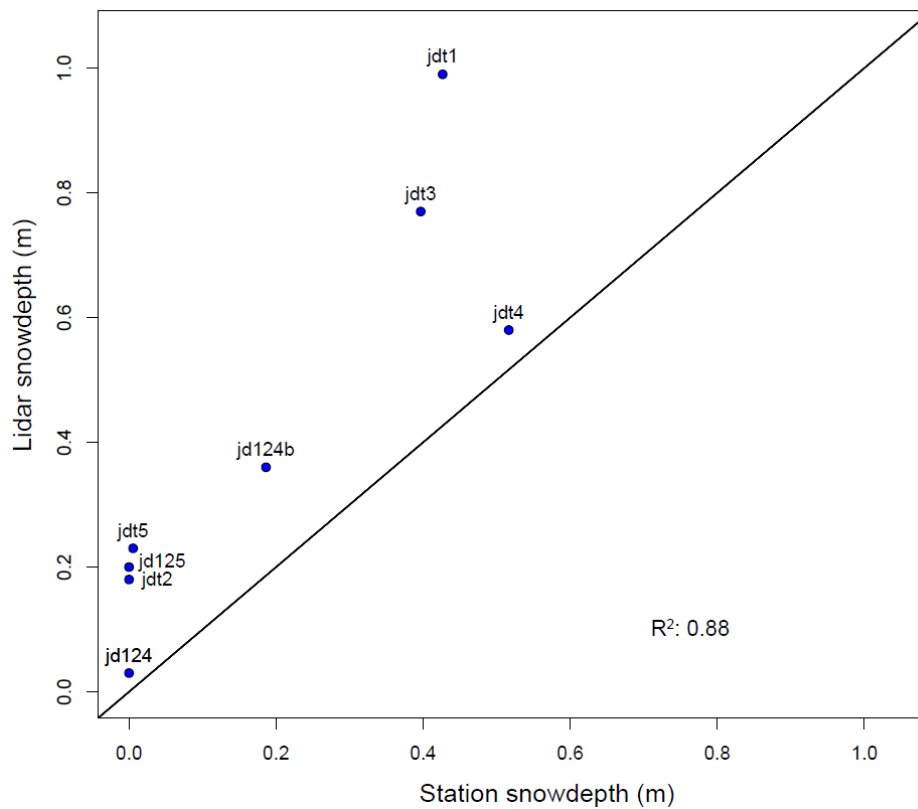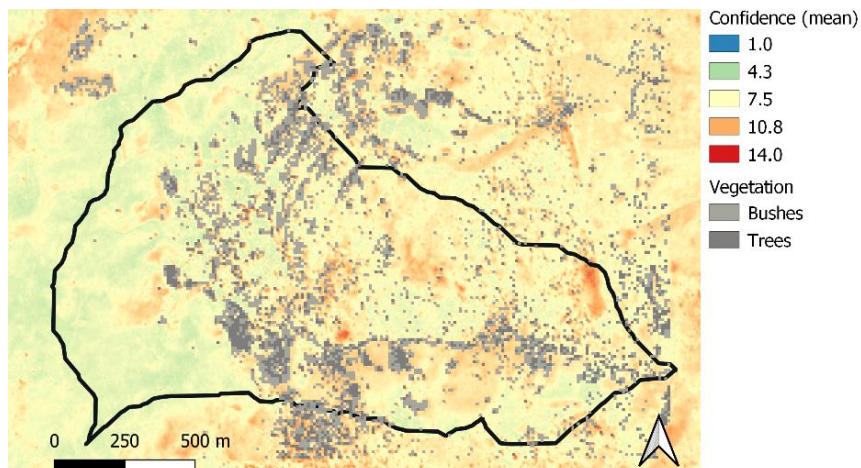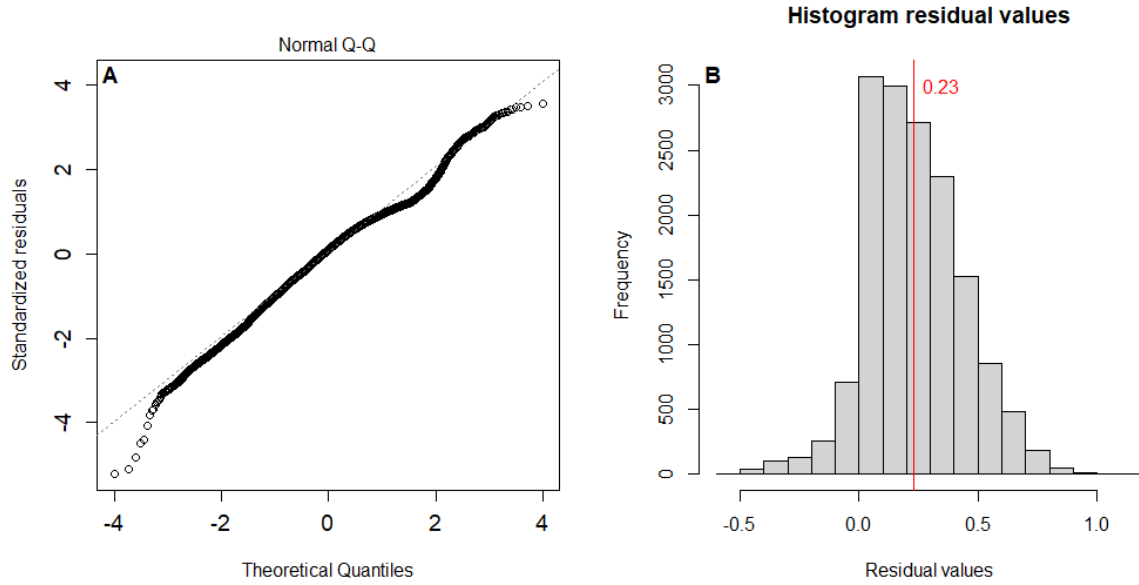# Supplemental material

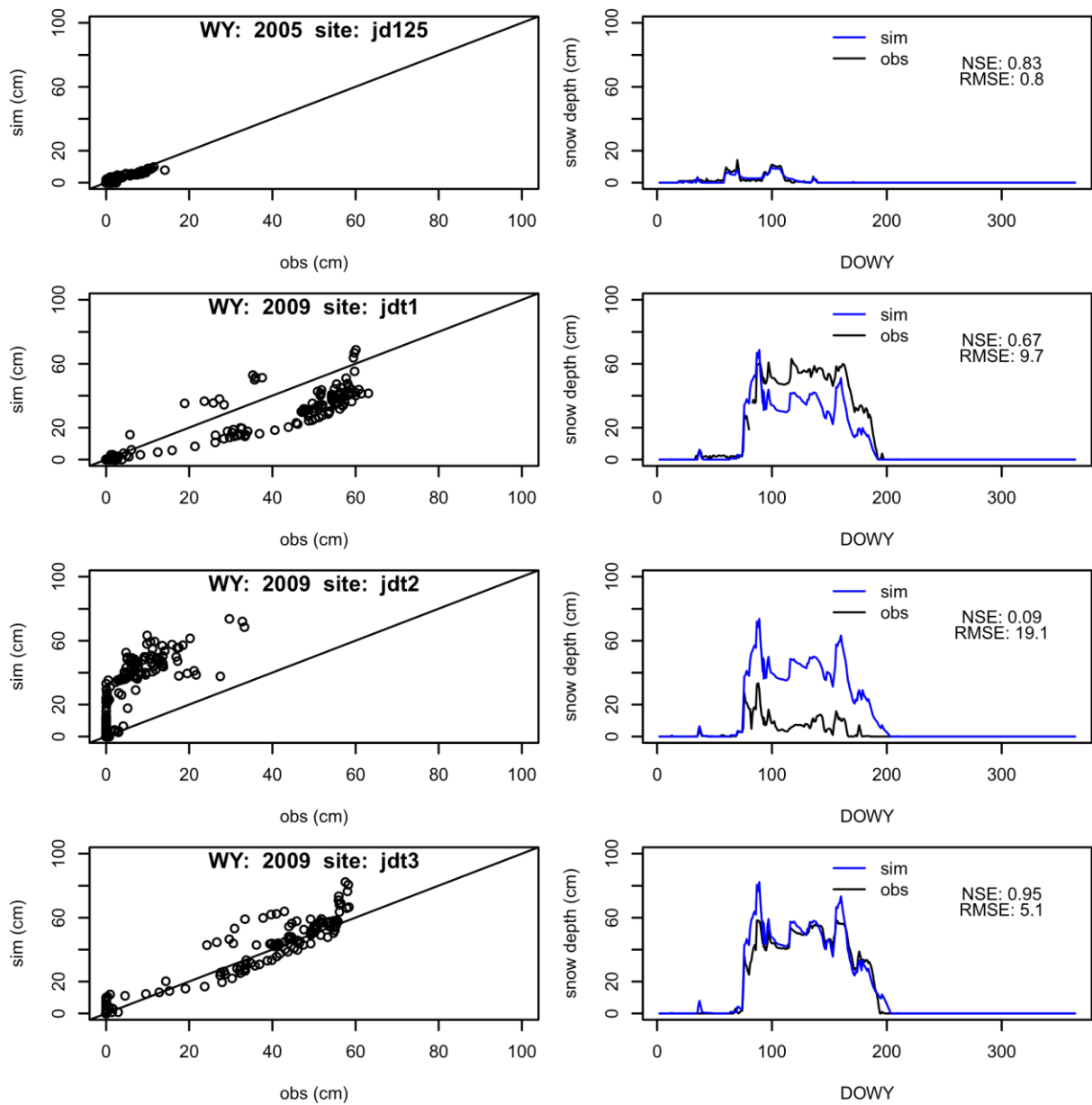**S1:** Scatter plot of lidar snow depths and weather station snow depths.

S2: Map of mean confidence levels of the Maximum Likelihood Classification tool in ArcMap, where blue and green colors indicate higher confidence levels, and orange and red colors lower confidence levels. Vegetated areas are shaded in light grey (bushes) and dark grey (trees).
