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Long-term weather predictability: Ural case study

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The accuracy of the state-of-the-art long-term meteorological forecast (at the seasonal level) is still low.
Here it is presented approach (RAMES method) realizing different forecasting methodology. It provides prediction horizon of up to 19-22 years under equal probabilities of determination of parameters in every analyzed period [1].

Basic statements of the method are the following.
1. Long-term forecast on the basis of numerical modeling of the global meteorological process is principally impossible. Extension of long-term prediction horizon could be obtained only by the revealing and using a periodicity of meteorological situations at one point of observation.
2. Conventional calendar is unsuitable for generalization of meteorological data and revealing of cyclicity of meteorological processes. RAMES method uses natural time intervals: one day, synodic month and one year. It was developed a set of special calendars using these natural periods and the Metonic cycle.
3. Long-term time series of meteorological data is not a uniform universal set, it is a sequence of 28 universal sets appropriately superseding each other in time.

The specifics of the method are:
1. Usage of the original research toolkit consisting of
- a set of calendars based on the Metonic cycle;
- a set of charts (coordinate systems) for the construction of sequence diagrams (of daily variability of a meteorological parameter during the analyzed year; of daily variability of a meteorological parameter using long-term dynamical time series of periods-analogues; of monthly and yearly variability of accumulated value of meteorological parameter).

2. Identification and usage of new virtual meteorological objects having several degrees of generalization appropriately located in the used coordinate systems.

3. All calculations are integrated into the single technological scheme providing comparison and mutual verification of calculation results.

During the prolonged testing in the Ural region, it was proved the efficiency of the method for forecasting the following meteorological parameters:
- air temperature (minimum, maximum, daily mean, diurnal variation, last spring and first autumn freeze);
- periods of winds with speeds of >5m/s and the maximal expected wind speed;
- precipitation periods and amount of precipitations;
- relative humidity;
- atmospheric pressure.

Atmospheric events (thunderstorms, fog) and hydrometeors also occupy the appropriate positions at the sequence diagrams that provides a possibility of long-term forecasting also for these events.

Accuracy of forecasts was tested in 2006-2009 years. The difference between the forecasted monthly mean temperature and actual values was <0.5ºC in 40.9% of cases, between 0.5ºC and 1ºC in 18.2% of cases, between 1ºC and 1.5ºC in 18.2% of cases, <2ºC in 86% of cases.

The RAMES method provides the toolkit to successfully forecast the weather conditions in advance of several years.

1. A.F. Kubyshen, “RAMES method: revealing the periodicity of meteorological processes and it usage for long-term forecast [Metodika «RAMES»: vyjavlenie periodichnosti meteorologicheskih processov i ee ispol’zovanie dlja dolgosrochnogo prognozirovanija]”, in A.E. Fedorov (ed.), Sistema «Planeta Zemlja»: 200 let so dnja rozhdenija Izmaila Ivanovicha Sreznevskogo. 100 let so dnja izdanija ego slovarja drevnerusskogo jazyka. LENAND. Moscow. pp. 305-311. (In Russian)