



Asset Management and Climatic Risks

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JSC NIIAS

Russian Railways Assets

Infrastructure:

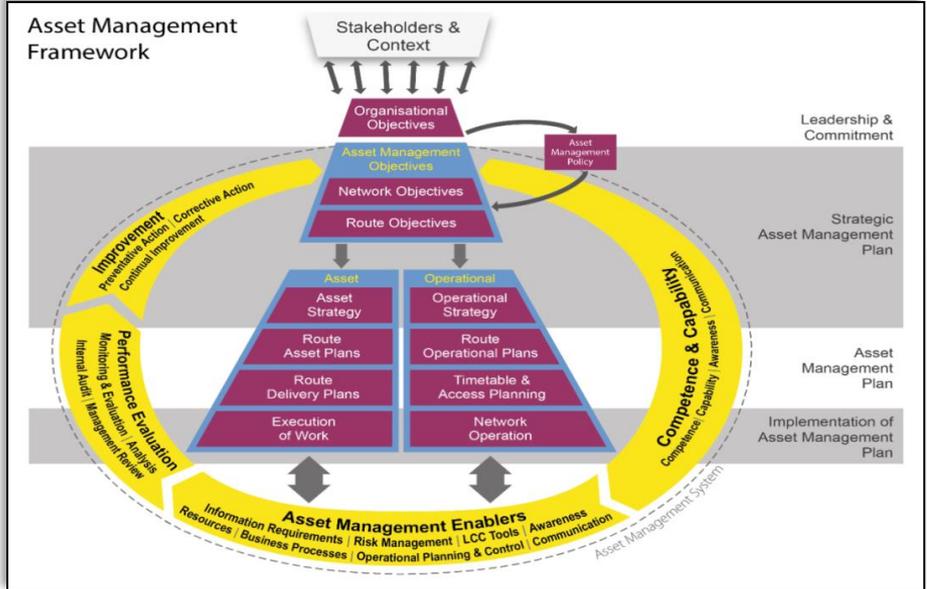
Length of operational tracks	85 300 km
Length of electrified lines	43 100 km
Lines equipped with signalling equipment	62 196 km
Railway stations	5 428
Traction substations	1 402
Service units (track divisions)	742



Rolling stock fleet:

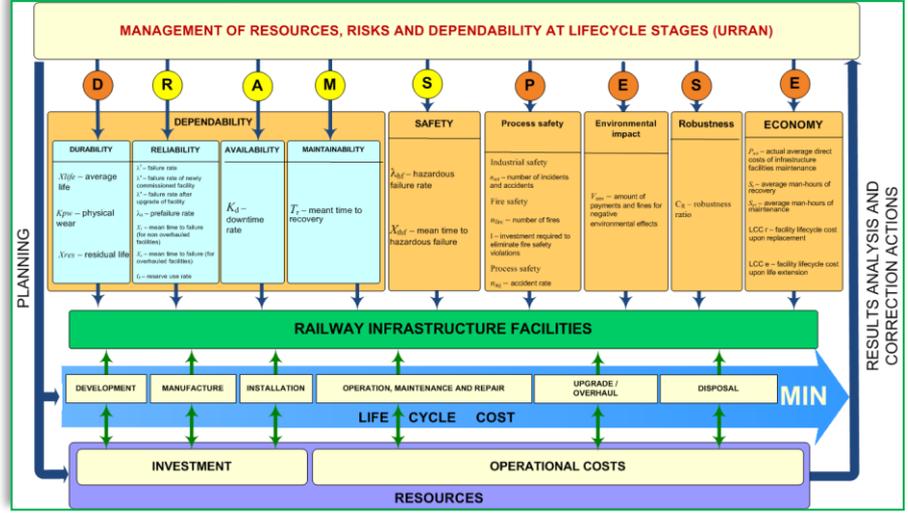
Freight locomotives (electric and diesel)	11 191
Freight cars of all types and owners	1 600 000
Shunting engines (diesel)	6 016
Long-distance passenger cars	24 100
Commuter cars	15 600
Motive power and car depots	411

Asset Management (ISO 55000:2014)



UIC ISO 55000 Guidelines Document
 ISO 55001 Implementation Guidelines
 for Railway Infrastructure Organisations

