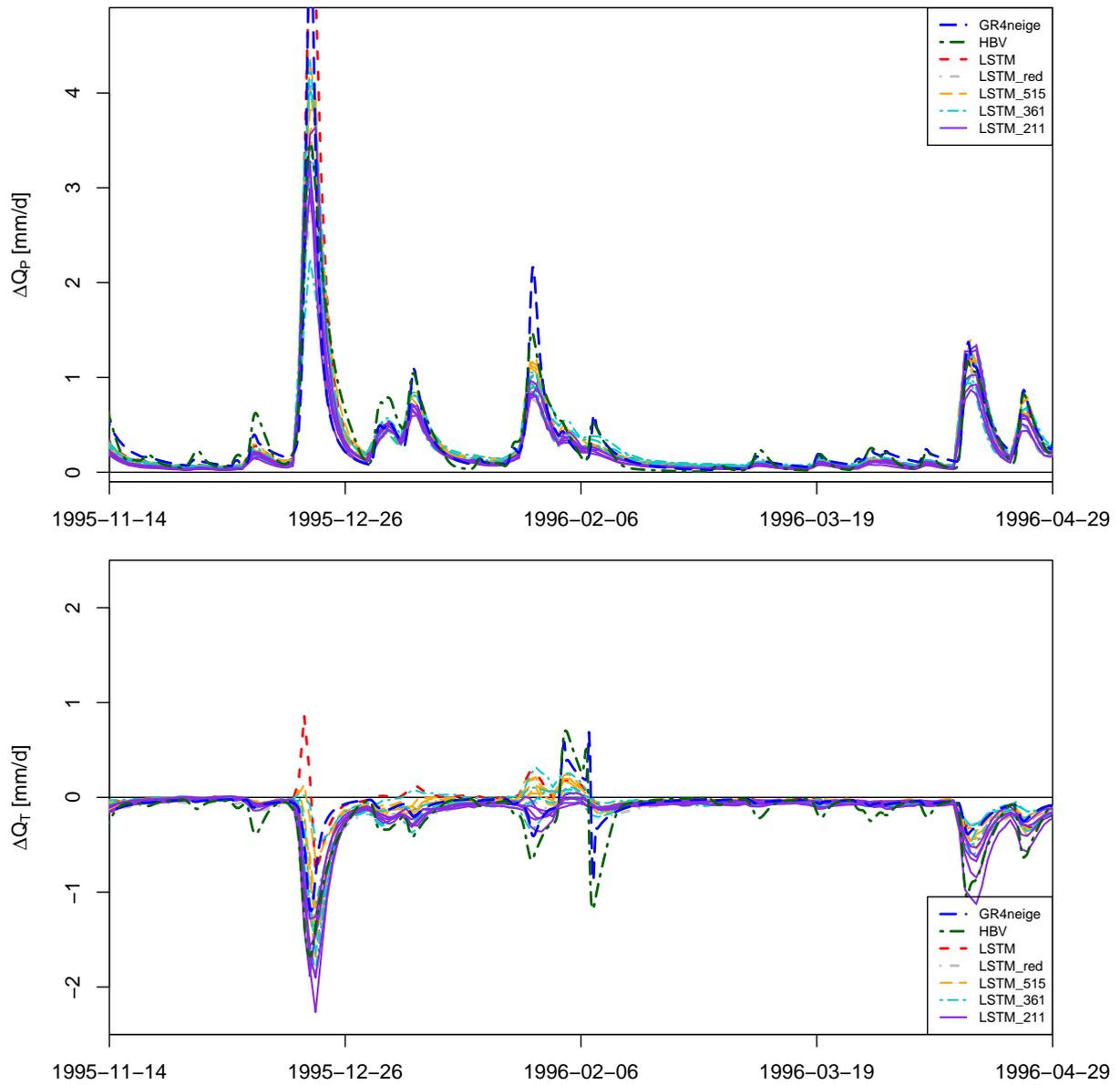
Figure SI.55. Sensitivities for basin 08014500, Nov. 1995 - April 1996 (part of validation). See Fig. 6 for an explanation of the plot panels.
