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Daily to decadal modulation of Atlantic jet variability

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The variability of the Atlantic eddy-driven jet is responsible for extreme regional weather patterns and has a strong influence on the ocean circulation. Hence it is important to understand factors which control and modulate jet variability. Here, we show that in general the variance of a jet's position in latitude is modulated by its average speed: when a jet becomes stronger its variability in latitude decreases. This relationship is shown to hold for observed midlatitude jets around the world and also across a hierarchy of numerical models.

In the North Atlantic in particular, jet variability is shown to be modulated on decadal timescales, with decades of a strong, steady jet being interspersed with decades of a weak, variable jet. These modulations are also related to variations in the basin-wide occurrence of high-impact blocking events. A picture emerges of complex multidecadal jet variability in which recent decades do not appear unusual. We propose an underlying barotropic mechanism to explain this behaviour, related to the change in refractive properties of a jet as it strengthens, and the subsequent effect on the distribution of Rossby wave breaking.