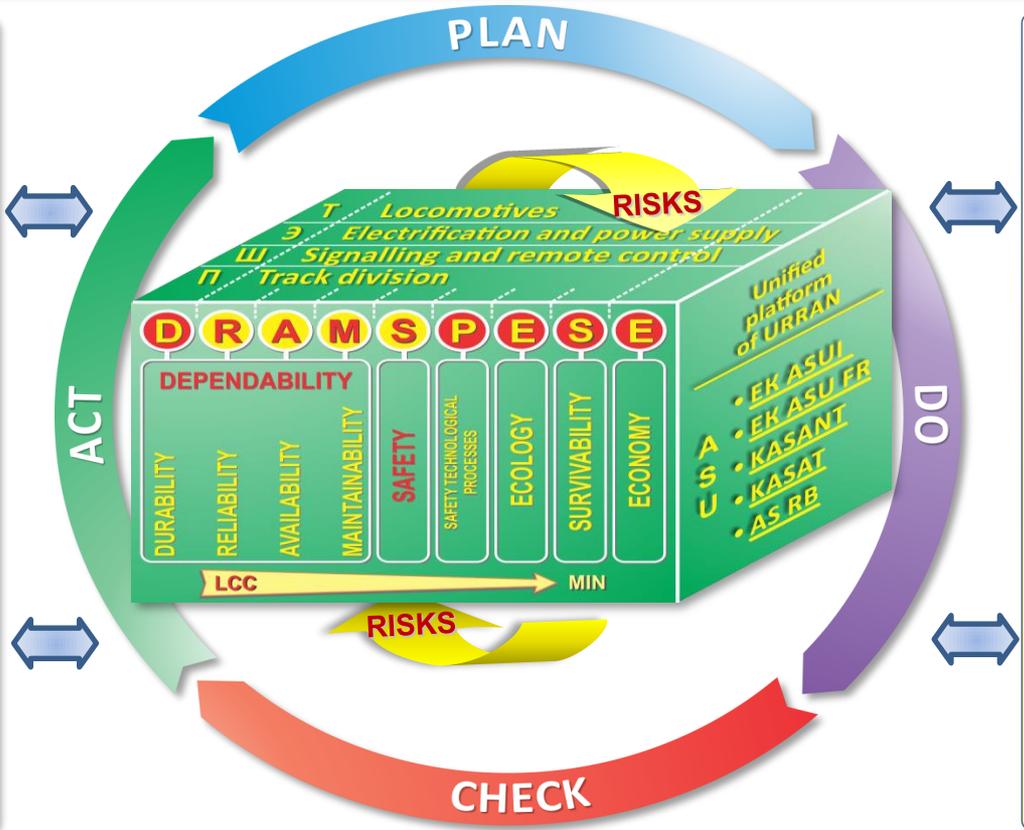
URRAN System



Asset Management in RZD (URRAN System)

OBJECTS OF TECHNICAL REGULATION

- Track facilities
- Electrification and power supply
- Signalling and remote control
- Telecommunication facilities
- Fleet

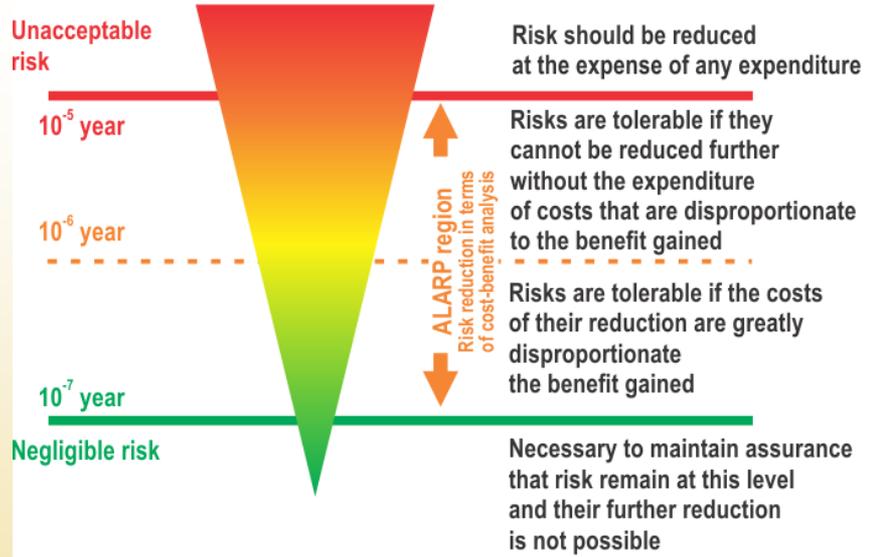


BASIC PROCESSES OF RAILWAY TRANSPORT MAINTENANCE

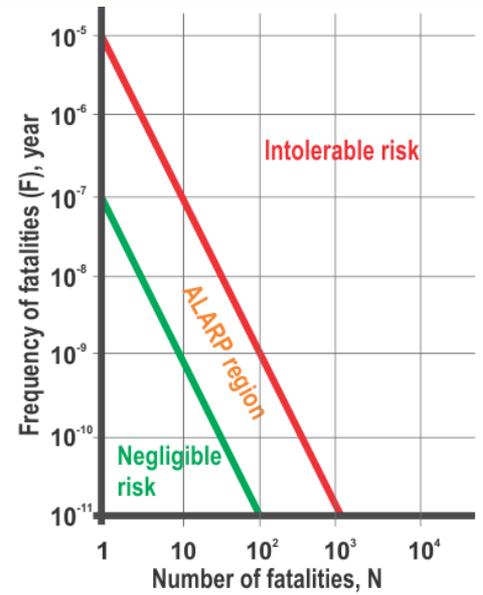
- Maintenance of infrastructure facilities and rolling stock
- Modernization of infrastructure and rolling stock
- Procurement management
- Management of environmental, fire, industrial and labor safety
- URRAN normative and methodological framework — over 125 documents

ALARP Principle

ALARP (Risk As Low As Reasonably Practicable)



a) ALARP based on the criterion of individual risk acceptability



b) ALARP based on FN diagram for the criterion of social risk acceptability

Acceptable risk level according to ALARP principle is such a level of risk that cannot be reduced further and so, expenditures spent to reach it are economically beneficial.

Common Industrial Platform in compliance with ISO 55000:2014



I. System for comprehensive management of operational assets at all lifecycle stages

Intended for increased efficiency of company operations based on adaptive management under conditions of limited resources.

- Improvement of work productivity
- Intensification of company infrastructure utilization
- Reduction of industrial disaster risk
- Improvement of capital investment and operational costs efficiency
- Decision-making based on asset condition evaluation
- Improvement of condition and failure prediction accuracy
- Risk, income, costs management at all lifecycle stages of an asset



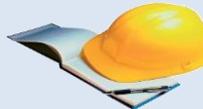
1.1. Integrated automated system for recording, investigation and analysis of technical failures (KAS ANT)

- Reduction of the number of technical failures
- Improvement of the quality of products acquired from suppliers
- Reduction of downtime at mass production enterprises



1.2. Integrated automated system for recording, investigation and analysis of process violations (KASAT)

- Improvement of the quality of business processes
- Reduction of non-production losses
- Improvement of work productivity and personnel motivation



1.3. Corporate automated system for employee workplace and fire safety knowledge monitoring

- Reduction of labor effort of organization, holding and documentation of training
- Elimination of the human factor in employee rating
- Improvement of technical training planning efficiency



1.4. Integrated automated system for investment projects performance monitoring

- Improvement of timeliness and efficiency of investment projects implementation
- Improvement of accuracy and efficiency of information exchange among project managers, customers, supervisors, asset holders and contractors

Common Industrial Platform in compliance with ISO 55000:2014



II. Innovative technologies of supervision and control of technical safety

Intended for condition monitoring of fire, industrial and environmental safety, analysis and planning of related activities.