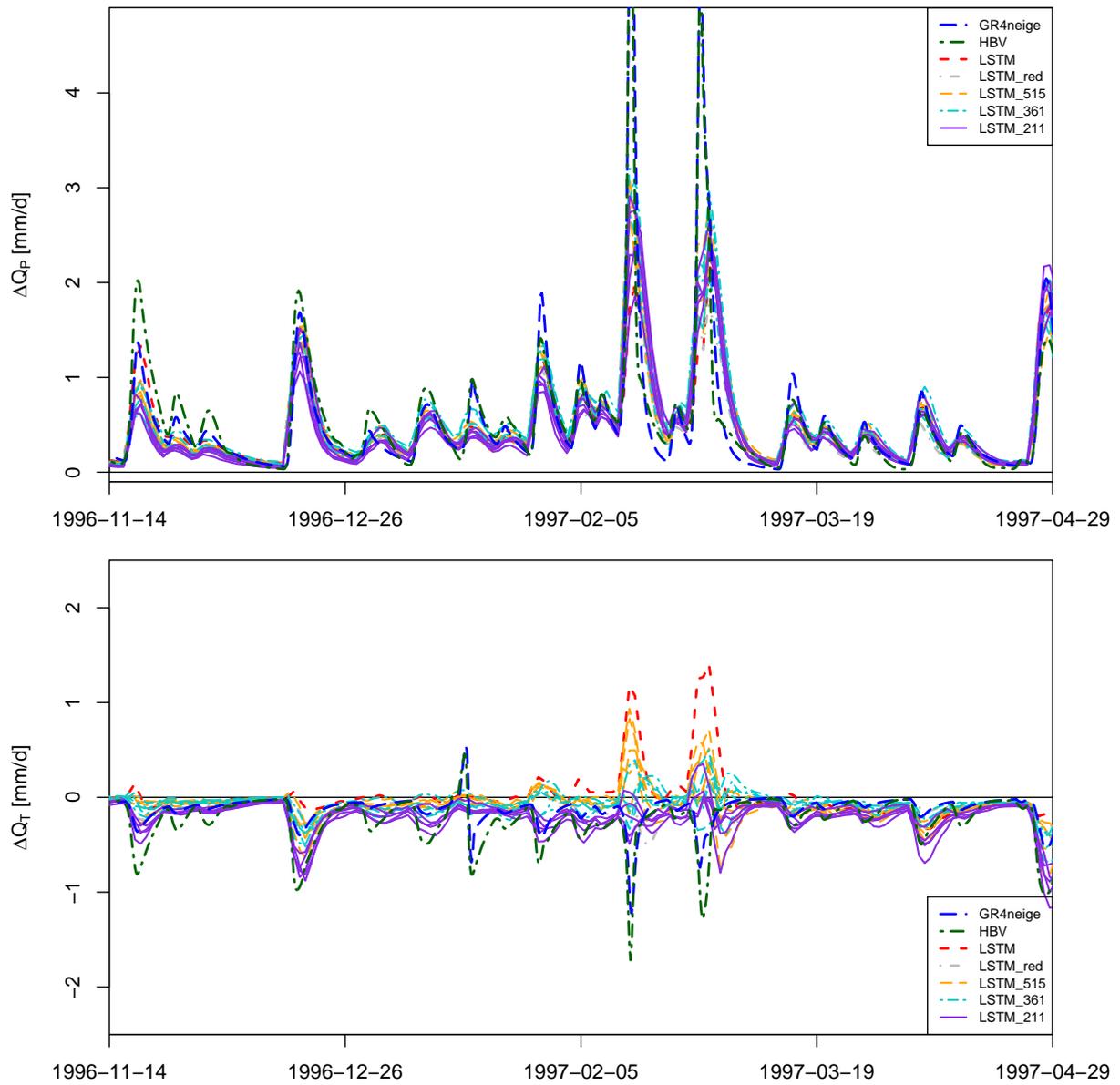
Figure SI.56. Sensitivities for basin 08014500, Nov. 1996 - April 1997 (part of validation). See Fig. 6 for an explanation of the plot panels.
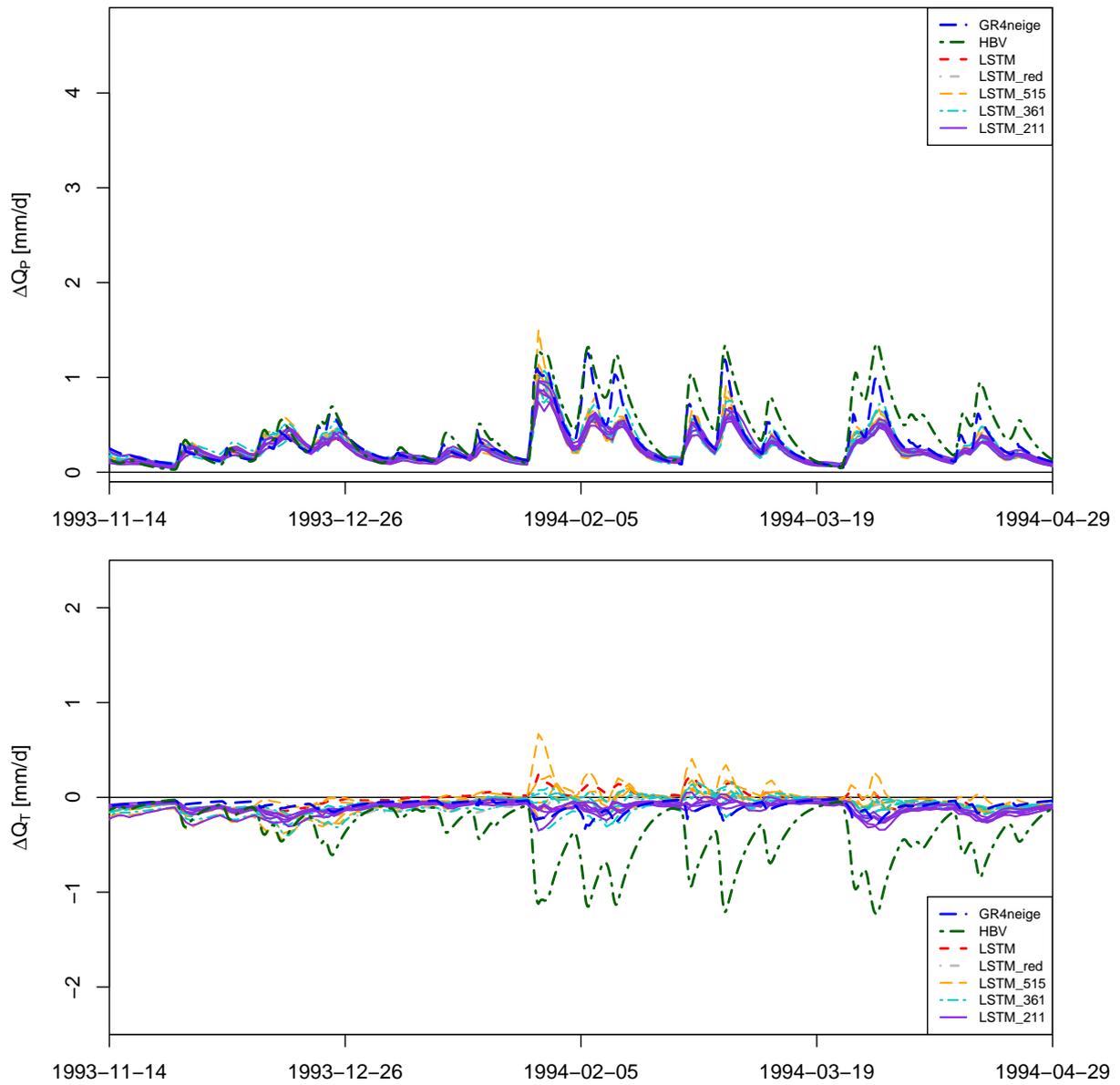
Figure SI.57. Sensitivities for basin 02363000, Nov. 