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Midlatitude ClO during the maximum atmospheric chlorine burden: in situ balloon measurements and model simulations

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Abstract. Chlorine monoxide (ClO) plays a key role in stratospheric ozone loss processes at midlatitudes. We present two balloon-borne in situ measurements of ClO conducted in northern hemisphere midlatitudes during the period of the maximum of total inorganic chlorine loading in the atmosphere. Both ClO measurements were conducted on board the TRIPLE balloon payload, launched in November 1996 in León, Spain, and in May 1999 in Aire sur l'Adour, France. For both flights a ClO daylight and night-time vertical profile was derived over an altitude range of approximately 15-35 km. ClO mixing ratios are compared to model simulations performed with the photochemical box model version of the Chemical Lagrangian Model of the Stratosphere (CLaMS). Simulations along 24-hour backward trajectories were performed to study the diurnal variation of ClO in the midlatitude lower stratosphere. Model simulations for the flight launched in Aire sur l'Adour 1999 show an excellent agreement with the ClO measurements. For the flight launched in León 1996, an overall good agreement is found, whereas the flight is characterized by a more complex dynamical situation due to a possible mixture of vortex and non-vortex air. We note that for both flights at solar zenith angles greater than 86°-87° simulated ClO mixing ratios are higher than observed ClO mixing ratios. However, the present findings indicate that no substantial uncertainties exist in midlatitude chlorine chemistry of the stratosphere.

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