- Improvement of fire, industrial and environmental safety
- Reduction of charged penalties
- Optimization of insurance expenditures
- Improvement of the efficiency of capital and operational expenditures related to the above safety activities



2.1. Automated systems for industrial safety management of dangerous manufacturing facilities

- Reduction of charged penalties related to industrial safety violations
- Optimization of insurance of dangerous manufacturing facilities
- Electronic delivery of information on operational supervision of dangerous manufacturing facilities to the Federal Environmental, Industrial and Nuclear Supervision Service of Russia
- Ensuring accuracy and immediacy of information on dangerous manufacturing facilities
- Improvement of industrial safety



2.2. Automated system for fire safety management of protected facilities

- Improvement of efficiency of fire safety supervision of protected facilities
- Improvement of efficiency of fire prevention activities
- Reduction of charged penalties related to fire safety violations
- Improvement of efficiency of fire safety activities implementation through objective evaluation of fire risks



2.3. Automated system for environmental safety and nature protection activities management

- Improvement of efficiency of natural resources management supervision
- Improvement of the accuracy and immediacy of accountancy through automated document management
- Reduction of costs related to submission of reporting documentation to national executive authorities through electronic reporting
- Improvement of objectivity of natural resources management analysis
- Insurance of efficiency of environmental protection activities planning
- Insurance of efficiency of environmental protection activities
- Reduction of charged penalties related to environment protection legislation
- Reduction of natural resources management payments to the minimum possible level

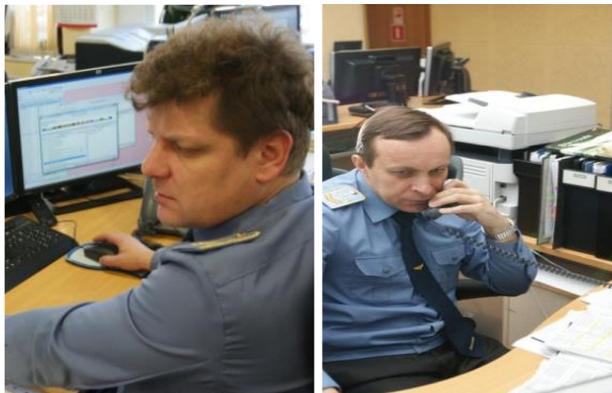
Some Climatic Impacts on Railway Operations

- ❑ Icing of railway contact wires.
- ❑ Heavy snowfalls causing breaks of catenaries.
- ❑ Heavy rains leading to flooding of track.
- ❑ Thunderstorms and high wind leading to falling trees and breaks of catenaries.
- ❑ Fires during hot summer periods.



May 2017, Moscow

RZD Situational Centre



Primary Tasks of Situational Center

- Safety monitoring of railway infrastructure and rolling stock in operation
- Forecasting the risk of traffic incidents and other events, development of preventive measures
- Quick response to traffic incidents and emergencies, recovery operations
- Reporting to JSC RZD top management of traffic, operations, transportation and fire safety at JSC RZD infrastructure facilities

About **2 000 messages** as regards traffic safety are processed daily by operational shift dispatchers

About **1 000 000 messages** as regards traffic safety are processed monthly by analysis unit specialists



Selection of Approach Routes to Emergency Site

Ситуационный центр
мониторинга и управления чрезвычайными ситуациями ОАО «РЖД»

РЖД Российские железные дороги

Выход

ТЕЛЕПРОВОДНИК
© 2011. Разработка и поддержка

Выберите радиус мобилизационной зоны, км.

Показать все Цель по центру 10 км Проложить маршруты Печать Руководство Пользователя

Поиск Поиск по адресу или координатам (долгота) Добавить Цель - левобере

Обновить

Выберите категории для отображения на карте

- больницы
- маршрут
- полиция(в т.ч. участковые)
- ГИБДД
- посты ДПС
- пожарные станции
- АЭС
- автомастерские
- шиномонтажные мастерские

ЖД станции

- РЖД

Мониторинг пожаров

Мониторинг погоды

Мобилизационная карта ликвидации ЧС

Google OpenStreetMap Яндекс Схема Спутник Гибрид

Пробки

Маршрут: № 25

Старт: Военный Госпиталь

Финиш: местоположение Цели

Время в пути: 21 мин.

Расстояние в пути: 11.3 км

Печать

Информация на карте:

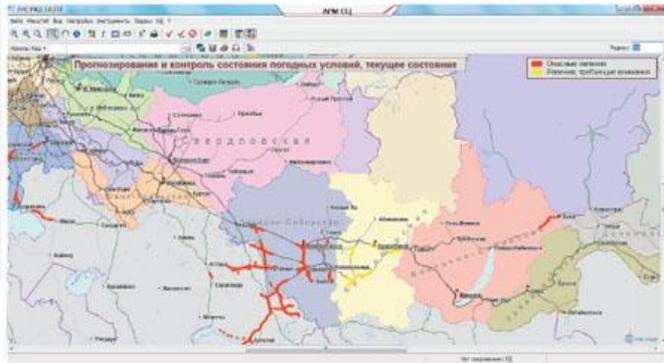
- Местоположение Цели (красная метка)
- Военный Госпиталь (красная метка)
- Пожарные станции (красные кресты)
- Полиция (красные звезды)
- ГИБДД (красные буквы)
- Посты ДПС (красные буквы)
- АЭС (красные буквы)
- Автомастерские (красные буквы)
- Шиномонтажные мастерские (красные буквы)
- ЖД станции (красные буквы)

2 км

Яндекс

Information on the nearest location of emergency services: police, hospitals, traffic police, fire stations, etc.