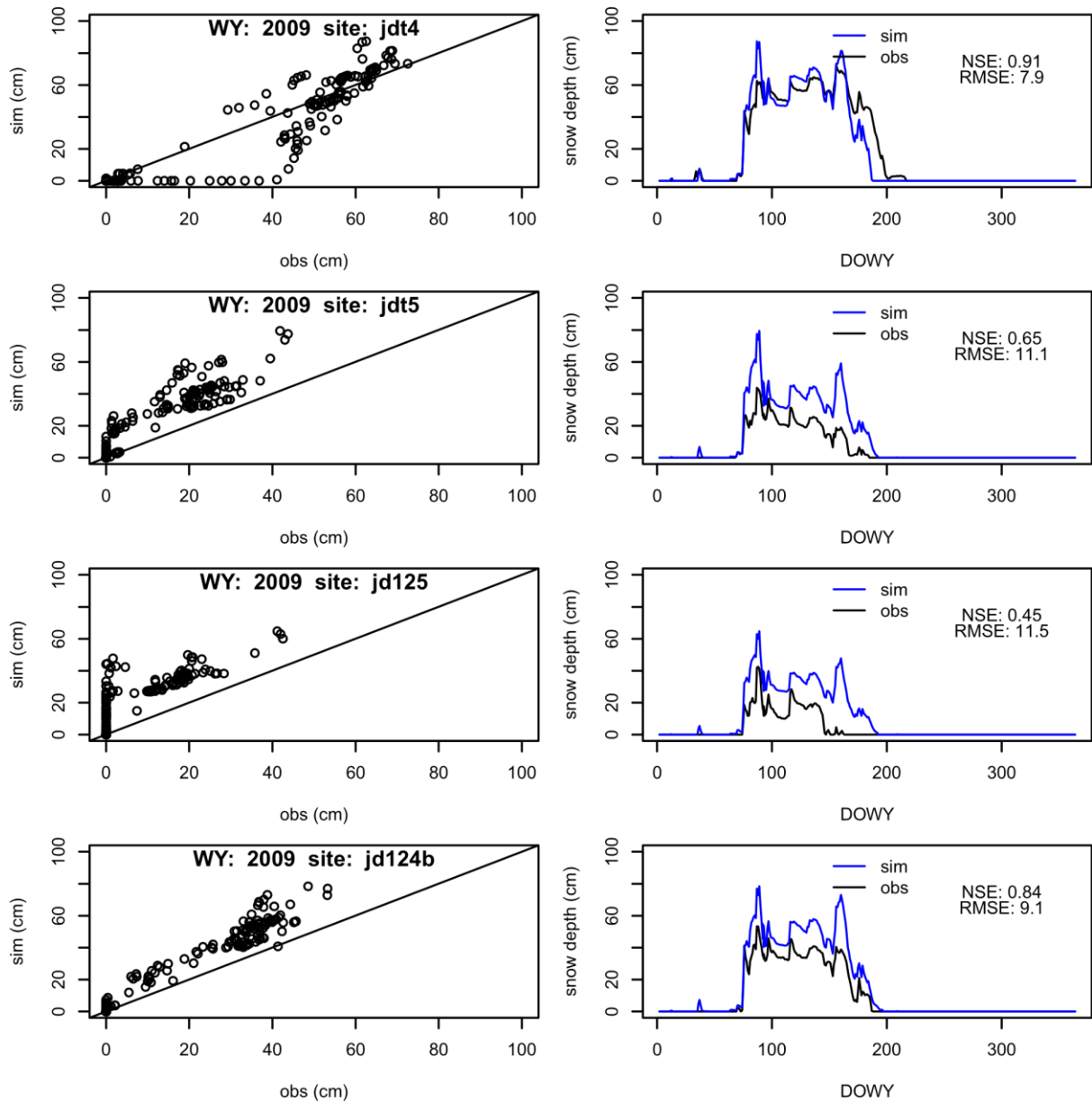
S3: (A) QQ-plot of the linear model between observed (lidar) and simulated snow depths, and (B) a histogram of the residual values of the observed minus the simulated snow depths, with the mean residual value indicated in red.

S4:

1/9: Scatter plots (left) and time series (right) of observed (obs, black) and simulated (sim, blue) snow depths. Water years (WY) and sites for each row