Abstract: The prediction formulas for large- or synoptic-scale weather patterns, one or several days in advance, are discussed in terms of present and past observations of similar patterns. The method and rationale of linear regression equations are set forth; and it is pointed out that, if the time series is periodic or, in general, if the integral of the logarithm of the spectrum diverges, the series is perfectly predictable since the geometric mean of the spectrum then vanishes. If instead, the series possesses a continuous spectrum, bounded away from zero, it is not perfectly predictable. In view of the fact that there is no evidence that the atmosphere behaves entirely periodically, it is proposed that nonlinear formulas can outperform linear formulas. An attempt is made to demonstrate this superiority by showing that deterministic systems of equations exist, the solutions of which vary aperiodically. In these equations, the error in predicting a finite time in advance may be made arbitrarily small, while linear predictability is still bounded by the Kolmogorov-Wiener result. On the basis of studies of linear formulas with predictor and predictands of North American sea level pressure, it was found that the best attainable statistical prediction formula should include some explicit nonlinearity. For this purpose, it was proposed to base the selection of predictors on the governing physical laws without abandoning statistical for numerical weather prediction. This is illustrated by a statistical study incorporating dynamic information and by a study aimed at determining whether the nonlinearity inherent in a numerical forecast could be incorporated into a statistical forecasting scheme. It is demonstrated that suitably chosen nonlinear formulas are superior to the best linear formulas in the short-range prediction of large- and synoptic-scale weather patterns.