Weather Monitoring and Forecasting



Environmental conditions information

Reporting of environmental conditions at railways facilities based on data supplied by JSC RZD weather and hydrological stations

Identification of conditions threatening traffic safety

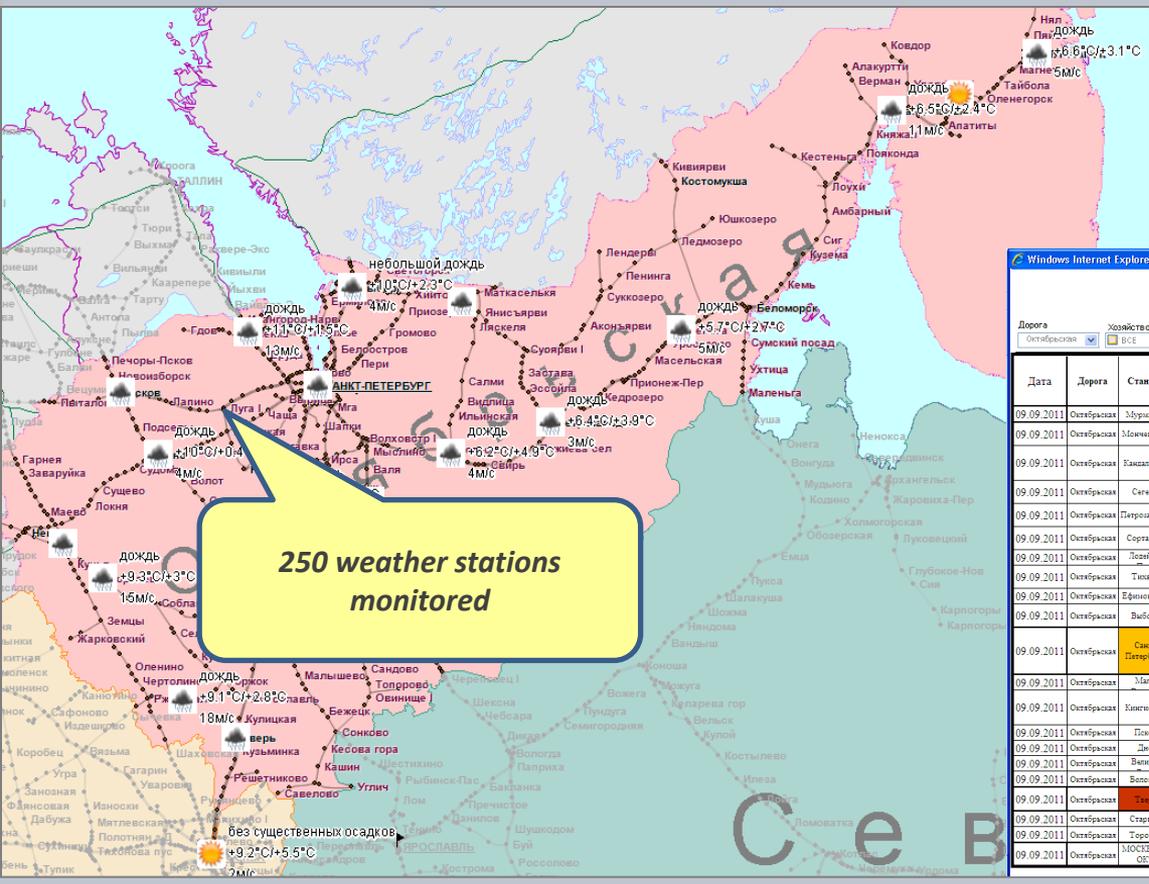
Processing of reports and forecasts aimed at identifying hazardous weather conditions affecting railway operations and requiring preventive measures

Planning of preventive measures

Generation of the list of measures per railway facilities foreseen for the case of hazardous environmental conditions



Monitoring and Forecasting of Weather Conditions



Analysis of the onset of weather conditions threatening traffic safety

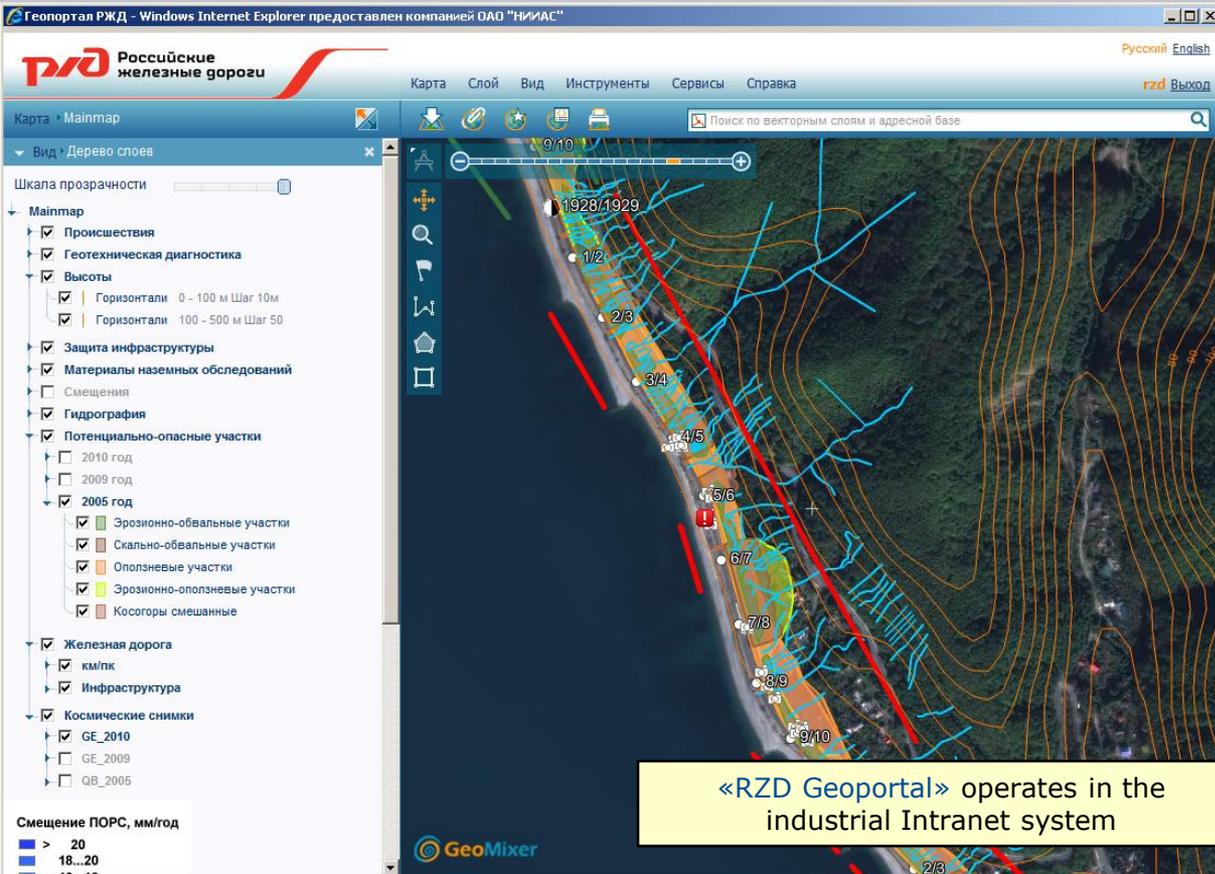
ГЕОЛОГИЧЕСКАЯ СВОДКА
по Октябрьской железной дороге
за 09.09.2011.