1993 - April 1994 (part of validation). See Fig. 6 for an explanation of the plot panels.
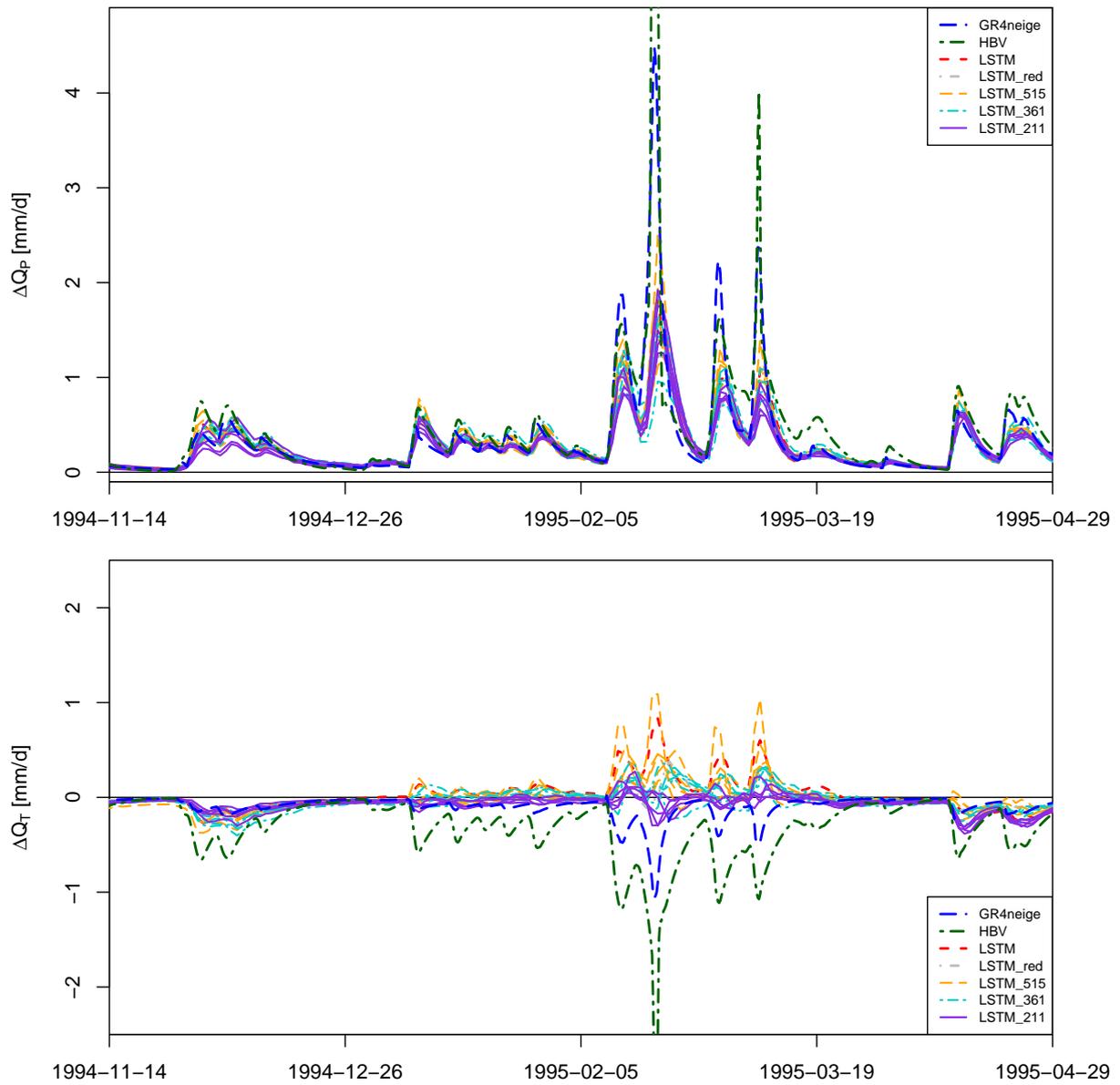
Figure SI.58. Sensitivities for basin 02363000, Nov. 1994 - April 1995 (part of validation). See Fig. 6 for an explanation of the plot panels.