are shown in the left-hand figure, and Nash-Sutcliffe Efficiency's (NSE) and Root Mean Square Errors (RMSE) are shown in the right-hand figures.
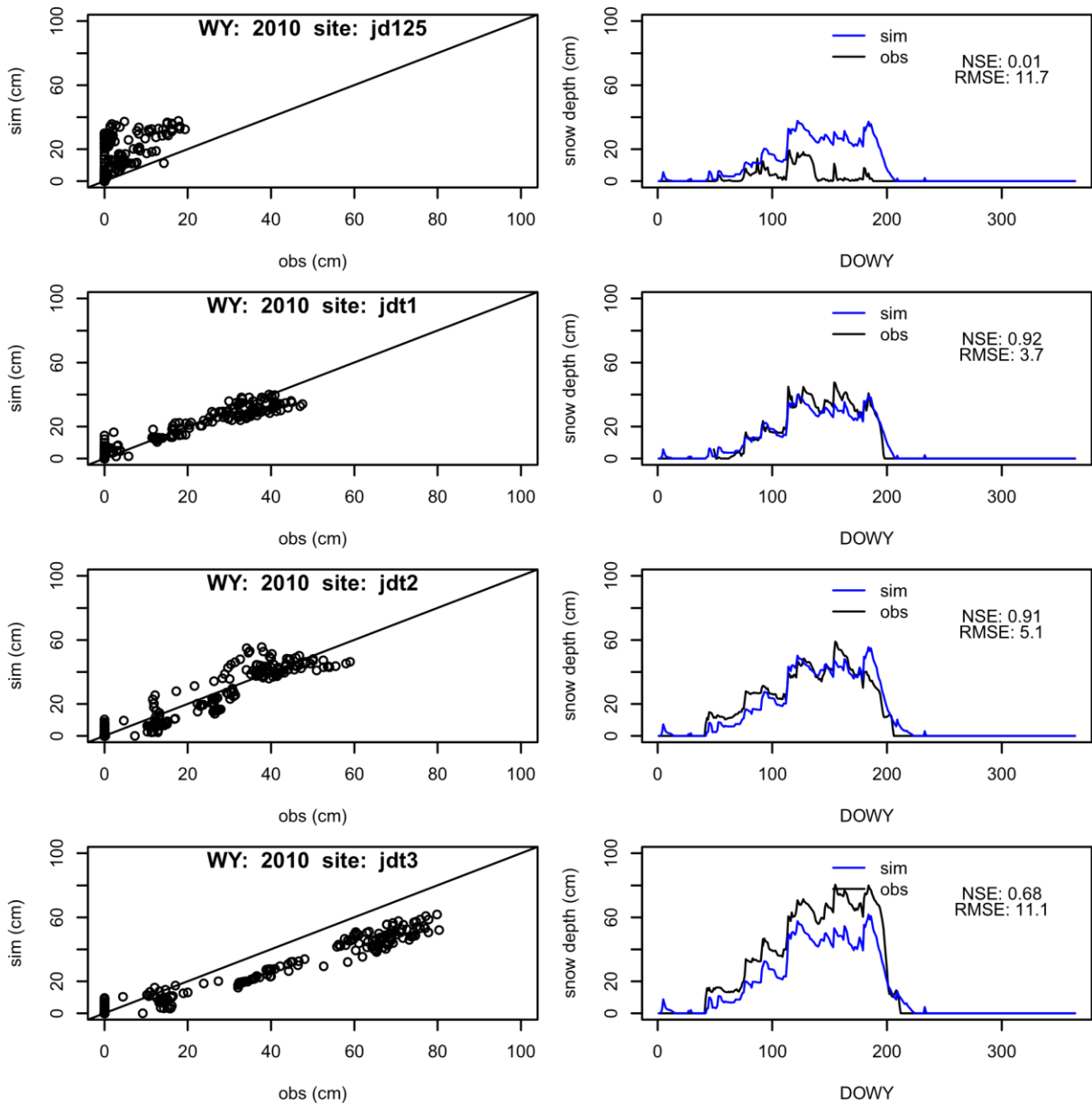
2/9: Scatter plots (left) and time series (right) of observed (obs, black) and simulated (sim, blue) snow depths. Water years (WY) and sites for each row are shown in the left-hand figure, and Nash-Sutcliffe Efficiency's (NSE) and Root Mean Square Errors (RMSE) are shown in the right-hand figures.