Влияние Опасных явлений - 2

Дата	Дорога	Станция	Гидромет	Температура воздуха (град.С)				Осадки (мм)			Ветер (М/с)			Снежный покров(см)		Явление погоды	Явление природы	Профилактические меры			
				день	ночь	макс	мин	день	ночь	проезд	день	ночь	макс	Н (см)	узал				ночи		
09.09.2011	Октябрьская	Муромская	Муромская	4	1	6	3	0	4	0	0	0	2	0	3	0	0	0	дождь		
09.09.2011	Октябрьская	Молочковский	Молочковский	4	1	6	3	0	4	0	0	0	2	0	3	0	0	0	кратковременный дождь		
09.09.2011	Октябрьская	Гандлицкая	Гандлицкая	6	1	8	5	0	6	0	0	0	3	5	10	0	0	0	ясно	возможен порывистый ветер	проверить линии связи и парализ
09.09.2011	Октябрьская	Сегежа	Сегежа	8	4	10	7	3	8	10	10	20	5	5	8	0	0	0	облачно, дождь		
09.09.2011	Октябрьская	Петрозаводск	Петрозаводск	8	4	10	7	3	8	20	20	40	7	5	11	0	0	0	облачно, дождь		
09.09.2011	Октябрьская	Сортавала	Сортавала	7	4	9	6	3	7	10	10	20	1	5	7	0	0	0	кратковременный дождь		
09.09.2011	Октябрьская	Ловозеро	Ловозеро	9	6	11	8	5	9	0	0	0	2	4	6	0	0	0	облачно		
09.09.2011	Октябрьская	Тиквино	Тиквино	8	4	10	7	3	8	10	10	20	1	2	2	0	0	0	небольшая осадки		
09.09.2011	Октябрьская	Ефремовский	Ефремовский	9	5	11	8	4	9	0	0	0	0	2	2	0	0	0	облачно		
09.09.2011	Октябрьская	Выборг	Выборг	11	7	13	10	6	11	10	10	20	2	2	3	0	0	0	небольшая осадки		
09.09.2011	Октябрьская	Санкт-Петербург	Санкт-Петербург	10	6	12	9	5	10	10	0	10	25	20	27	0	0	0	дождь	Штормовое предупреждение на	Проверить линии связи, ССВ, проверить пути на возможное появление деревьев.
09.09.2011	Октябрьская	Малая	Малая Вешера	13	9	15	12	8	13	3	10	13	10	0	15	0	0	0	дождь		
09.09.2011	Октябрьская	Клинтосел	Клинтосел	16	11	18	15	10	16	0	0	0	2	0	3	0	0	0	облачно, возможны дождь		
09.09.2011	Октябрьская	Псков	Псков	14	10	16	13	9	14	0	0	10	0	0	0	0	0	0	дождь		
09.09.2011	Октябрьская	Дно	Дно	14	10	16	13	9	14	0	0	0	1	0	1	0	0	0	облачно		
09.09.2011	Октябрьская	Вичинка	Вичинка Луки	14	10	16	13	9	14	0	0	20	20	0	0	0	0	0	ясно		
09.09.2011	Октябрьская	Волого	Волого	13	9	15	12	8	13	0	0	0	0	0	3	0	0	0	облачно		
09.09.2011	Октябрьская	Тярь	Тярь	30	25	32	12	8	13	0	0	0	0	0	3	0	0	0	облачно		Проверить состояние пути.
09.09.2011	Октябрьская	Старая	Старая	13	9	15	12	8	13	0	0	0	0	0	3	0	0	0	облачно		
09.09.2011	Октябрьская	Торопец	Торопец	13	9	15	12	8	13	0	0	0	0	0	3	0	0	0	облачно		
09.09.2011	Октябрьская	МОСКВА-Т-ОДТ	Москва	13	9	15	12	8	13	0	0	0	0	0	3	0	0	0	облачно		

«RZD Geoportal»

Industrial System for Geospatial Information Distribution



«RZD Geoportal» operates in the industrial Intranet system

- Provides user access to up-to-date geospatial information
- ERS imagery is licensed for JSC RZD use
- Reduces ERS data cost by eliminating repetitive purchase of images
- RSD Geoportal is a platform allowing to display and analyze geospatial information referenced to operational (linear) coordinates

Radar Satellite Monitoring of Railway Infrastructure



Karst-related track collapse in the Lvov region



Landslide effect at the North Caucasian railway



Track destruction on the North Caucasus railway caused by landslide process

- early detection of roadbed slumps, slope slides
- detection of karst and cryogenic processes appearances
- monitoring of landslide and rock-fall slopes
- monitoring of buildings and structures stability
- infrastructure protection measures efficiency monitoring