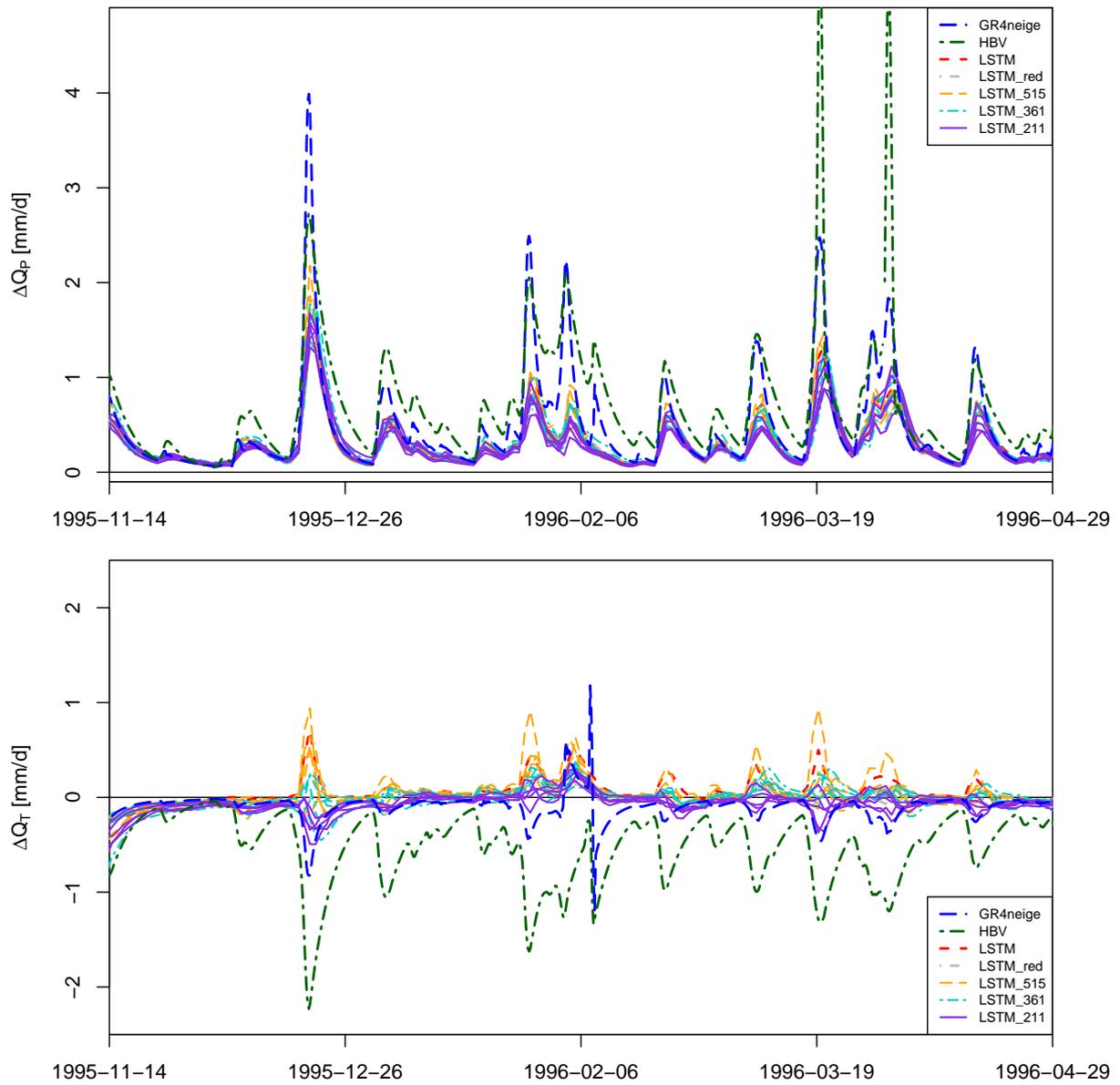
Figure SI.59. Sensitivities for basin 02363000, Nov. 1995 - April 1996 (part of validation). See Fig. 6 for an explanation of the plot panels.
