

Supplementary Information 1

Past changes in the North Atlantic storm track driven by insolation and sea ice forcing

Study site descriptions

The study sites of northwest Spain and northwest Scotland were selected as these regions are highly influenced by the NAO during the instrumental period; storminess is higher/lower during a negative/positive NAO in northwest Spain, with the opposite relationship in northwest Scotland (Andrade et al., 2008).

Pedrido Bog

Pedrido Bog is an ombrotrophic peat bog situated in the Xistral Mountains of northwest Spain (43.4503 N, 7.5292 W; 770 m altitude). The Xistral Mountains is an upland area around 600-800 m a.s.l. with some peaks over 1000 m. The site is a raised ombrotrophic mire situated in a bedrock depression in the lee of higher ground.

The Pedrido Bog surface vegetation consists of *Calluna vulgaris*, *Eriophorum vaginatum*, *Erica makaiana*, *Molinia caerulea*, *Gentiana pneumonanthe*, *Potentilla erecta*, *Carex echinata*, *Carex sp*, *Sphagnum sp*, *Narthecium ossifragum*, *Parnassia palustris*, *Potamogeton*, *Succisa pratensis* and *Drosera rotundifolia*. The surrounding slopes have *Ilex aquifolium*, *Castanea sativa*, *Eucalyptus* and *Pinus pinaster* with *Pinus radiata* higher up.

Land-use in the area is currently limited to free livestock grazing at higher altitudes, with wind farms constructed in recent years, while on lower slopes there is intensive agriculture and livestock grazing (Díaz Varela et al., 2008). Recently plantations of *Pinus pinaster* and *Eucalyptus* have developed.

The sampled core consists of highly decomposed sedge and grass dominated peat. Organic Bulk Density changes (data not shown) showed higher values over 0.12 g cm⁻² at 4000-2500 cal yrs BP and after 500 cal yrs BP, with lower values between these periods, which indicates changes in the humification through the core.

Outer Hebrides Bogs

Struban Bog (57.5597 N, 7.3458 W) and Hill Top Bog (57.1681 N, 7.3478 W) are two ombrotrophic peat bogs situated on the western side of the Outer Hebrides, Scotland. The western coastline of the islands has sandy machair grasslands, sand dunes and beaches, and to the east of this are soils consisting of peaty gleys, peaty podzols and raised peat bogs (Angus 1997, Hudson 1991). The two bogs are in close proximity to the sand sources along the coast. The two sites are approximately 40 km apart; Struban Bog is on North Uist and Hill Top Bog is on South Uist. The bogs are situated in rural locations: there are small settlements (villages and farms) and the land use is predominantly livestock grazing or open land that is not currently in use.

Each peat core had similar composition, consisting of humified sedge dominated peat with small amounts of *Sphagnum*. The age-depth model of Hill Top Bog is constrained by 7 AMS radiocarbon dates spanning the 3.3 m core, while Struban Bog is constrained by 6 AMS radiocarbon dates along the 3 m core. The Organic Bulk Density of Struban Bog increases after 1500 cal yrs BP, while the density of Hill Top Bog shows no trend but centennial variability. See Orme et al (2016) for further details.

Bibliography

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TABLE DR1. PEDRIDO BOG RADIOCARBON DATES

Midpoint sample depth (cm)	Laboratory code	¹⁴ C age (yrs BP)	Error (yrs)
20.5	GrA-30387	360	45
24.5	GrA-26807	370	30
30.5	GrA-30464	540	35
37.5	GrA-30454	665	35
44.5	GrA-30466	795	35
56.5	GrA-30467	945	35
60.5	GrA-26809	940	30
70.5	GrA-30402	1130	50
80.5	GrA-30468	1260	35
90.5	GrA-26810	1190	35
96.5	GrA-30459	1460	35
99.5	GrA-30460	1580	35
129.5	GrA-30455	1955	35
139.5	GrA-30410	2080	50
143.5	GrA-26854	2220	40
151.5	GrA-30406	2290	50
153.5	GrA-30408	2330	50
157.8	GrA-30403	2480	50
159.5	GrA-30409	2600	50
162.5	GrA-26811	2715	35
167.5	GrA-30448	2865	40
175.5	GrA-30449	3050	40
216.5	GrA-26800	3640	45
220.5	GrA-30462	3555	40
222.5	GrA-30486	3725	40
230.5	GrA-30404	3720	50
233.5	GrA-30487	3795	35
235.5	GrA-30450	3805	40
237.5	GrA-30452	3945	40
248.5	GrA-25192	4155	40

TABLE DR2. PEDRIDO BOG ^{210}Pb DATES

Depth (cm)	Unsupported ^{210}Pb activity (count $\text{d}^{-1} \text{g}^{-1}$)	Date (A.D.)	Error (yrs)
0.5	438	2002	6
2.5	560	1995	4
4.5	491	1982	5
6.5	290	1963	6
8.5	180	1944	8
10.5	88	1920	13
12.5	69	1896	24
14.5	9	1825	96