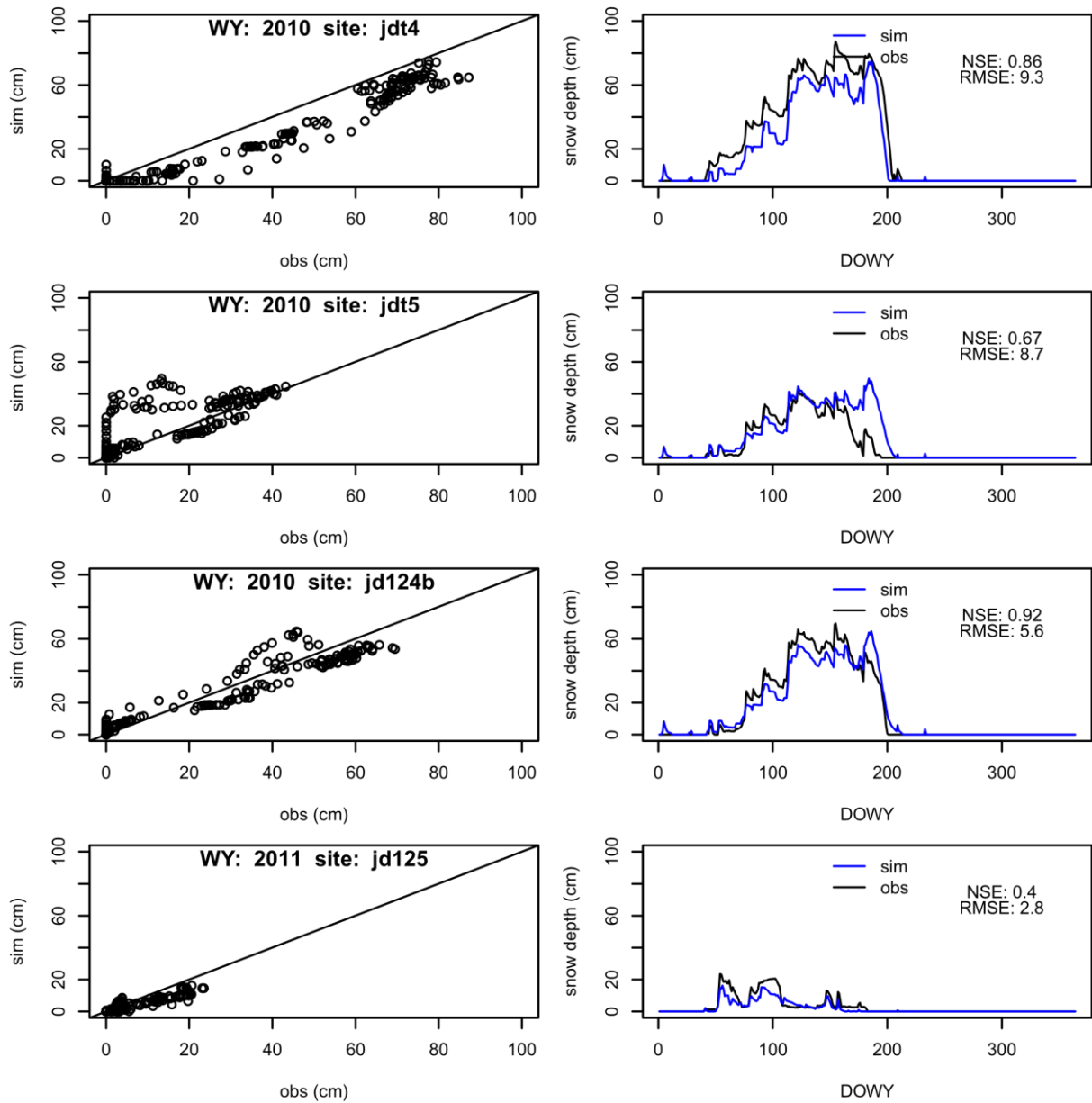
3/9: Scatter plots (left) and time series (right) of observed (obs, black) and simulated (sim, blue) snow depths. Water years (WY) and sites for each row are shown in the left-hand figure, and Nash-Sutcliffe Efficiency's (NSE) and Root Mean Square Errors (RMSE) are shown in the right-hand figures.