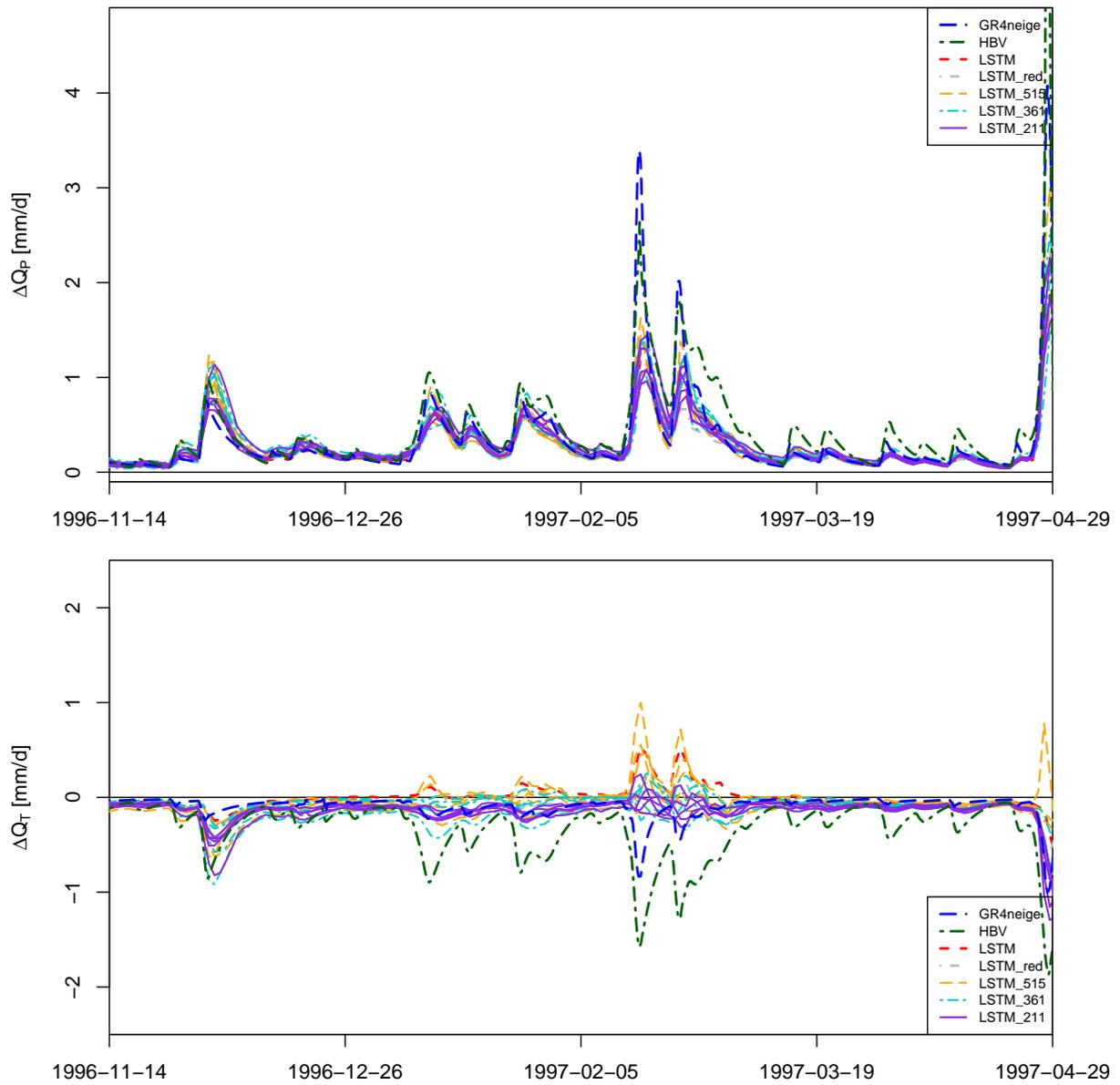
Figure SI.60. Sensitivities for basin 02363000, Nov. 1996 - April 1997 (part of validation). See Fig. 6 for an explanation of the plot panels.
