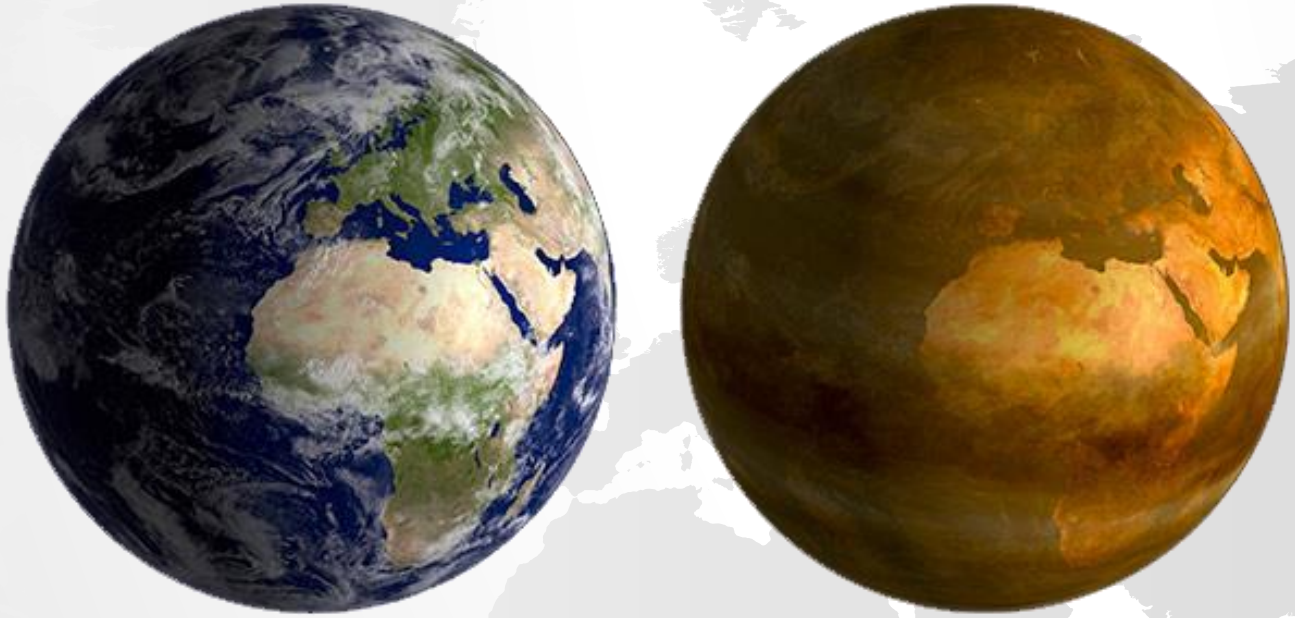
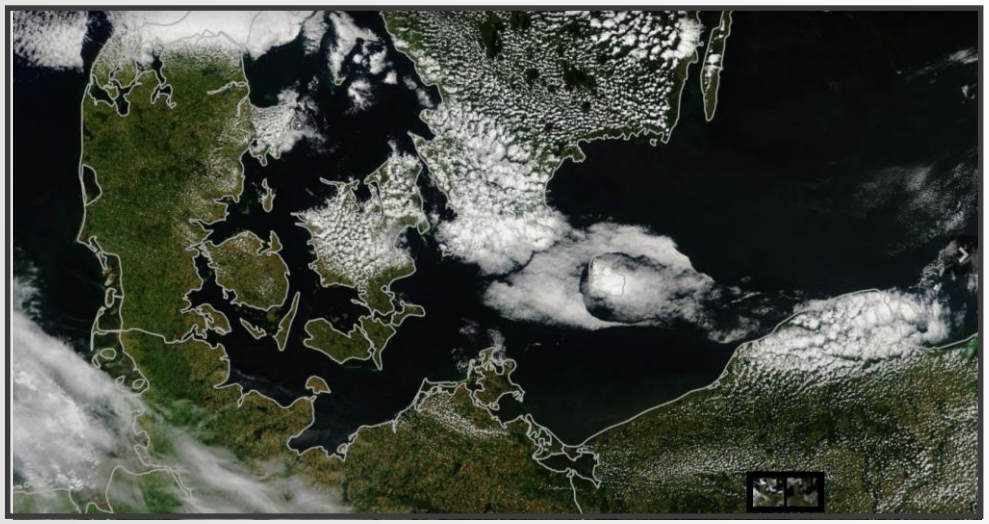


