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Characteristics of annual laminae in speleothem from Grotte de Rolande, SW France and relationships to seasonal changes in the cave and surface environment.

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Speleothems provide important information on past climate conditions and the multiple proxies they contain preserve different relationships to climatic change at seasonal to multiannual timescales from different cave environments. The Grotte de Rolande (GdR) located near Montcuq, Lot Department, SW France is a 700m horizontal vadose passage situated on a plateau with a single opening that enters through a roof fissure. The local climate shows strong seasonality in temperature with moderate annual rainfall unevenly distributed across the year. The cave has been continuously monitored for $CO_{2,}$temperature and driprate in relation to surface weather since 2009. Drip rates vary regularly with season and reach a maximum in late winter. Cave air CO_2concentrations remain relatively high and vary from 5000-9000 ppm, reaching maximum values in late summer. Winter cave air variations are more complex as a result of thermal instability in the cave under winter conditions. Spelothem calcite obtained by coring the central axis of actively growing stalagmites from GdR reveals strongly developed paired laminae composed of transparent sparry and white fine grained calcite 150-400 microns thick. In this study we have performed high resolution analysis of stable isotopes and trace elements to characterise seasonal responses in isotopes and trace elements and their relationships to the fabric and composition of speleothem laminae, the local cave environment and surface weather. The roles of seasonal variations in driprate versus cave air CO_2 in controlling degassing rates and fabric development will be examined.