Sand and Dust Storms Risk Assessment in Asia and the Pacific

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**Intergovernmental Mandate**

**ESCAP resolution 72/7 (2016)** requested the secretariat to promote regional and interregional networking on sand and dust storms.

**Tehran Ministerial Declaration on Combating SDS (2017)** recognized the role of APDIM in developing human and institutional capacities in disaster information management.

**ADPIM first Governing Council (2016)** mentioned APDIM can serve as a repository for a geospatial database on sand and dust storms in the ESCAP subregions.

**General Assembly resolution 70/195 (2016)** acknowledged role of UN system in promoting international cooperation to combat sand and dust storms.
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Chapter 1. Sand and Dust Storms in Asia and the Pacific
- Sand and Dust Storms Impact on Sustainable Development
- The Intergovernmental Mandate for Sand and Dust Storms

Chapter 2. Developing a Methodology
- The Conceptual Framework for Risk Assessment
- Measuring Risk

Chapter 3. Sand and Dust Storms Risk in Asia and the Pacific - Sectoral Risk Analysis
- Human Health
- Energy
- Transport – Aviation
- Agriculture
- Environment
- Urban

Chapter 4. Projection of Sand and Dust Storms in the Region and Economic Loss
- Projected Sand and Dust Storm Trends
- Assessing and Projecting Economic Losses due to Sand and Dust Storms

Chapter 5. Findings and policy implications
- Risk Assessment Findings
- Sand and Dust Storms Risk Management
Sand and Dust Storms Risk Assessment in Asia and the Pacific

Sectors Covered in the Risk Assessment

- Agriculture
- Energy
- Environment
- Health
- Transport (Aviation)
- Cities

Impact of SDS on Sectors

Concept of Risk in the Assessment

- Hazard
- Vulnerability (exposure & sensitivity)
- Resilience

SDS Risk

Methodology
Data Sources

Hazard
- MERRA-2
- Resolution of 0.625°×0.5°
- From 1980-2019

Sectors
(exposure, sensitivity, resilience)
- **Agriculture** and **Environment**: Landcover map (GLCNMO-V3, MODIS-2013), Resolution of 15 arcseconds
- **Energy**, Solar powerplant database (location, capacity, etc), ESCAP, DustClim
- **Transport**,   
  *Aviation*: FMI, IATA, DustClim
  *Road*: Asian Highway, ESCAP
- **Health**, WHO, SEDAC, UNDP, WB.
- **Cities**, UNDESA, 2020
Sand and Dust Storms Impact on Sustainable Development
Human Health

SDS damage to the human organs, particularly skin and lung

The impact of SDS is higher in vulnerable groups, children, elderly people, people with pre-existing conditions.
Population at Risk

Percentage of population in medium and high exposure to total population in Asian and Pacific countries

Note: Review of this map is underway in OICT
Urban

Impact on human health

Interruption in services; closure of schools, airports etc and damage to infrastructures

Pressure on health sector

Cost of cleaning

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Dust exposure in cities with population higher than 300,000

Note: Review of this map is underway in OICT

*days with dust concentration more than 50 µg/m³
Energy

SDS damage to wind powerplants

Scouring by sand-blasting and erosion at base

Backscattering and absorption of solar radiation by atmospheric dust

SDS increase the cost of maintenance by damaging the electrical and mechanical instruments

SDS increase cost of cleaning

SDS reduce energy production by reducing solar panel efficiency due to soiling and less solar radiation
Exposure and Impact of SDS on Energy Sector (Solar)

Exposure of solar powerplants (circles on map) to dust (average deposited) and percentage of average energy loss due to dust deposition

Amount of energy loss and percentage of energy loss in energy production of solar powerplants in Asia-Pacific countries

Note: Review of this map is underway in OICT
Transport

- Sand accumulation on roads and rail tracks
- Damage to road surface markings, asphalt and traffic signs
- Abstraction of vehicle surfaces
- Interruption in ports and railway services
- Car accident and traffic jam due to low visibility
- Flight delays, diversions and cancellations due to low visibility caused by SDS
- Damage to equipment and instrumentation at airports
- Erosion in aircraft engines
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The risk of flight delay and cancellation due to low visibility due to dust, considering dust concentration, exposure, and resilience.