CLIMATE CHANGE AND IMPACT ON MILITARY OPERATIONS

Status quo, Integration of Scenarios and Operational Planning Processes

UPCOMING HEAT WAVES TURN EUROPE BROWN

July **2017**



July **2018**

Source: NASA-Images of Change

New dimension - impact for north/east Germany:

- Record of number of very hot days (>20) (temps in excess of 30 °C) since 1881,
- temporary shut downs of power plants,
- strongly obstructed inland transport on water (183 days with low water level),
- Major forest fires (record 1.708!),
- Temporary Sand storms (vis < 1km),
- Fauna & Flora (i.e bark beetle plague),
- Aviation: damaged turf, heat in the cockpit, influence on material and electronic systems due to radiation and heat,
- A Tornado Jet Pilot: "*The flight to the east was like another world.*"

NATO CLIMATE CHANGE OVERVIEW

- NATO has acknowledged climate change as a “threat multiplier”
  - No political stance, but a ‘special interest’ due to operational risks

- Climate Change challenges NATO’s operational capabilities both directly and indirectly:
- Direct Impacts:
  Temperature extremes; changes in precipitation; sea-level rise; drought and flooding
- Indirect Impacts:
  Famine and disease; mass migration; humanitarian emergencies; conflict and instability

- NATO’s role in climate change is twofold:
  1.) **Environmental Protection**: We must try to reduce the environmental affects of our military activities as much as possible
  2.) **Environmental Security**: We need to respond to security challenges emanating from the environment

NATO - SHAPE METOC SECTION

- NATO forces are operating in a range of geographic environments, and rely on forecast information of the current and future physical environment to enhance the effectiveness of their air, land and maritime operations/missions
- METOC is responsible for providing climate data, including information pertinent to climate change and operations, within the NATO Force Structure (NFS) and the NATO Command Structure (NCS)
- SHAPE's METOC section operates at the military-strategic level
- The Allied Command Operations Chief METOC Officer (ACO CMO) is responsible for the overall design and implementation of METOC support to ACO and the co-ordination with Nations
- SHAPE METOC operates under a robust and proven framework for supporting NATO military operations
- It is the responsibility of METOC to use the products and services available to offer **climate data** as an integral element of support to Allied Command Operations and the given missions within which it may be required

NATO BASIC DOCUMENTS

The following documents make up the core framework and operating procedures for SHAPE METOC

- MC 0594/1 – Military Committee Policy on METOC support to Allied Forces
  This policy paper sets out the fundamentals of METOC's commitments, underlining key policy objectives, general responsibilities, operational requirements, and terms of reference; establishing the methods of work for implementing METOC support to operations.

- AD 080-034 – METOC Services for ACO
  This directive prescribes the key responsibilities and procedures which govern the provision of METOC support to Allied Command Operations.
  - This directive includes climatology provisions within the IMETOC framework.

- MC 0632 – Recognised Environmental Picture (REP)
  The REP is established to provide a combination of Meteorological, Oceanographic, and Geospatial data to inform commanders at all levels on environmental impacts on the planning and conduct of NATO-led activities.
  - The REP provides the opportunity to merge climate data with geospatial products to help ACO consider the impact of climate change on operations, exercises and missions.

OPERATIONAL IMPACTS OF CLIMATE CHANGE: AN INITIAL APPROACH BY ACO

Brussels Dialogue on Climate Diplomacy

Climate Change and the Military

Charlemagne Building, EC – June 28th 2018

Operational Impacts of Climate Change: An Initial Approach by ACO

NATO SHAPE (ACO)'s first attendance at the Brussels Dialogue on Climate Diplomacy was at the 5th meeting, in March 2018, following a Military Committee Working Group tasking to METOC / SPOPS (Meteorology & Oceanography Section, Support to Operations). METOC is broadly tasked to provide meteorological and oceanographic data, through software systems, to the NATO commands via Lead and Assisting Nations. In addition to METOC's fundamental requirements, other relevant deliverables can be tasked to the Section.

Allied Command Operations (ACO), in conjunction with staff from METOC and CIMIC (Civil-Military Co-operation), and advisor's from CCOMC (Comprehensive Crisis and Operations Management Centre), is beginning to take note of the impacts of climate change to operations in the hope that we can increase both our awareness of the risks, and our preparedness for the challenges ahead. At this stage, ACO is primarily concerned with current operational challenges, given that long-term adaptation strategies are more generally the concern of Allied Command Transformation (ACT) in Norfolk, Virginia (USA), and policy issues are to be controlled by NATO HQ. It is therefore important to state that SHAPE will assess the current climate change impacts at the military-strategic level, and from there make provisions to ensure that future operations can be prepared for climate change impacts to operations, by setting capability requirements etc.