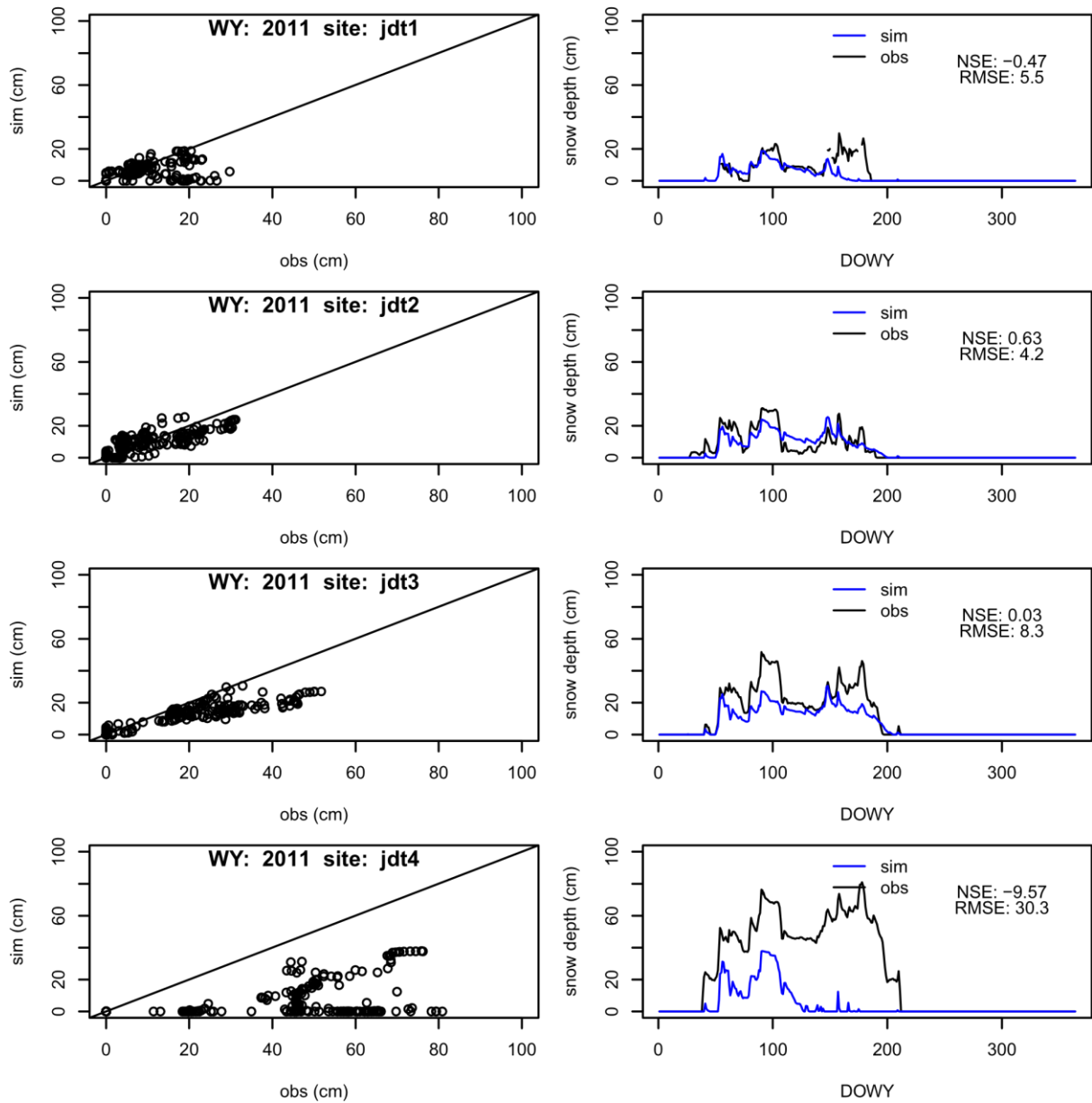
4/9: Scatter plots (left) and time series (right) of observed (obs, black) and simulated (sim, blue) snow depths. Water years (WY) and sites for each row are shown in the left-hand figure, and Nash-Sutcliffe Efficiency's (NSE) and Root Mean Square Errors (RMSE) are shown in the right-hand figures.
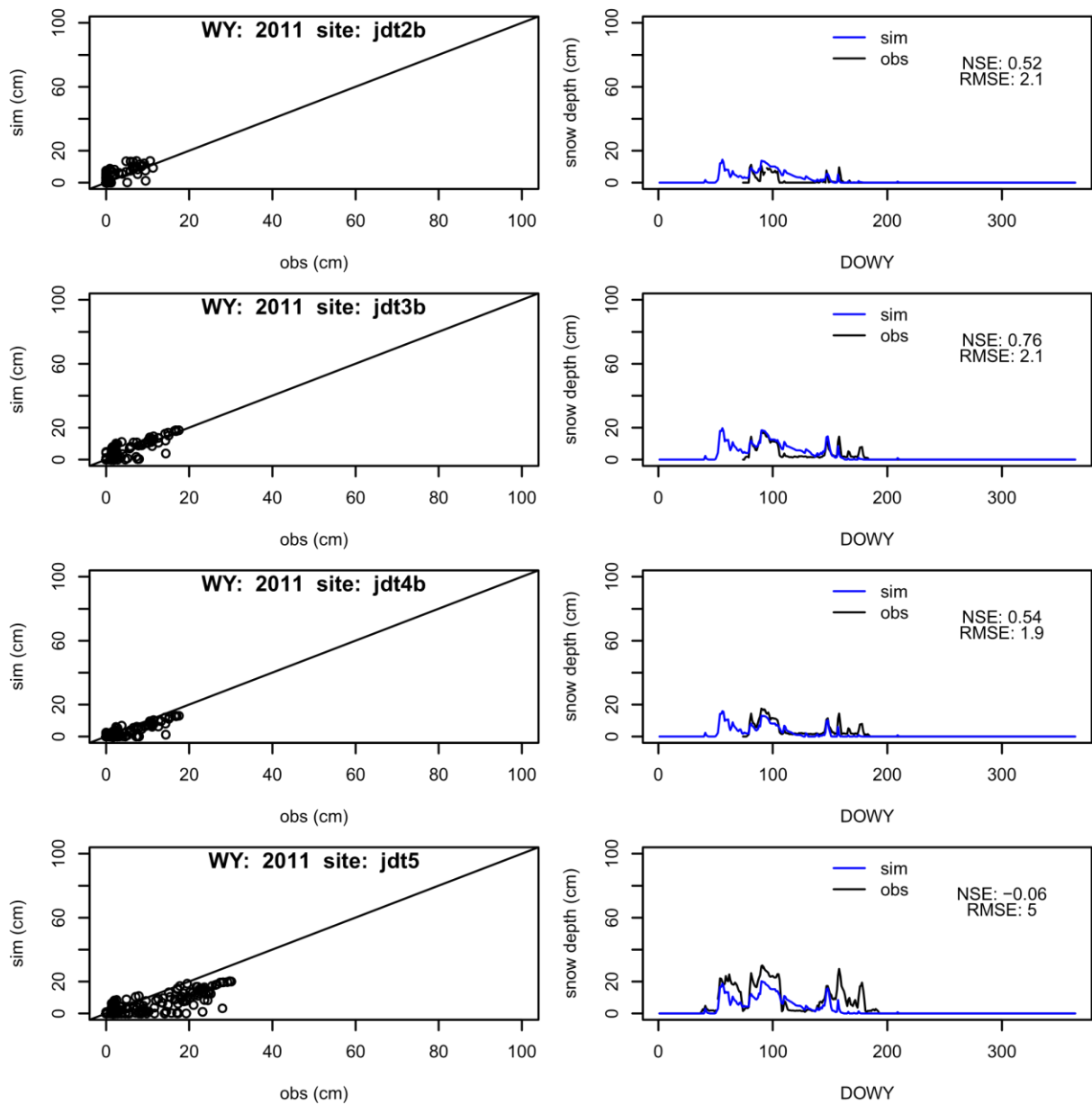
5/9: Scatter plots (left) and time series (right) of observed (obs, black) and simulated (sim, blue) snow depths. Water years (WY) and sites for each row are shown in the left-hand figure, and Nash-Sutcliffe Efficiency's (NSE) and Root Mean Square Errors (RMSE) are shown in the right-hand figures.