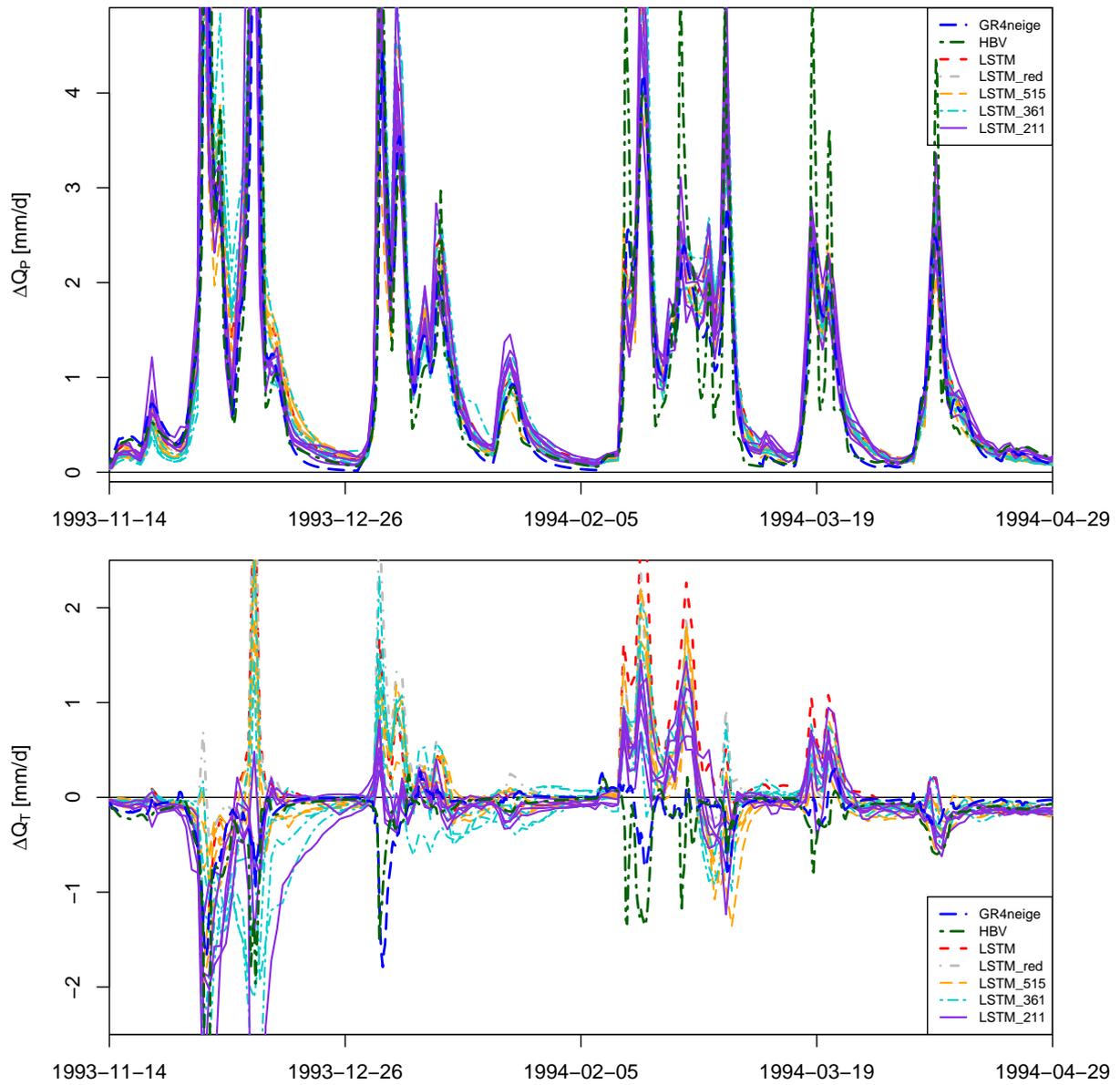
Figure SI.61. Sensitivities for basin 12013500, Nov. 1993 - April 1994 (part of validation). See Fig. 6 for an explanation of the plot panels.
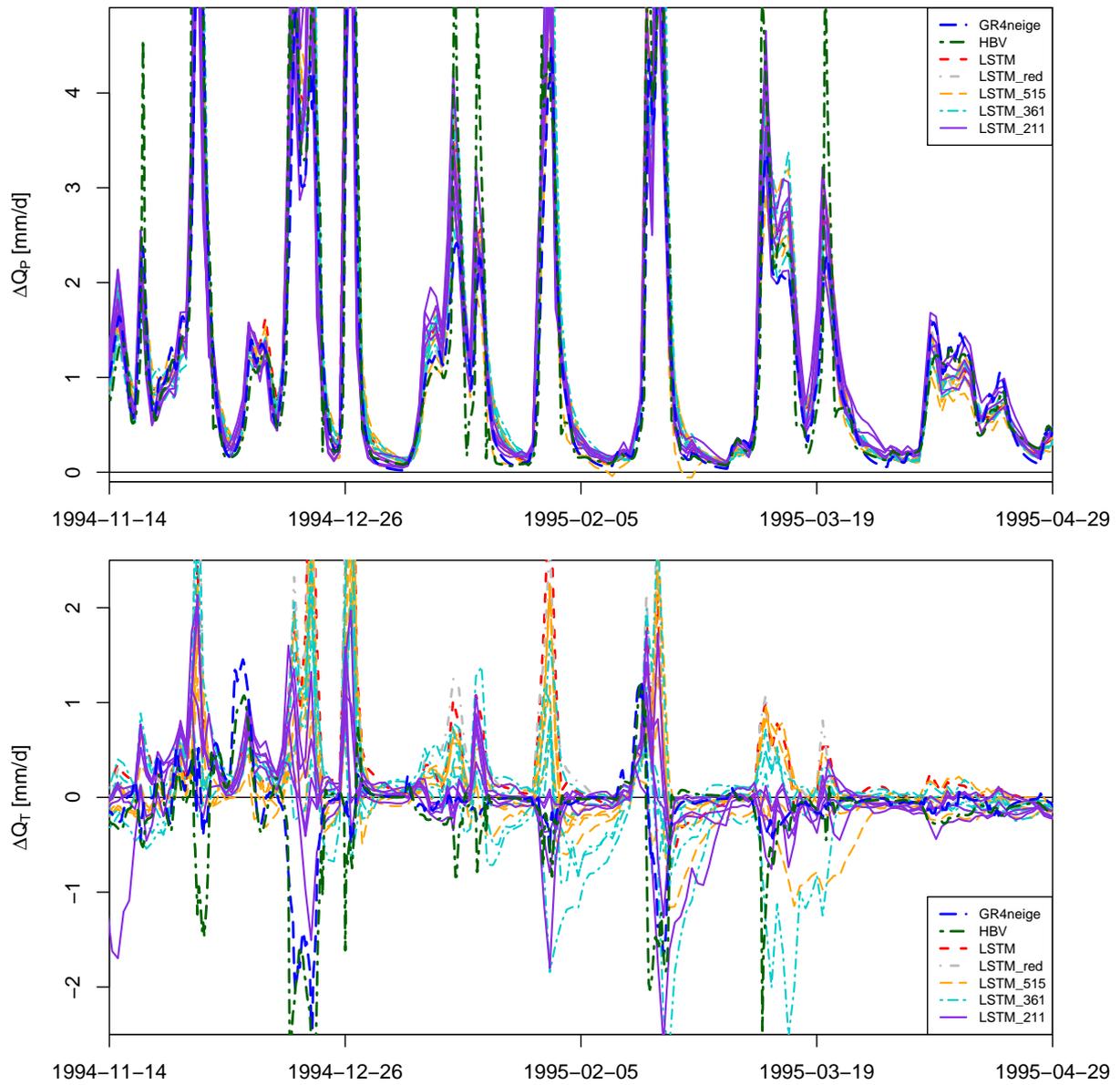
Figure SI.62. Sensitivities for basin 12013500, Nov. 