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Synoptic weather patterns conducive to compound extreme rainfall–wave events in the NW Mediterranean

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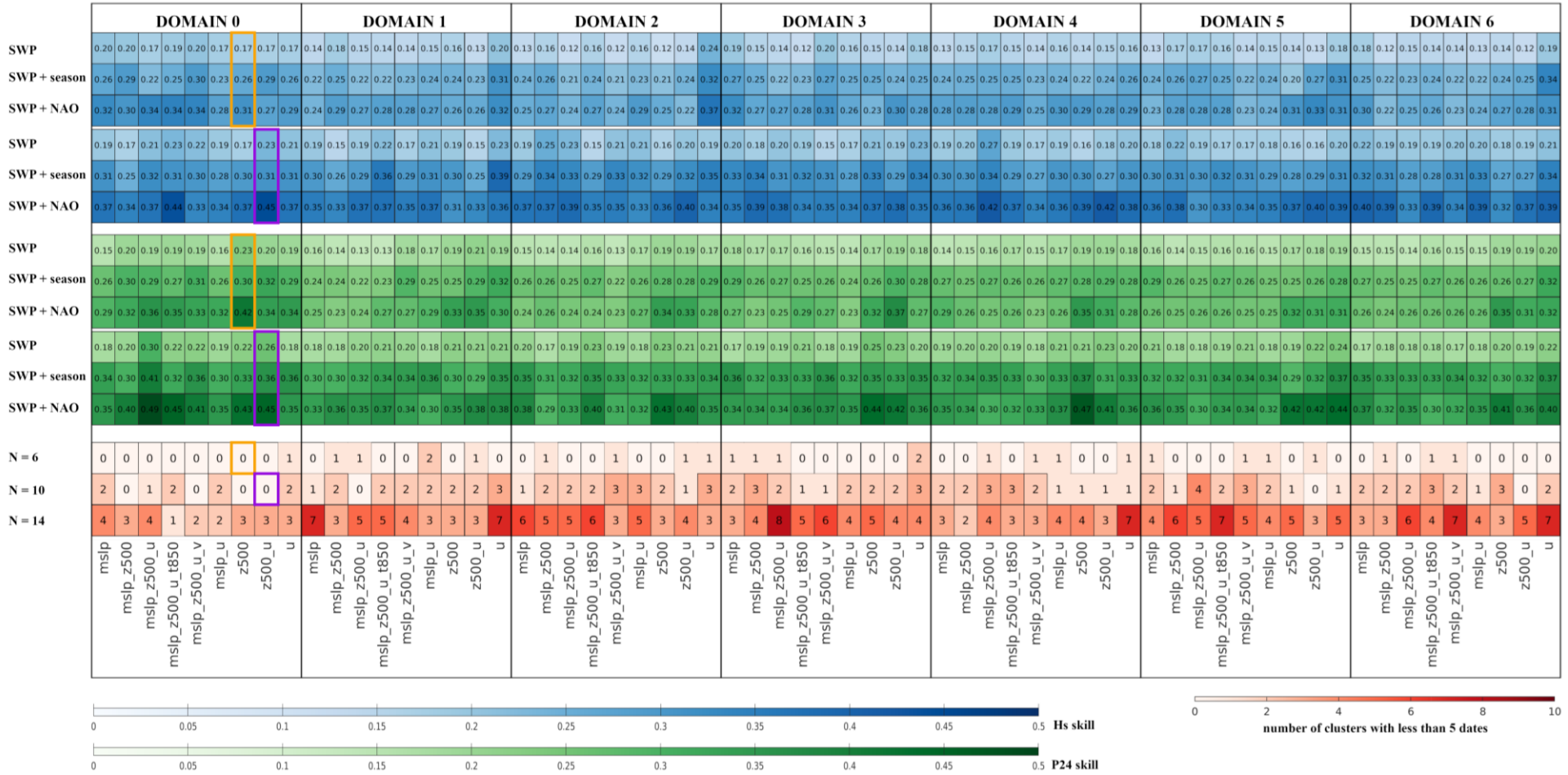

Figure S1. Results of main classification tests for compound events. The BN-skill to reproduce Hs (blues), P24 (greens) and their average (oranges) is given for all domains and tested atmospheric variables, using N = 6 and N = 10 k-means clusters (see right vertical axis). Skills results are given using as predictor only the SWP, the SWP + season, and the SWP + NAO (see left vertical axis). The number of groups containing less than 5 dates (reds) is also presented for all tested classifications and for N = 6, 10, and 14. Only classifications with zero groups with less than 5 dates are considered for the skill comparison. As an example, the best obtained classification is marked in purple, which corresponds to N =10, using z500 and u at domain 0. It is compared to the best classification for N = 6 (marked in orange), which corresponds to z500 at domain 0. Note that none of the classifications with N = 14 passed this criterion.