6/9: Scatter plots (left) and time series (right) of observed (obs, black) and simulated (sim, blue) snow depths. Water years (WY) and sites for each row are shown in the left-hand figure, and Nash-Sutcliffe Efficiency's (NSE) and Root Mean Square Errors (RMSE) are shown in the right-hand figures.
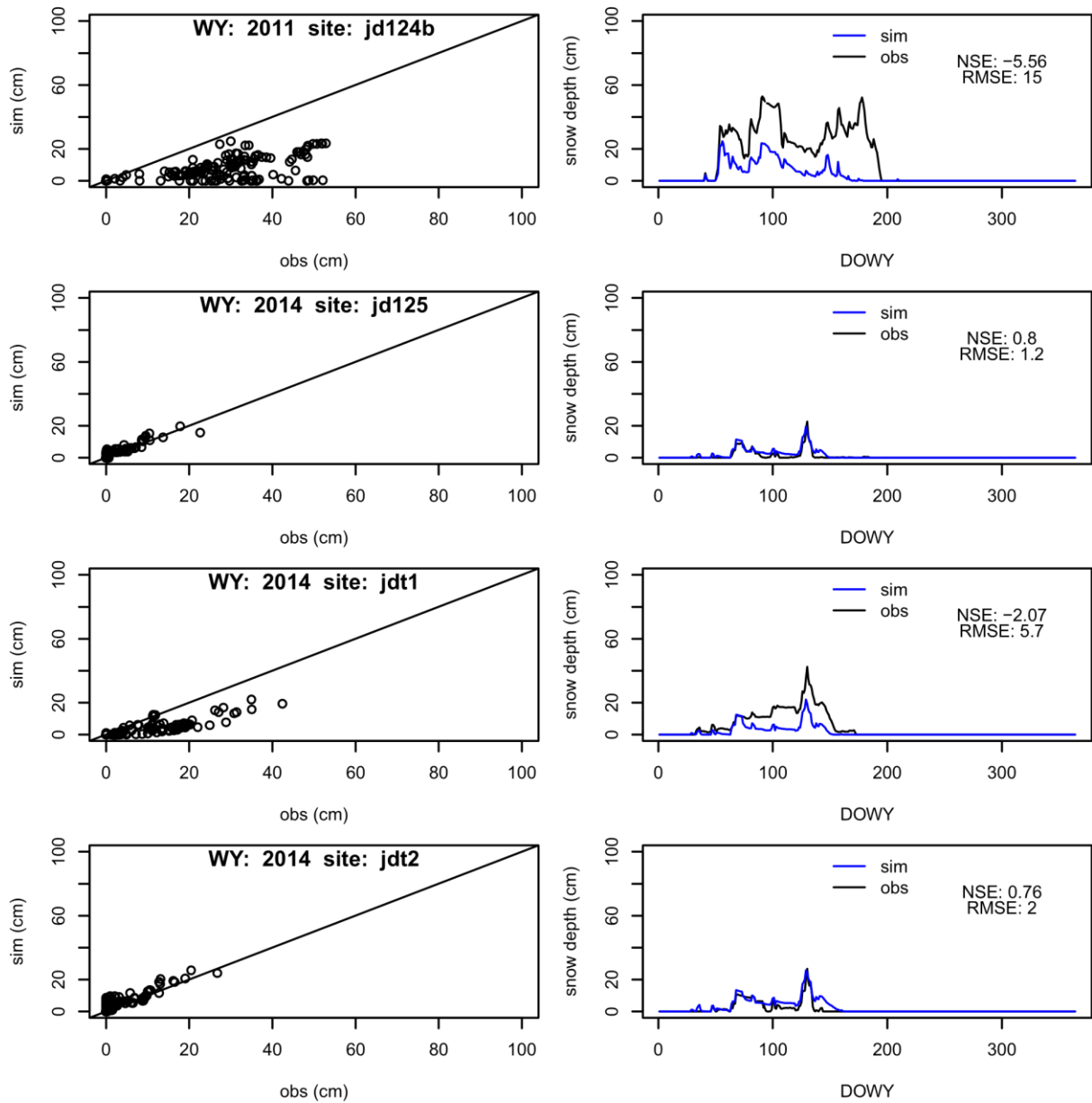
7/9: Scatter plots (left) and time series (right) of observed (obs, black) and simulated (sim, blue) snow depths. Water years (WY) and sites for each row are shown in the left-hand figure, and Nash-Sutcliffe Efficiency's (NSE) and Root Mean Square Errors (RMSE) are shown in the right-hand figures.