1994 - April 1995 (part of validation). See Fig. 6 for an explanation of the plot panels.
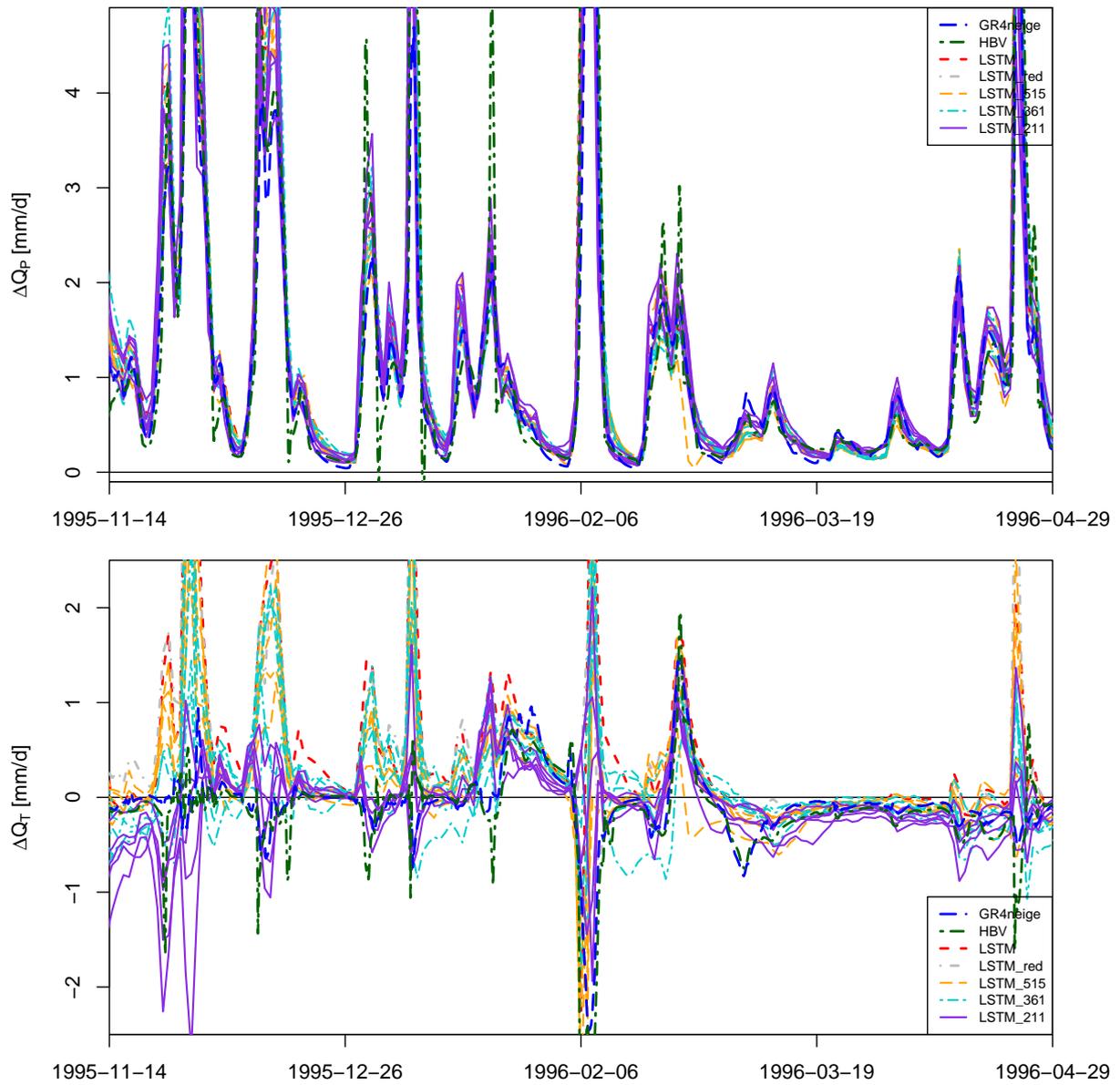
Figure SI.63. Sensitivities for basin 12013500, Nov. 1995 - April 1996 (part of validation). See Fig. 6 for an explanation of the plot panels.