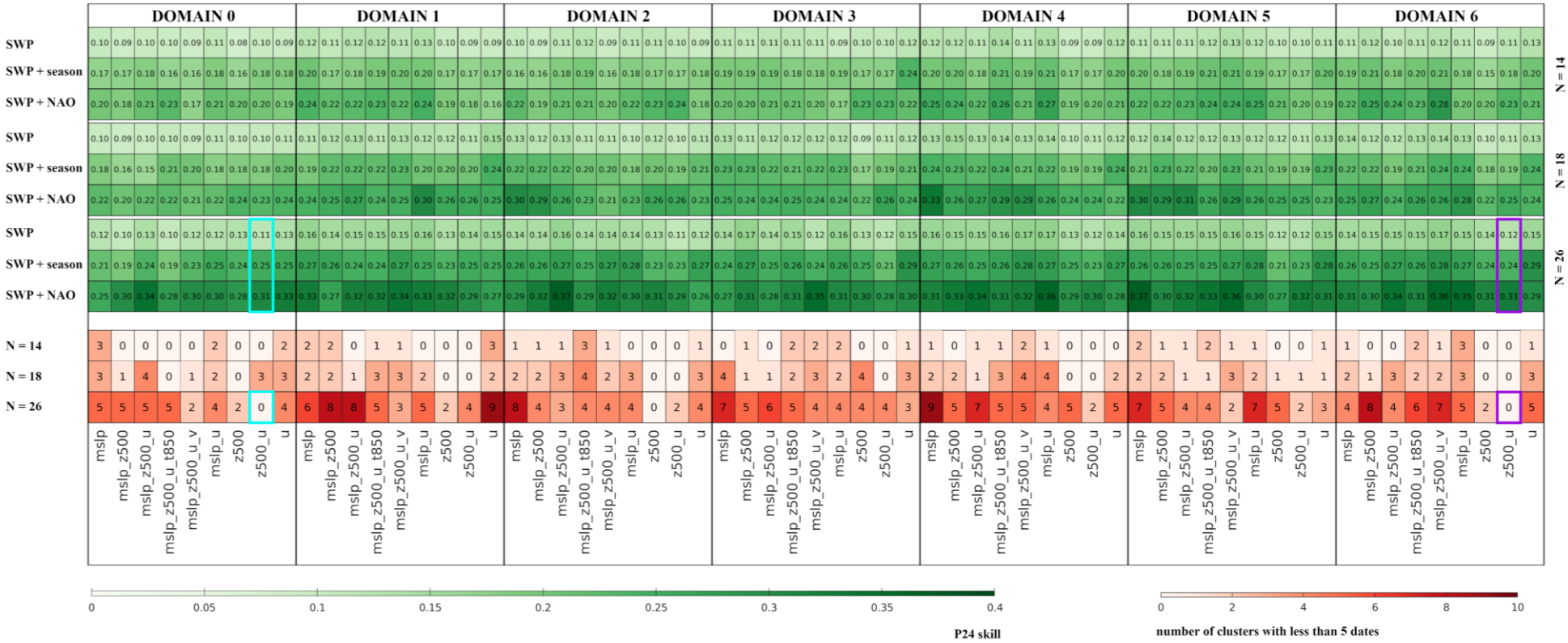

Figure S2. Results of main classification tests for compound events. The BN-skill to reproduce P24 (greens) is given for all domains and tested atmospheric variables, using N = 14, N = 18 and N = 26 k-means clusters (see right vertical axis). Skills results are given using as predictor only the SWP, the SWP + season, and the SWP + NAO (see left vertical axis). The number of groups containing less than 5 dates (reds) is also presented for all tested classifications and for N = 14, 18, and 26. Only classifications with zero groups with less than 5 dates are considered for the skill comparison. As an example, the best obtained classification is marked in purple, which corresponds to N = 26 using z500 and u at domain 6. The same combination for domain 0 is marked in light blue, which yielded similar skills. Notably, in general, skills obtained for domain 6 (the smallest in size) and 4 are higher when compared to the other (larger) domains.

