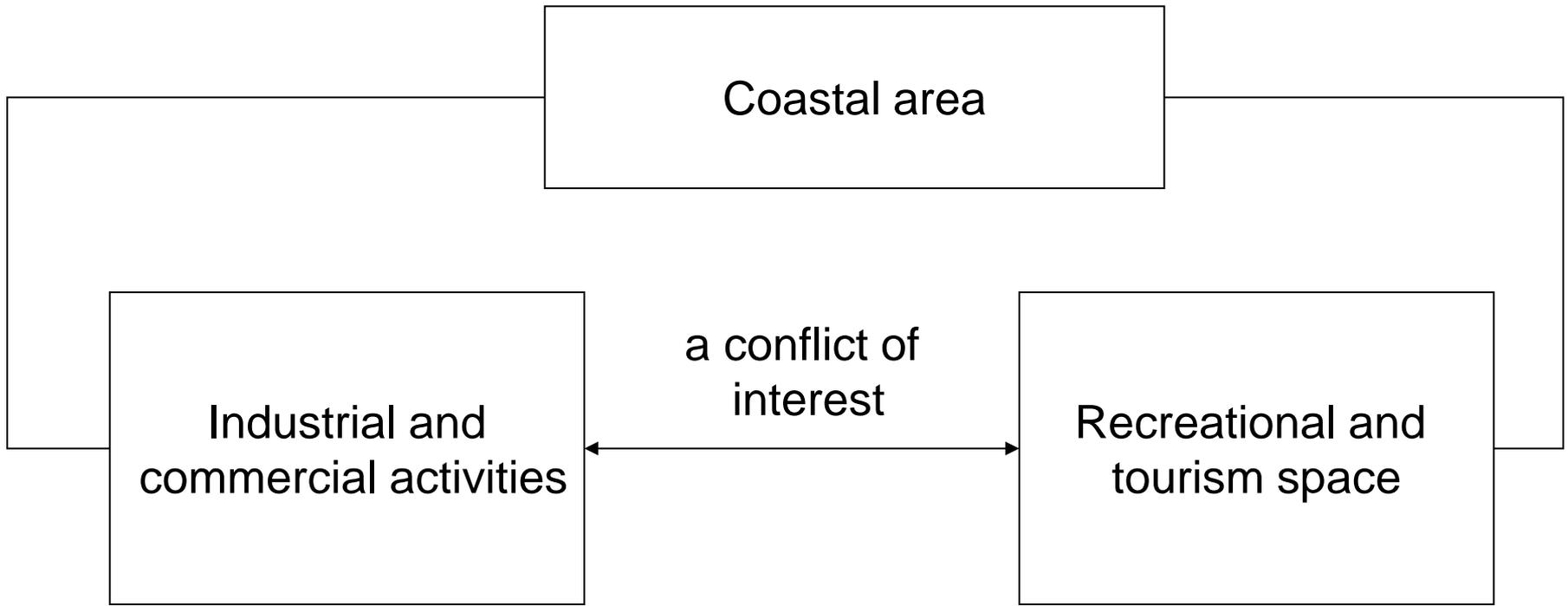


Istomin E.P., Sokolov A.G., Fokicheva A.A.,  
Slesareva L.S., Popov N.N.