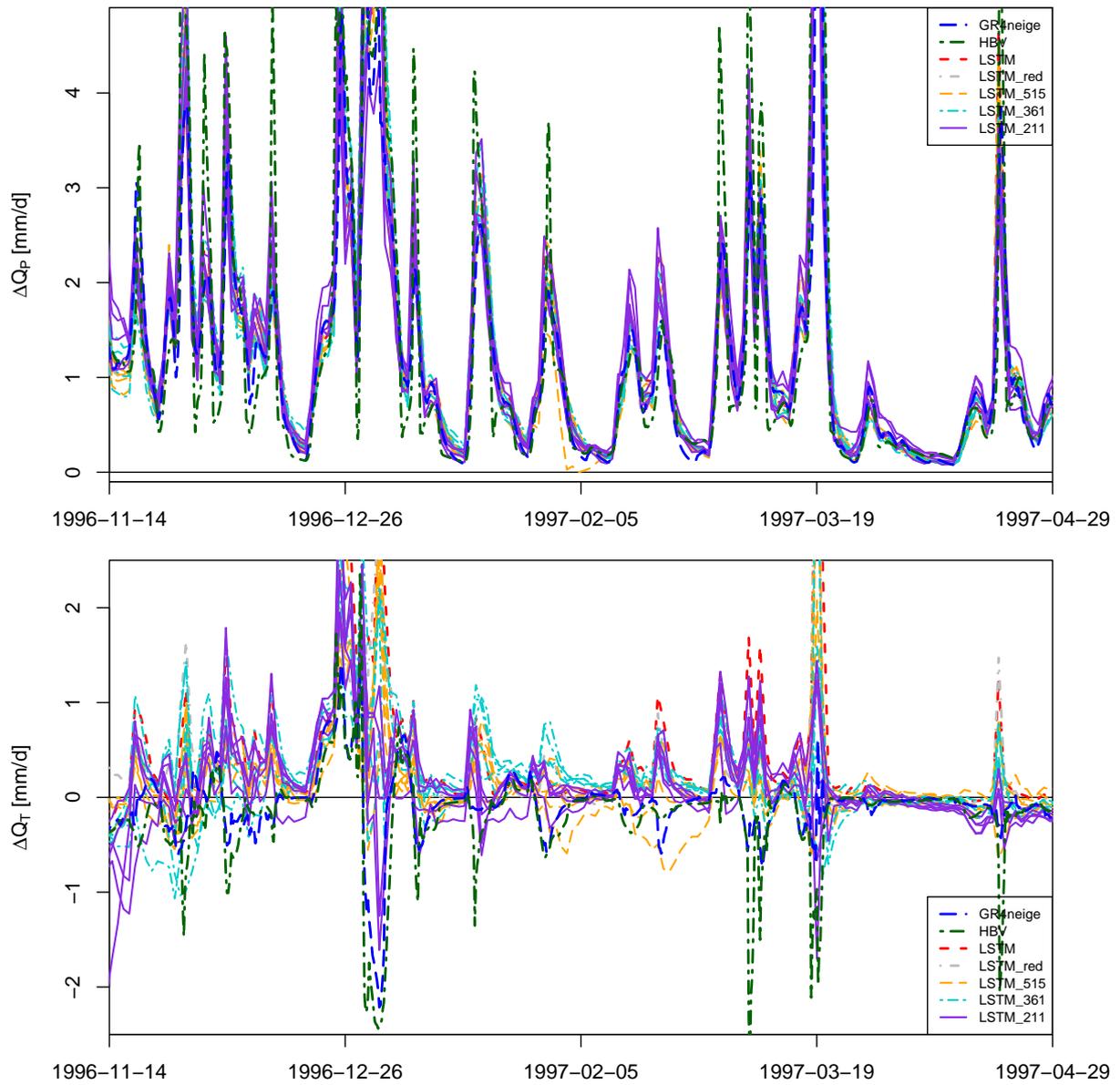
Figure SI.64. Sensitivities for basin 12013500, Nov. 1996 - April 1997 (part of validation). See Fig. 6 for an explanation of the plot panels.