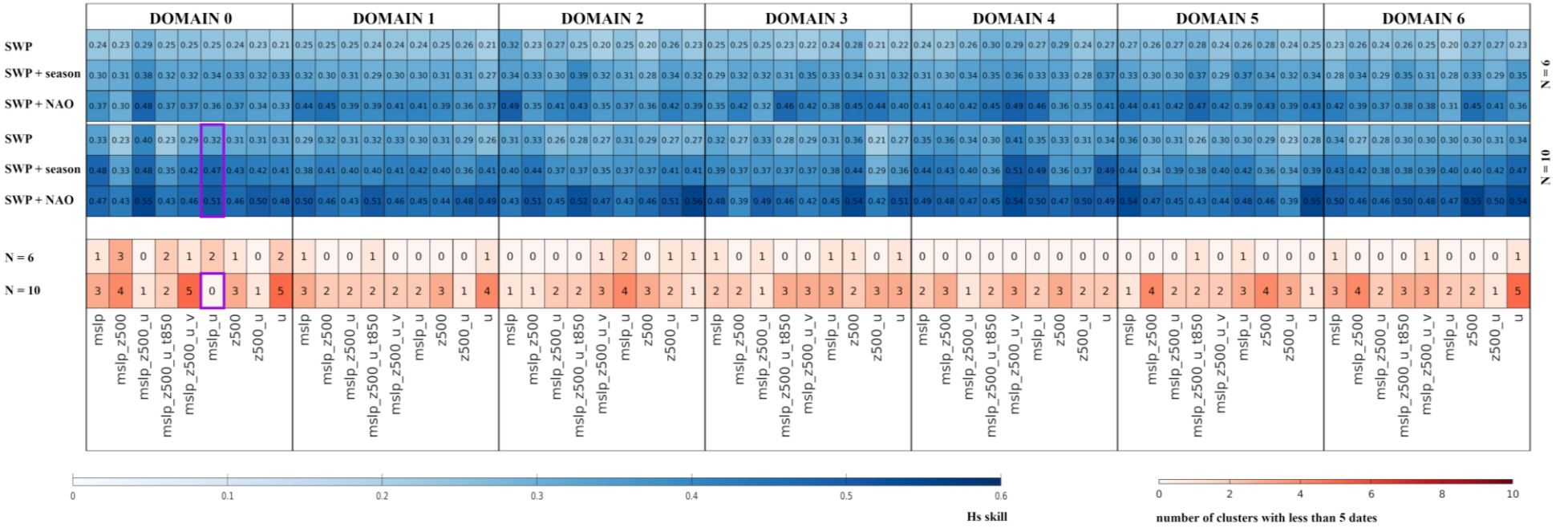

Figure S3. Results of main classification tests for compound events. The BN-skill to reproduce Hs (blues) is given for all domains and tested atmospheric variables, using N = 6 and N = 10 k-means clusters (see right vertical axis). Skills results are given using as predictor only the SWP, the SWP + season, and the SWP + NAO (see left vertical axis). The number of groups containing less than 5 dates (reds) is also presented for all tested classifications and for N = 6 and 10. Only classifications with zero groups with less than 5 dates are considered for the skill comparison. Note that only one case with N = 10 passed this criterion (marked in purple).