**THE MANAGEMENT OF  
HYDROMETEOROLOGICAL RISKS IN SOCIO-  
ECONOMIC SYSTEMS OF COASTAL AREAS**

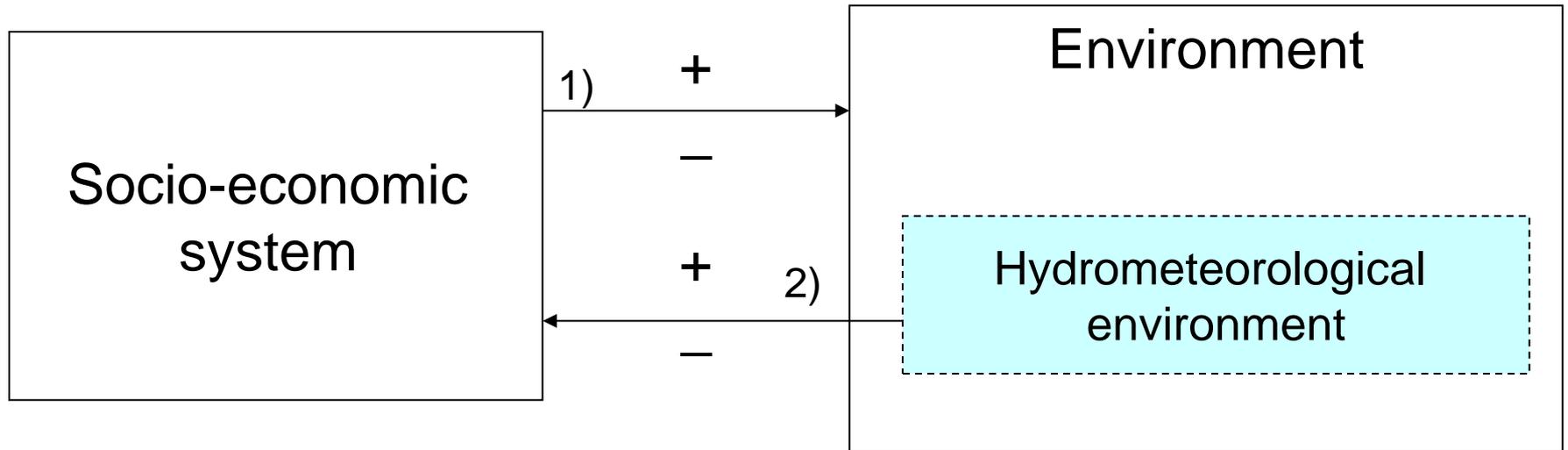
# Features of socio-economic systems of coastal areas:

- predefined spatial organization of Economics
- high population density



**Important: to ensure optimum use of natural resources by all participants of economic activity!**

# The interaction of socio-economic systems with the environment



1) the impact of socio-economic activities on the environment  
2) the influence of weather-climatic conditions on the results of socio-economic activities

Economic systems risks associated negative effects of the weather:

- **Current hydrometeorological risks** (due to daily fluctuations in weather conditions)
- **Catastrophic hydrometeorological risks** (due to extreme manifestations of weather and climate)

Important: both types of risks must be considered in strategic planning and operational management of the region

Need: inventory of economic entities in the region affected by hydro-meteorological risks.

The inventory procedure includes:

- compiling a list of weather-compensated sites in the region. determination of threshold values of meteorological and hydrological variables that can cause economic losses (for each group a weather-objects).
- determination of the extent of damage under different meteorological conditions (weather dependent for each object)

Important: any socio-economic system characterized by the susceptibility and vulnerability to the negative impact of hydro-meteorological environment

**The exposure** is determined by the characteristics of influencing weather conditions depends on the extent of the economic objects located in this territory, and their density.

**The susceptibility** characterizes the potential impact of weather conditions on economic activity and should be considered in the development of strategic plans for the development of the territory

**Vulnerability** is the susceptibility of the socio-economic system to the adverse effects from exposure to hydrometeorological conditions (economic and social losses).

**The degree of vulnerability** depends on the capacity of the socio-economic system to protect against adverse meteorological conditions.

Vulnerability characterizes the actual impact of hydro-meteorological environment on the socio-economic system (shows the response of the system)

## Assessment of hydrometeorological risks:

- **hazard** assessment (probability of occurrence of adverse meteorological conditions)
- **vulnerability** assessment (damage assessment when implementing adverse meteorological conditions).

Important: the management of hydrometeorological risks are managed in the territory - the economy - the environment and aims to reduce economic losses

**Adaptation of the object** to adverse weather conditions is a complex process of adaptation of economic activity to the expected weather:

- the information component
- technical component
- economic component

### **The stages of adaptation**

- preliminary development of protective measures (including the intensity and duration of meteorological factor)
- implementation of protective actions in anticipation of inclement weather

The choice of measures of protection shall consider:

- 1.The level of production (demand forecasts)
- 2.The specifics of the protected object
- 3.Industrial and geographical scale of the object
- 4.The period of time required to bring the protective measures into action
- 5.Organizational, technical and financial support
- 6.The role of the insurance operations and the recoverability of losses

