

Contents

1	Introduction	1
1.1	Composition of air in the UTLS region and its climatological relevance	1
1.2	Scientific achievements presented in this “kumulative Habilitationsschrift”	2
1.3	Modeling of transport with CLaMS	6
2	Lagrangian transport with CLaMS	9
2.1	Transport equations	9
2.2	Lagrangian view of transport	12
2.3	Aspect ratio and vertical diffusivity	15
2.4	Numerical diffusion	17
2.5	Entropy- and static stability-based grid	19
2.6	Re-gridding procedure	24
2.7	Closing remarks	27
3	Scientific achievements: Composition of air in the UTLS region	29
3.1	Asian summer monsoon and the seasonality of tropical ozone	29
3.2	Mixing-driven origin of the ExTL and TIL	33
3.3	Climatological relevance of mixing and interpretation of trends	38
4	Relevant publications	43
A	Appendix	49
A.1	Vertical velocity	49
A.2	Effective horizontal diffusivity	51
A.3	Interpolation and numerical diffusion	53
A.4	Idealized 2D flows	54
A.5	Lyapunov exponents	55
A.6	Next neighbors, Delaunay triangulation and Voronoi polygons	57
	Bibliography	61