Derailed on the Shimanovskaya – Seletkan line caused by cryogenic processes



Track deformation on the Kharp – Labytnangi line caused by cryogenic processes



Deformation of a bridge over the Norilskaya river

Track Deformations, Damages and Obstruction Caused by Development of Dangerous Natural Processes and Phenomena

Causes of abrupt railway track deformations in coastal and mountainous areas

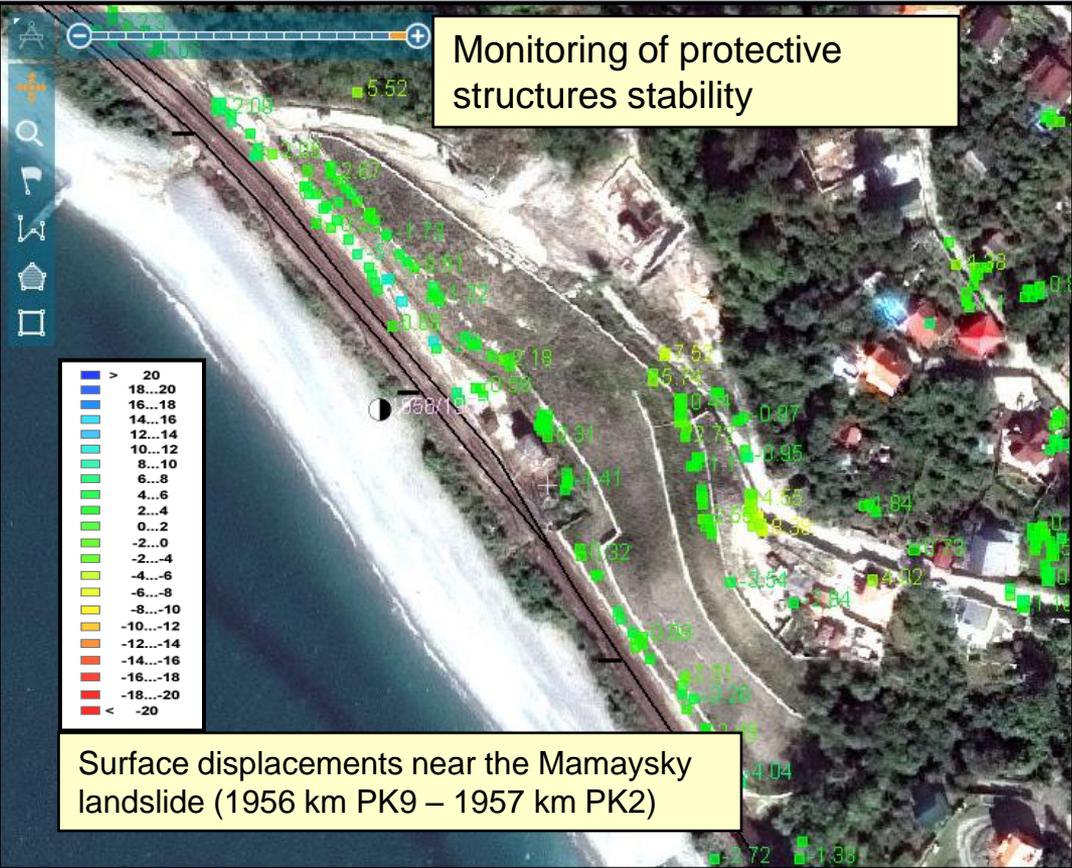
Year	Washout	Landslide	Mudflow	Rock fall	Avalanche	Total
2005	10	3	1	4	9	27
2006	14	1	2	7	21	45
2007	3	-	-	13	4	20
2008	3	-	3	27	22	55
2009	12	-	2	6	12	32
2010	27	6	-	10	13	56
2011	8	10	1	12	3	34
2012	12	-	15	4	4	35
Total	89	20	24	83	88	304

Data provided by Center for Artificial Facilities – JSC RZD subsidiary

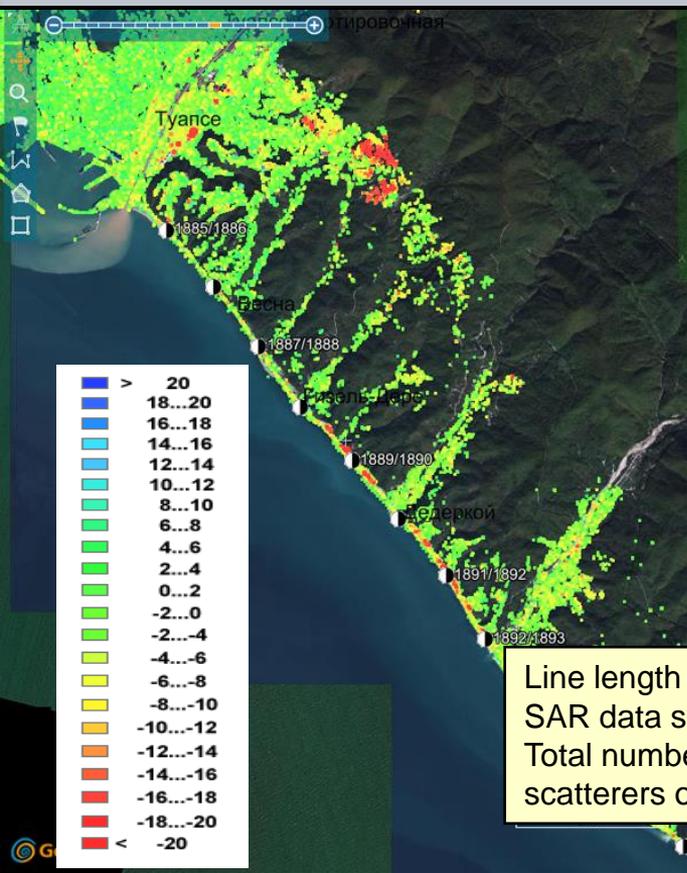
Hazardous natural processes and phenomena:

- Coastal abrasion
- Mudflows
- Floods
- Erosion processes
- Landslide and mud-gutter
- Rock falls and crumbles
- Karst depression
- Suffusion subsidences
- Icing
- Thermo karst
- Thermo erosion
- Solifluction
- Rupturing deformations
- Frost heave
- Avalanches
- Earthquakes

