UNIVERSITY OF CALIFORNIA
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North Atlantic Weather Regimes: A Synoptic Study of Phase Space

A thesis submitted in partial satisfaction of the requirements for the degree Master of Science in Atmospheric Sciences

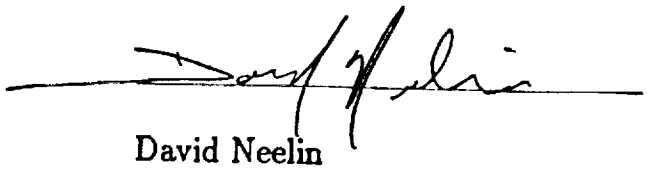
by

Anna Karin Orrhede

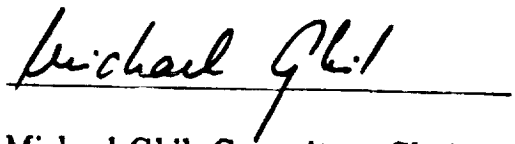
1990

The thesis of Anna Karin Orrhede is approved

Akio Arakawa



David Neelin



Michael Ghil, Committee Chair

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ABSTRACT OF THE THESIS

North Atlantic Weather Regimes:
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Professor Michael Ghil, Chair

In the phase space of weather, low-frequency variability (LFV) of the atmosphere can be captured in a large-scale subspace, where a trajectory connects consecutive large-scale weather maps, thus revealing flow changes and recurrence. Using this approach, Vautard (1989) applied the trajectory-speed minimization method (Vautard and Legras, 1988) to atmospheric data. From 37 winters of 700 mb geopotential height anomalies over the North Atlantic and the adjacent land masses, four persistent and recurrent weather patterns, interpreted as weather regimes, were discernable: a blocking regime, a zonal regime, a Greenland anticyclone regime and an Atlantic ridge regime.

In this study, we investigate these regimes further in terms of

maintenance and transitions. A regime survey unveils preferences regarding event durations and precursors for the onset or break of an event. The transition frequencies between regimes vary, and together with the transition times, suggest the existence of easier transition routes. These matters are more systematically studied using complete synoptic map sequences from a number of events. In the maintenance of an event, oscillations between different balancing forces are observed, in connection with recurring nonlinear interaction sequences. Also the transition routes seem to contain particular evolution sequences leading to the next quasi-stationary flow pattern.