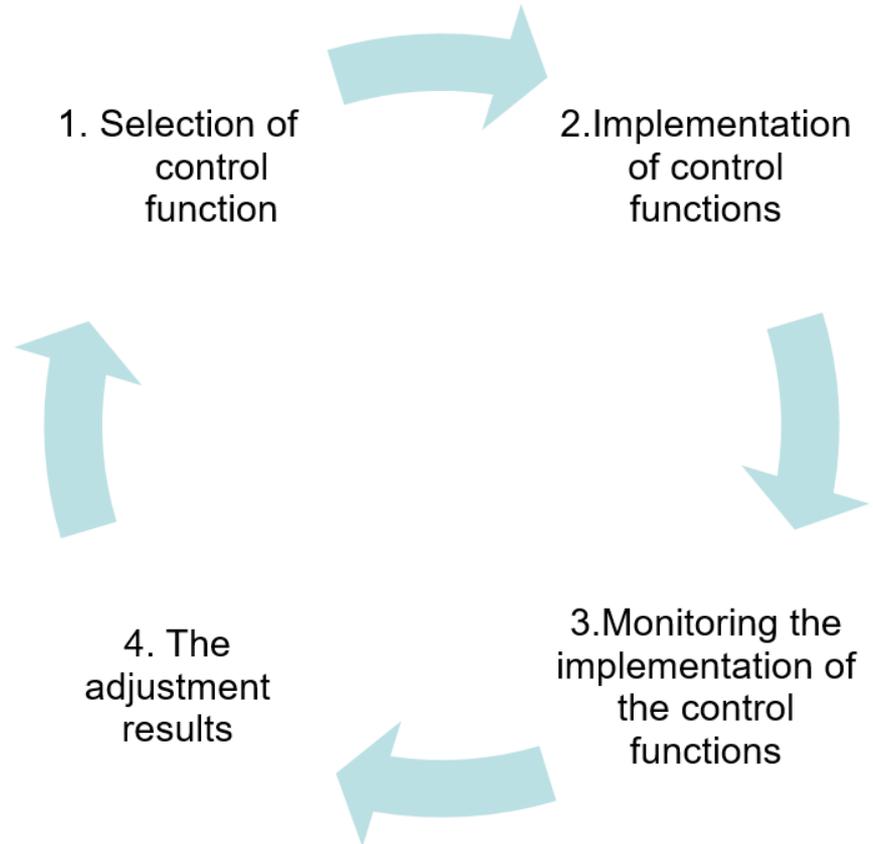
Important: the use of weather forecasts allows you to reduce the damage for meteorological reasons due to timely measures of protection.

Risk management related to the choice of managerial decisions under conditions of partial uncertainty of hydrometeorological state of the environment

# Management of operational hydrometeorological risk

**Operational management of the economic-meteorological risk in the cycle of the decision-making process.**

**The goal of management is minimizing losses due to meteorological reasons.**



Important: operational risk management involves the use of specialized hydrometeorological information

# Selection of the optimal decisions under conditions of partial uncertainty

## Background information:

- Meteorological (matrix conjugate forecasts)
- Economic (consumer loss matrix)

## General view of the matrix of contingency alternative projections

Actually experienced, $\Phi_i$	Predicted, $\Pi_j$		$\sum_{j=1}^m n_j$
	$\Pi$ - the presence of unfavorable weather	$\bar{\Pi}$ - the lack of unfavorable weather	
$\Phi$ –unfavorable weather was observed	$n_{11}$	$n_{12}$	$n_{10}$
$\bar{\Phi}$ - unfavorable weather was not observed	$n_{21}$	$n_{22}$	$n_{20}$
$\sum_{i=1}^n n_i$	$n_{01}$	$n_{02}$	$N$