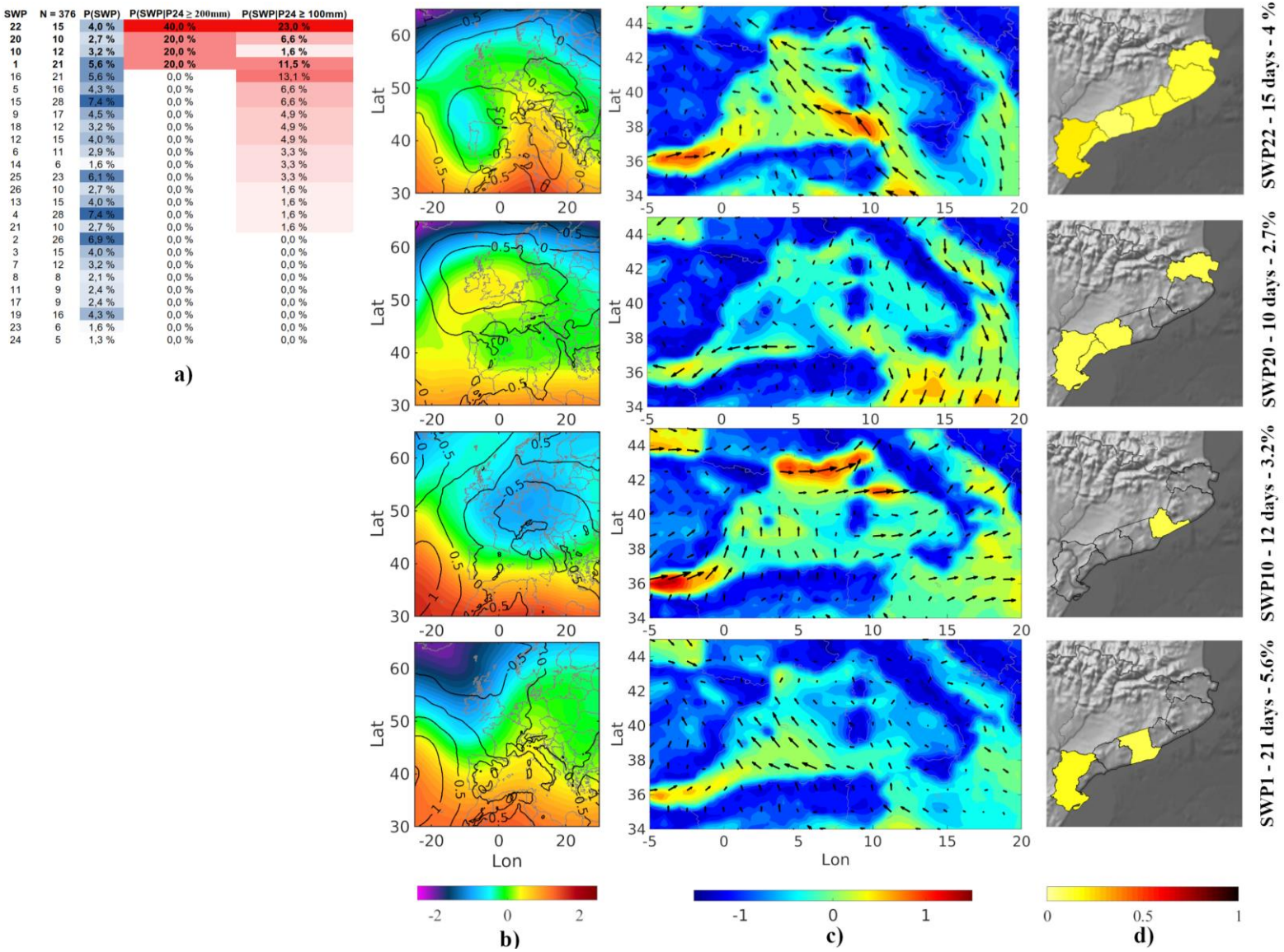

Figure S4. BN characterization of the rain type, using z500 and u at D6 with N = 26 clusters. (a) Probability of occurrence of each SWP, unconditioned (in blue) and conditioned on different intensities of the interest variables (in red). The colour intensities vary from maximum to minimum values within each column. SWP associated with P24 ≥ 200 mm are marked in bold and presented in panels b, c and d. (b) z500 anomaly (colormap) overlaid with mslp anomaly (contours). (c) Wind anomaly. (d) Probability of P24≥100 mm (land) at each basin.

