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Local Winter Type Forecasting Based on Frost Sum and NAO-index Sum Regression Analysis

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Seasonal to interannual forecasting based on climatology and/or atmospheric circulation models is common nowadays. Coupled models of both the atmosphere and the ocean represent the most technically advanced approach (Harrison, 2005). This research aims on estimating frost sum (cumulative sum for Tdaily < 0) and NAO-index sum/trend behavior which give local winter type forecasts. With frost sum forecasts cold/mild 10 day periods, sea ice thickness and extent development can be estimated for January, February and March.

In current research Helsinki-Kaisaniemi station data 1844-1950 is the basis for the calculations. With cumulative frost sum starting from October we have defined linear and nonlinear 10, 20, 30 and 40 day regression equations for frost sum growth. The first 10-40 days approximations can be given in the beginning of January. With the linear and nonlinear equations we have tested Helsinki frost sum prediction skill during 1950-2000 and stations along the coastal area of southern Finland during winters 1981/1982... 2004/2005. Frost sum approximations are modified into sea ice thickness and sea ice largest extent forecasts (Myllys, 2004). It seems that these methods provide a practical tool for forecasting winter type development at least in southern Finland and Gulf of Finland. The skill of the frost sum approximation increases naturally towards March.

Similar approach as for the frost sum was used to define NAO-index sum growth. The regression analysis was done for standardized NAO index 1950-1980. It seems that it is possible to make forecasts for the NAO-index sum for the period 1981-2005 and correlation is high (0, 9). But the information gained like this is not straightforward to interpret. However it seems that the trend of the NAO-index sum between the winter

months provides information of probable weather type changes. Negative trend in this concept as in other NAO related studies (e.g. Cohen and Barlow, 2004) means a change towards a more stable and colder weather type. Positive trend means the opposite. Therefore it is considered that negative trend causing colder and less variable weather suggests using non-linear equations for frost sum forecasting. In case of a positive trend accompanied often by milder and more instable weather linear equations are assumed to be better for prediction purposes. The results for frost sum forecasts without and with NAO-index trend forecasts will be presented. The effect of these different approaches on ice thickness and ice extent forecasts is also discussed.