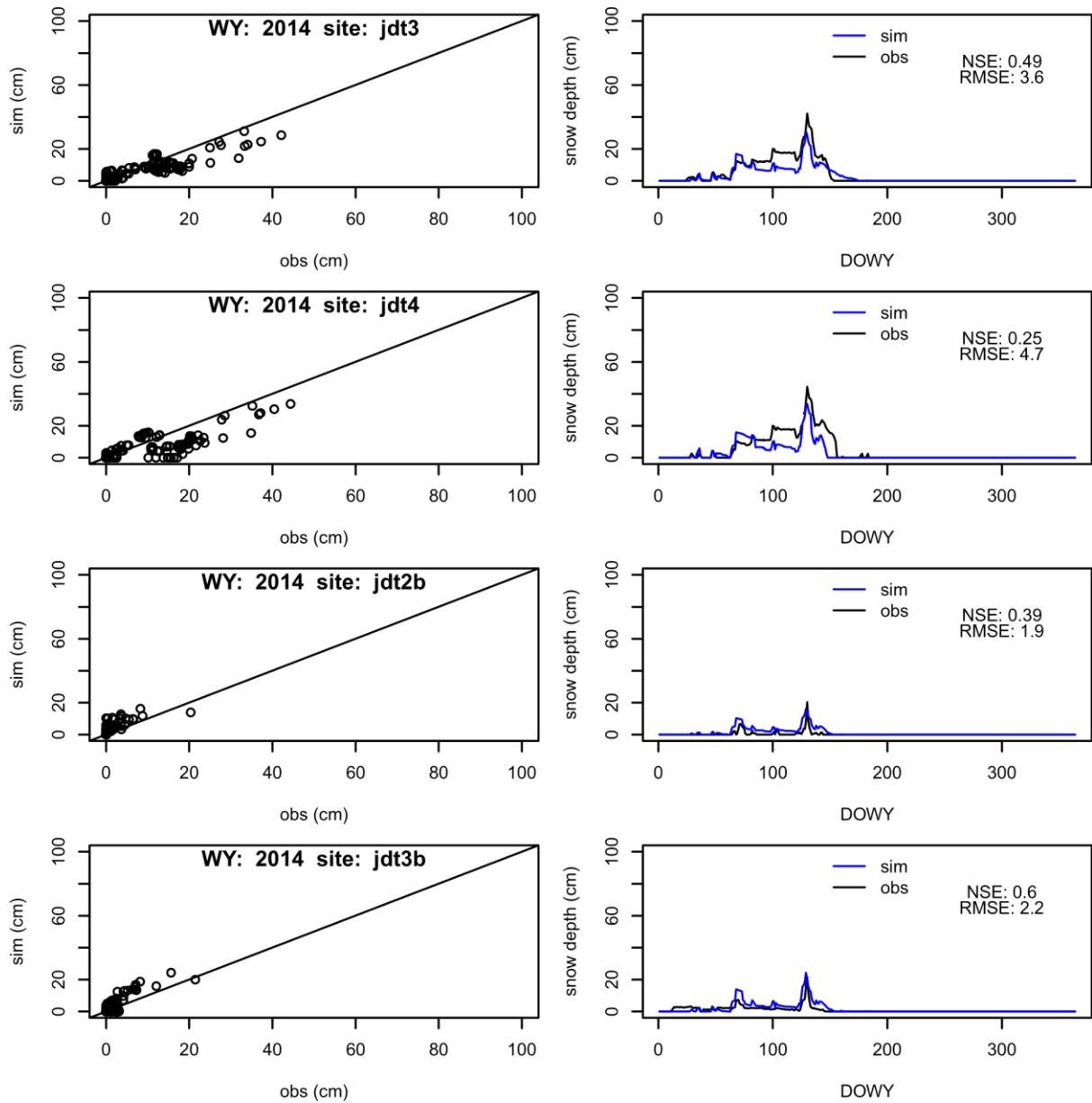
8/9: Scatter plots (left) and time series (right) of observed (obs, black) and simulated (sim, blue) snow depths. Water years (WY) and sites for each row are shown in the left-hand figure, and Nash-Sutcliffe Efficiency's (NSE) and Root Mean Square Errors (RMSE) are shown in the right-hand figures.
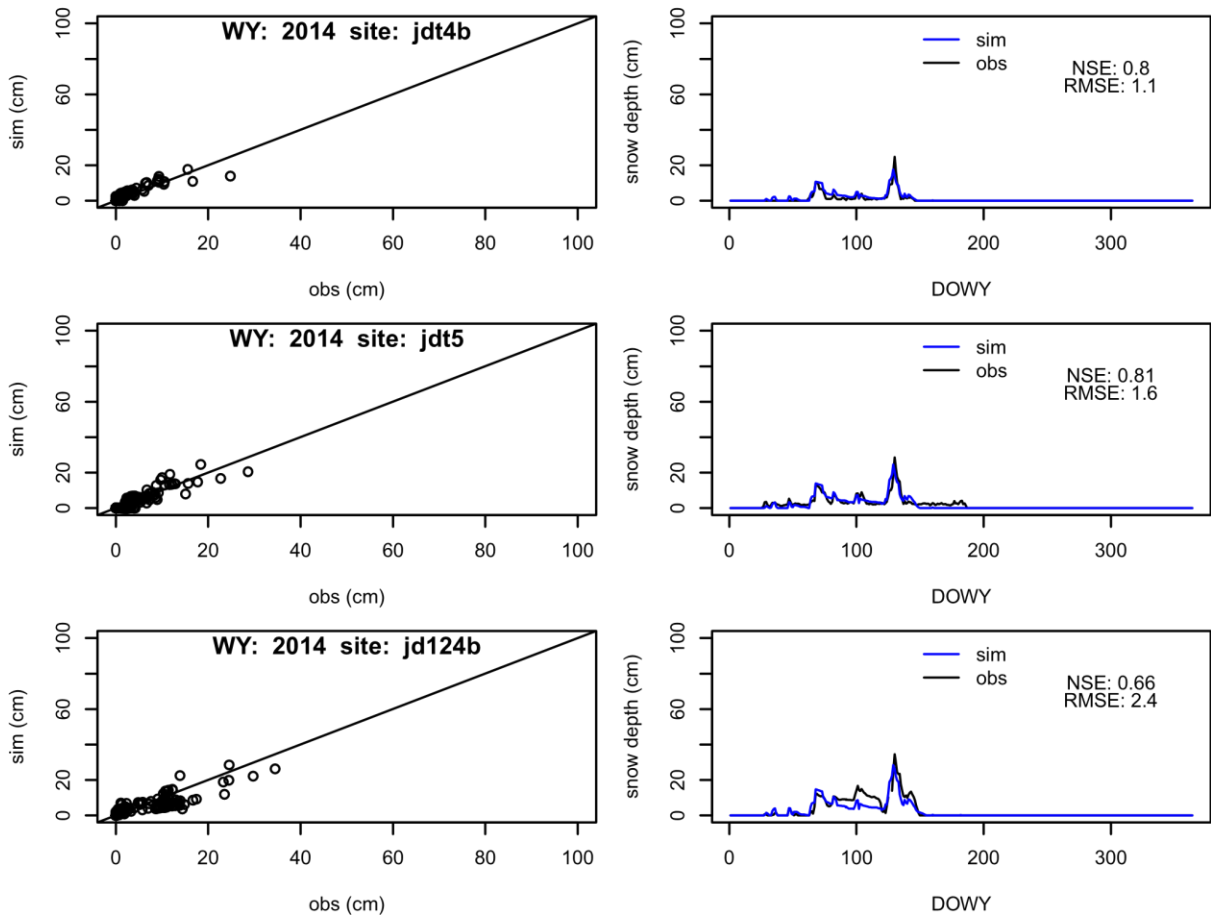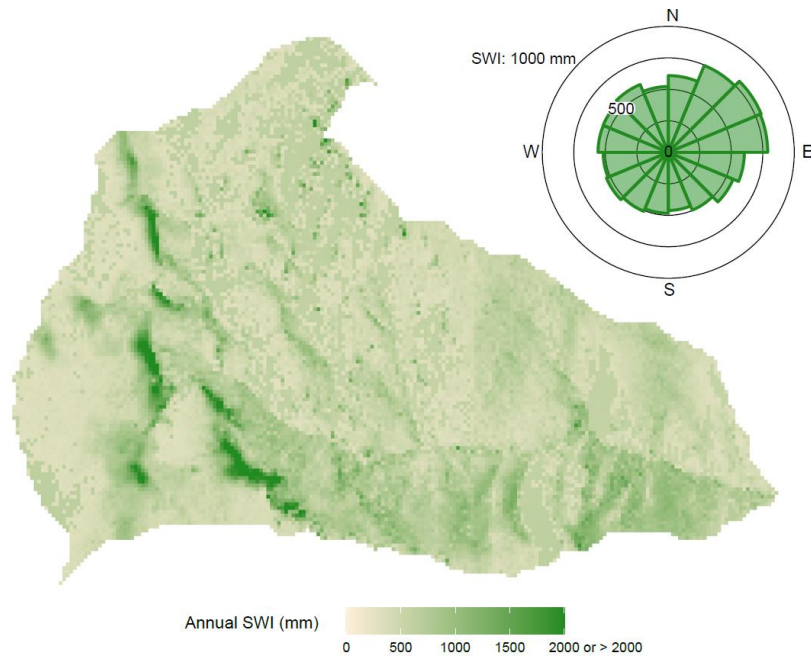
9/9: Scatter plots (left) and time series (right) of observed (obs, black) and simulated (sim, blue) snow depths. Water years (WY) and sites for each row are shown in the left-hand figure, and Nash-Sutcliffe Efficiency's (NSE) and Root Mean Square Errors (RMSE) are shown in the right-hand figures.
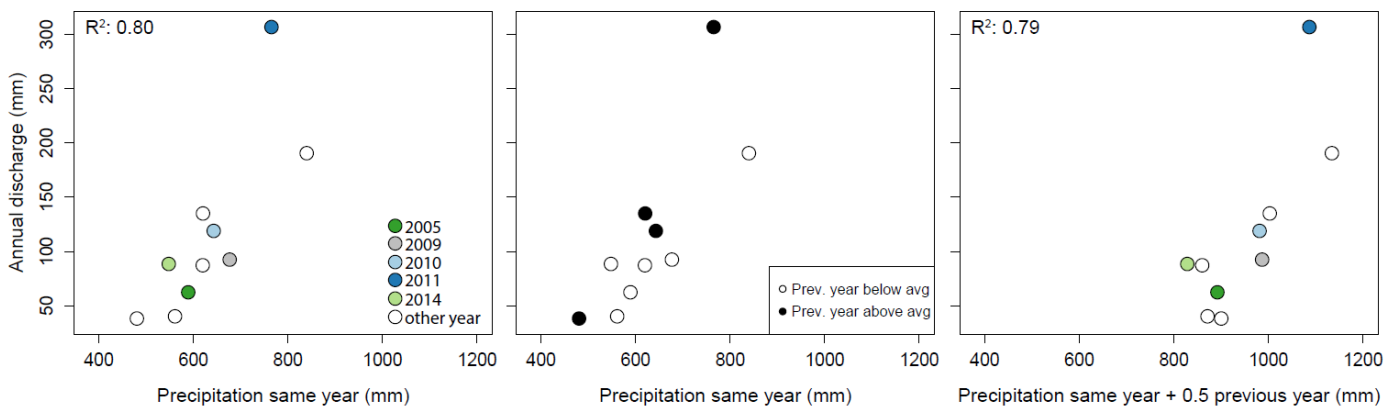
S5: Map showing yearly sum of surface water inputs (SWI, mm) for 2009, with a polar diagram showing the average sum of SWI per 10-m grid cell for each aspect (binned per 22.5°). Higher SWI values are shown in darker colors, lower SWI values in lighter colors, and SWI values are capped at 2000 mm to enhance the contrast.

S6: Scatter plots of annual precipitation vs. annual discharge. The left-hand and middle panel show precipitation recorded in the same year as discharge, and the right-hand panel shows precipitation recorded in the same year as discharge + 0.5 times precipitation recorded in the preceding year. In the left-hand and right-hand panels colored circles indicate years that have been simulated and white circles indicate additional years that have not been simulated. In the center panel, filled symbols indicate years that were preceded by a year with above-average precipitation and open circles are years that were preceded by a year with below-average precipitation.