Monitoring of Efficiency of Landslide Stabilization Measures

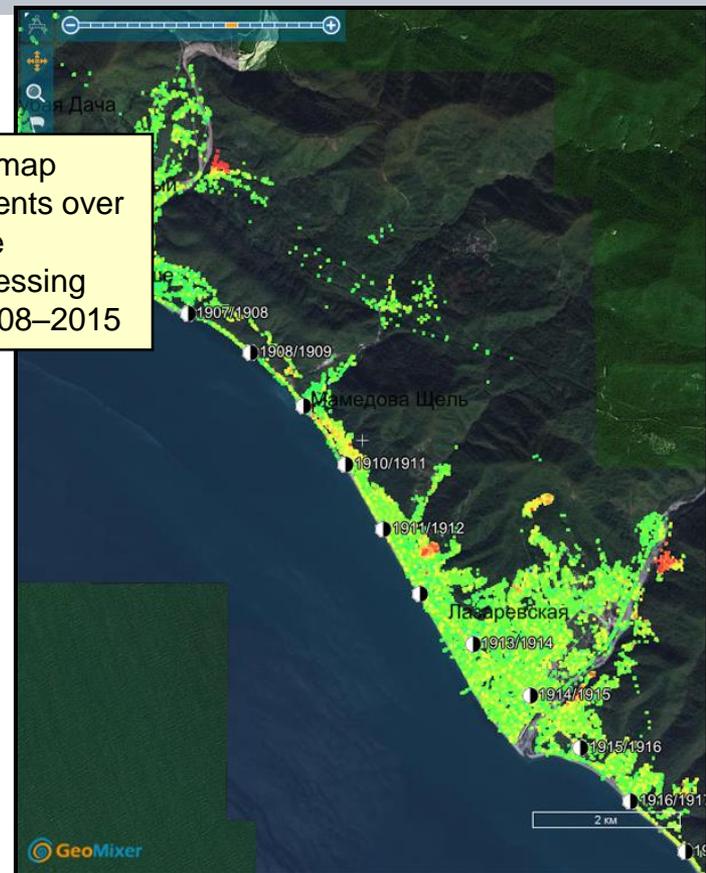


Identification of Active Geodynamic Process Areas by SAR Data Processing



Fragments of the general map of the Earth surface displacements over the Tuapse – Adler line based on the results of processing of COSMO-SkyMed data in 2008–2015

Line length - 115 km
SAR data swath width - 2 km
Total number of identified persistent scatterers of SAR signal - over 2 mln



Map of Spectra of Exogenous Geomorphologic Processes Composition

КАРТА СПЕКТРОВ ЭКЗОГЕННЫХ ГЕОМОРФОЛОГИЧЕСКИХ ПРОЦЕССОВ НА РАЙОН ЖЕЛЕЗНОЙ ДОРОГИ УЧАСТКА ТУАНСЕ-АДЛЕР



Spectra of exogenous geomorph. processes:

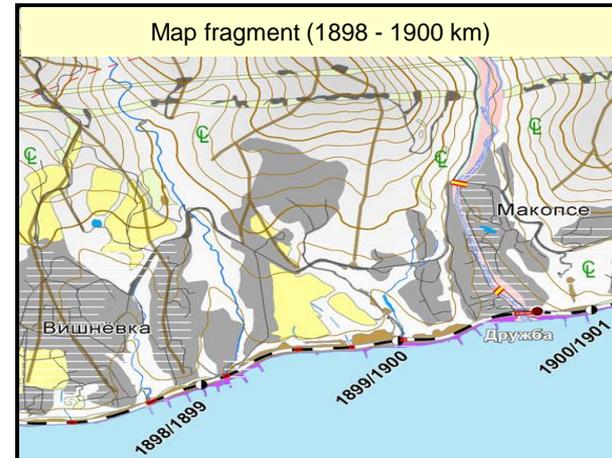
	Дефлюкционно-оползневой склоновый лесной
	Дефлюкционно-оползневой склоновый луговой
	Обвальнo-осыпной скальных обнажений
	Флювиальный русловой
	Озерно-седиментационный водоемов
	Флювиальный пойменный
	Флювиальный надпойменных террас
	Абразионно-аккумулятивный морской
	Антропогенный на участках плотной застройки
	Антропогенный (сельскохозяйственный)
	Антропогенный на карьерах, отсыпках, свалках и пр.
	Водоразделы
	Водные ПТК
	Крупные водные объекты
	Средние водотоки
	Малые водотоки
	Сезонные водотоки
	Дорожная сеть
	Железная дорога
	Другие железные дороги
	Автомобильные дороги
	Тоннели

Map provides:

- analysis of specificity of processes development inside landscape allocations considering their mutual location and relief characteristics
- analysis of direction of processes influence considering relief characteristics and presence of way of influence transit (currents, roads)