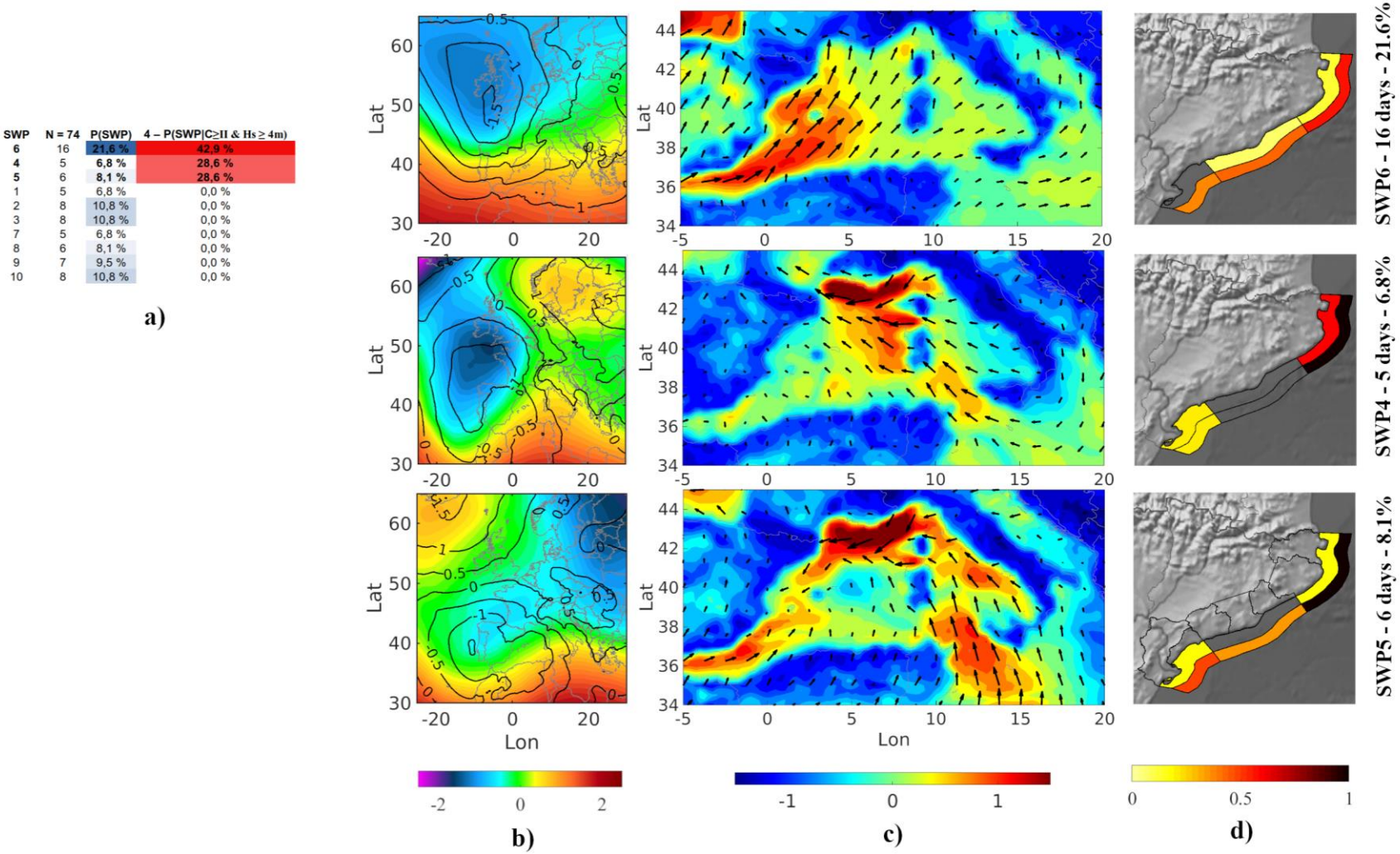

Figure S5. BN characterization of the wave type, using mslp and u at D0 with N = 10 clusters. (a) Probability of occurrence of each SWP, unconditioned (in blue) and conditioned on different intensities of the interest variables (in red). The colour intensities vary from maximum to minimum values within each column. SWP associated with severe conditions (C ≥ II and Hs ≥ 4 m) are marked in bold and presented in panels b, c and d. (b) z500 anomaly (colormap) overlaid with mslp anomaly (contours). (c) Wind anomaly. (d) Probability of C≥II (internal coastal band) and Hs ≥ 4 m (external coastal band) each coastal sector. Note that there is not any event reaching extreme conditions (i.e. C≥ IV and Hs ≥ 4 m) within the wave type.