Note: Review of this map is underway in OICT
The flight paths with the high risk of erosion in aircraft engines due to dust concentration in the cruise elevation
Agriculture

- SDS impact honey harvesting
- Filling irrigation canals and cover pipelines
- Negative impact on livestock (suffocation in extreme storms)
- Less solar radiation due to atmospheric dust reduces photosynthetic activity in crops
- Loss of soil particles, nutrients, seeds, fertilizers and beneficial microorganisms
- Reduce soil and water quality (e.g. increase soil salinity)
- SDS damage plants by sand-blasting and root exposure
- Damage to agricultural equipment
- Burial of seedlings under sand deposits
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The exposure of agricultural land to average dust deposition (2019)

Note: Review of this map is underway in OICT
Environment

SDS increase melting rate of glaciers and change the hydrologic regime.

SDS reducing solar radiation.

SDS adding nutrition to sea and water bodies and as the result impact life under water. E.g. iron nutrition effect the number of phytoplankton.

Floods and end-season drought as results of changes in hydrologic regime.

SDS impact to natural vegetation, animals, and soil quality.
The exposure of glaciers to average dust deposition (2019)

Note: Review of this map is underway in OICT
Findings on Current Impact

• More than **80 per cent** of the entire populations of the Islamic Republic of Iran, Pakistan, Tajikistan, Turkmenistan, and Uzbekistan are exposed to medium or high levels of poor air quality

• Cities in southwestern Asia have the highest exposure to sand and dust storms, where nearly **60 million** people experienced **more than 170 dusty days** in 2019

• Large areas of farmland are affected by dust deposition

• Considerable impact on the generation of electricity by solar power plants

• Exposure of aircraft engines to dust particles is a considerable risk on flightpaths traversing southwestern and central parts of Asia and flights to and from airports on the Arabian Peninsula, Pakistan, India and China are most affected

• Risk of flight delay and cancellation due to low visibility is greatest at airports in Central Asia, southern parts of the Islamic Republic of Iran, the border area between Pakistan and India, and northern parts of China.
Findings on Long-term Impact

• High dust deposition occurs in the Himalaya-Hindu Kush mountain range and the Tibetan Plateau, the so-called Third Pole which provides fresh water to more than 1.3 billion people in Asia

• Risk of impacts of SDS is projected to increase in the 2030s due to more extreme drought conditions in parts Western Australia, south-eastern Turkey, Iran and Afghanistan
Looking Ahead:
Suggested Next Steps for Coordinated Regional Action on Sand and Dust Storms

• A **deeper understanding** of the socio-economic impacts of sand and dust storms

• A **coordinated monitoring and early warning** system, with an **impact-based** focus, to timely forecast sand and dust storms and enable targeted measures to minimize exposure and reduce risks

• **Coordinated actions** in most at-risk and exposed geographical areas with a view to **mitigating the risks**
Partners in the SDS Risk Assessment

- ESCAP Divisions (Statistic, IDD, Transport, Energy)
- World Meteorological Organization (WMO)
- United Nations Convention to Combat Desertification (UNCCD)
- Food and Agriculture Organization of the United Nations (FAO)
- World Health Organization office in Iran (WHO)
- Tohoku University
- Barcelona Supercomputing Center (BSC)
- United Nations Environment Management Group
- Finnish Meteorological Institute
- Japan Meteorological Agency (JMA)
- Environment Department of Environment of the Islamic Republic of Iran (DOE)
- European Institute on Economics
- Spanish Council of Scientific Research in Barcelona
- Risk Nexus Initiative
Guideline on monitoring and reporting the impacts of sand and dust storms through the Sendai Framework monitoring