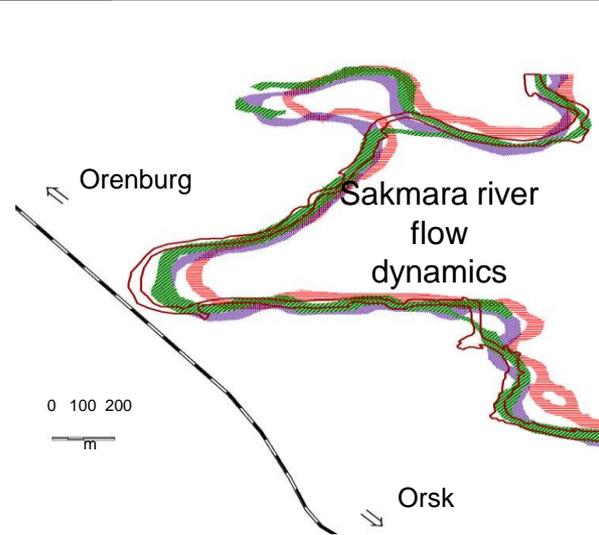
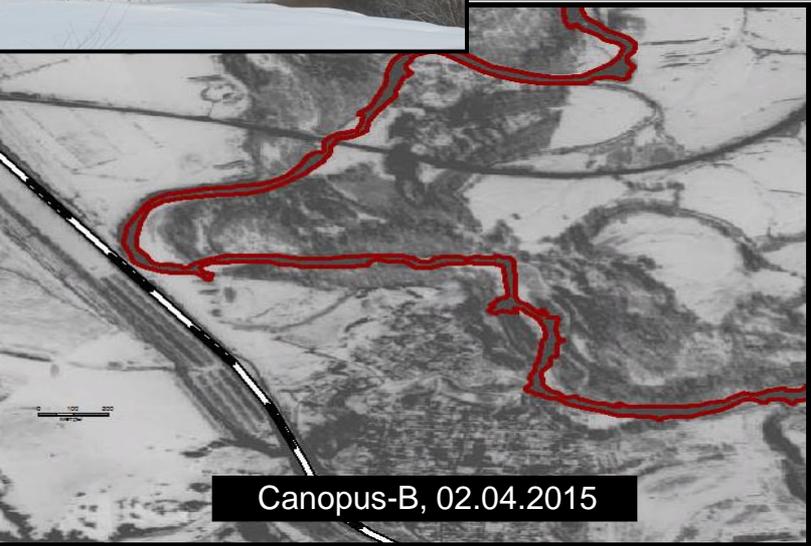
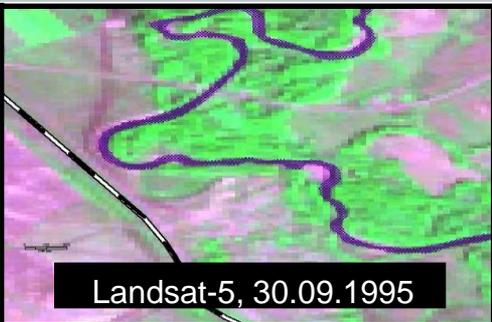
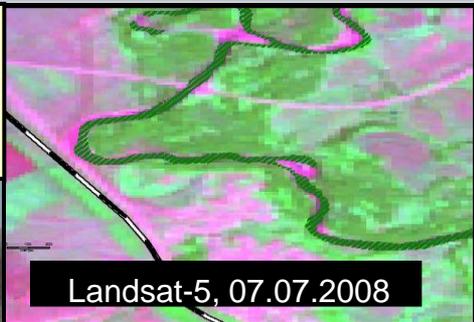
It is utilized for linear zoning of railway track and efficient planning of detailed in-situ inspections, providing minimization of costs

Map fragment (1898 - 1900 km)



Evaluation of Potentially Dangerous Processes for Railway River-flow and Erosion by Retrospective Satellite Data Analysis

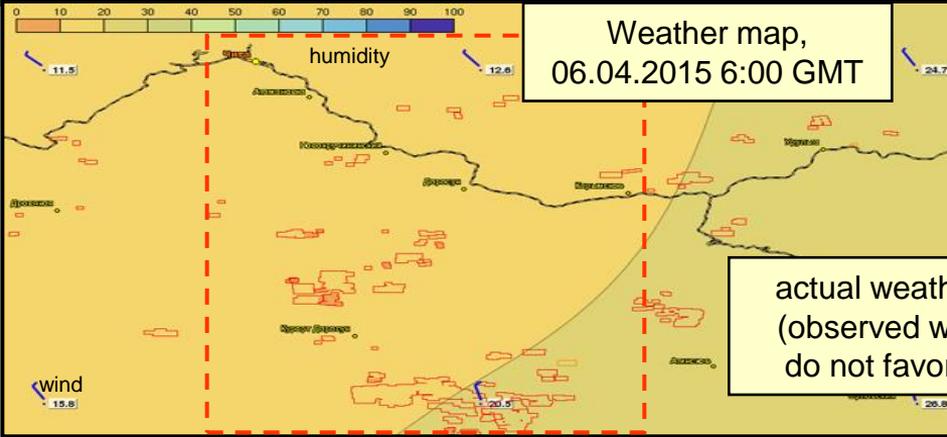
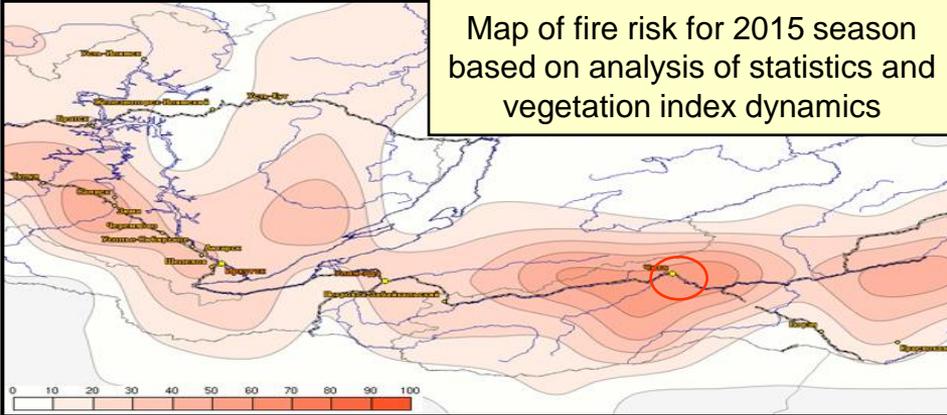
River Sakmara meandering flow dangerous approach to railway at 126–127 km of Orenburg – Orsk line



Retrospective analysis of archive ERS data shows the dynamics of erosion process during last 30 years

- Estimated distance of river bank to railway
- 02.04.2015 – 38 m
 - 07.07.2008 – 100 m
 - 30.09.1995 – 130 m
 - 11.05.1984 – 230 m
 - railway line

Fire Risk Assessment for Railway Infrastructure



actual weather conditions (observed wind direction) do not favor fire impacts



UIC Affiliate Member



Thank you

www.vniias.ru