## Development of contingency matrices:

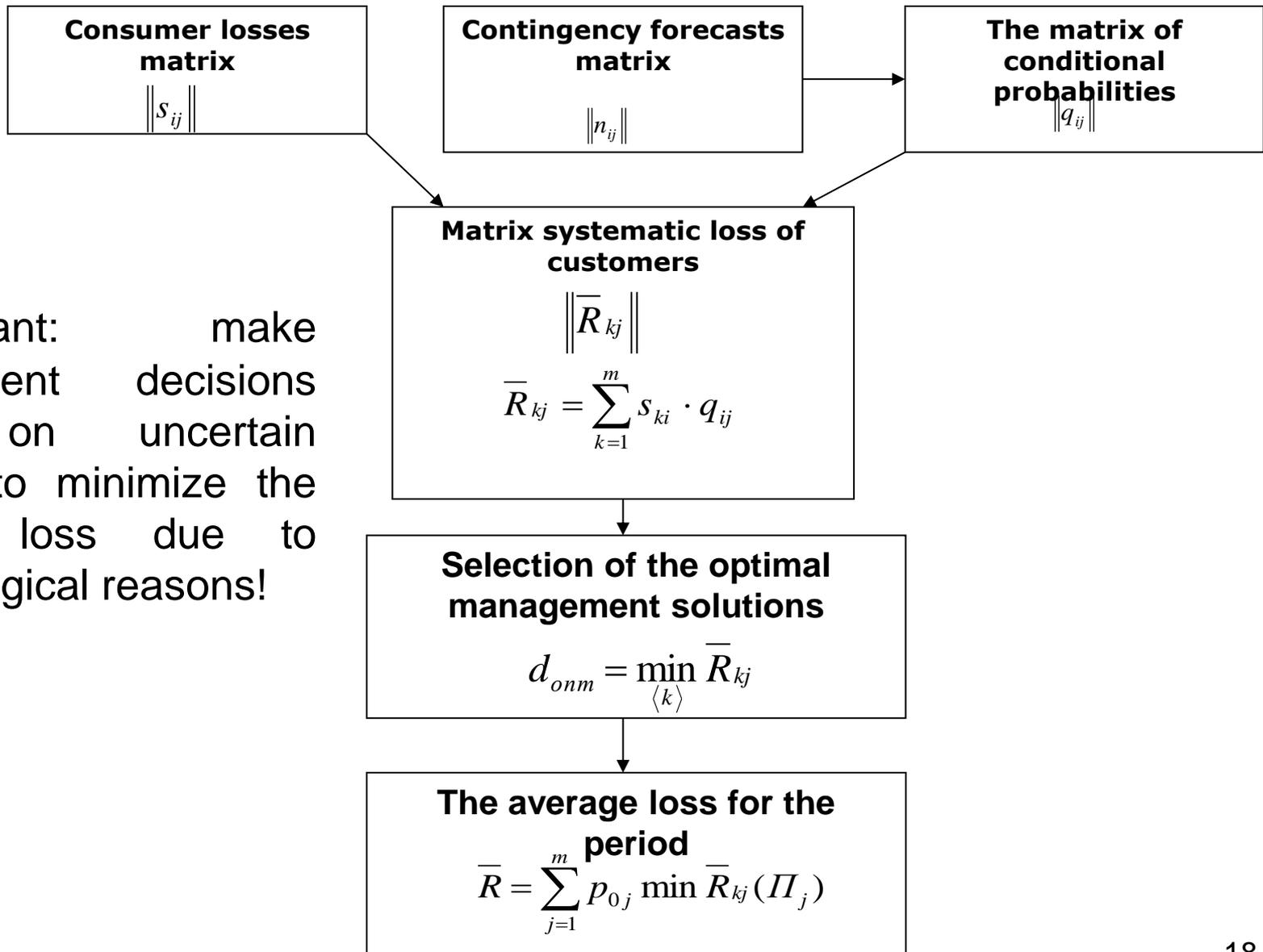
- meteorological factor threshold value determined by the specific production activity of the consumer
- requires binding to time and territory (accounting features of synoptic processes, methods of forecasting, providing statistical significance of results)

# Matrix of consumer losses

It was actually observed $\Phi_i$	Consumer makes a decision $d$ , being guided by the forecast $\Pi_j$	
	$d(\Pi)$ - Accepted measures of protection (according to the text of the forecast bad weather is expected)	$d(\bar{\Pi})$ Protection measures are not taken (the text of the unfavorable weather forecast is not expected)
$\Phi$ - unfavorable weather was observed	S11	S12
$\bar{\Phi}$ - unfavorable weather was not observed	S21	S22

1.  $d(\Pi) \sim \Phi: s_{11}$  - the cost of protective measures (protective measures justified). The user applies the protection measures, waiting for bad weather (according to the text forecast). Applied by the consumer protection measures are effective and fully prevent losses due to meteorological reasons.
2.  $d(\Pi) \sim \bar{\Phi}: s_{21}$  - the cost of security measures (taken in vain protections). The user applies the security measures in anticipation of bad weather (according to the text of the forecast), but favorable weather conditions actually observed.
3.  $d(\bar{\Pi}) \sim \Phi: s_{12}$  - the maximum possible loss. The consumer does not use security measures, waiting for favorable weather (according to the forecast of the text). In fact, there are dangerous weather conditions
4.  $d(\bar{\Pi}) \sim \bar{\Phi}: s_{22}$  - the loss of the consumer with the successful prediction of favorable weather conditions,  $s_{22}=0$  .

# Selection of the optimal management (weather and economic) decisions



Important: make management decisions based on uncertain weather to minimize the average loss due to meteorological reasons!

Thank you for attention!