The means by which SHAPE can develop a state of preparedness for the impacts of climate change to operations is varied, however, in relation to weather development the focus will primarily be placed upon the creation of software tools to be used as Tactical Decision Aids (TDA) in the operational theatre.

Visual mapping projection tool in NATO-GIS

SHAPE's METOC office, under the guidance of LTC Rene Heise, is currently drafting a proposal for a co-operative study in order to create and implement a visual tool which can be used operationally to aid in force planning and tactical decision making. The end-goal is to have an integrated system in which the risks of climate change impacts in operational

AIR OPERATIONS

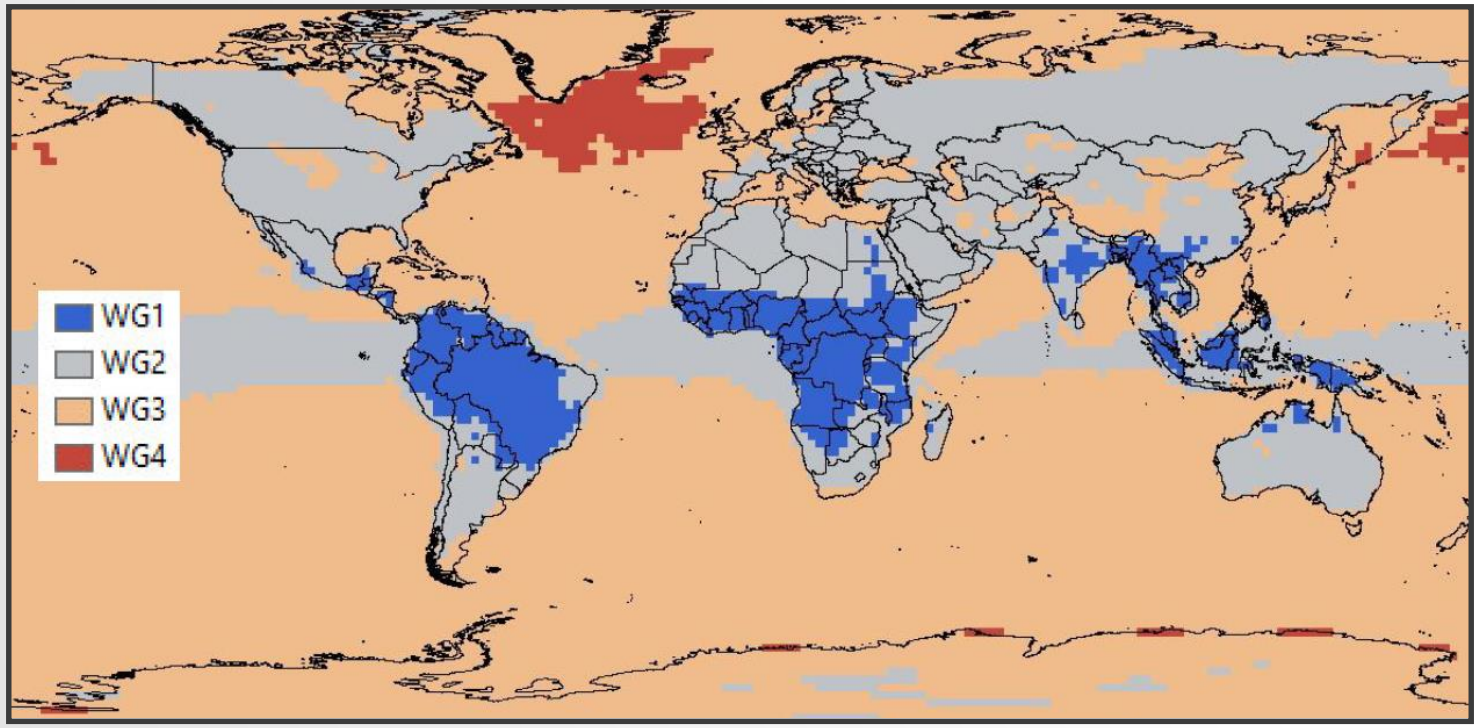
- Climate change threatens to push the limits of our ability to cope with regular atmospheric variability during air operations
- See also climate/environmental factors temperature, humidity, air pressure, icing, dust/sand,… (NATO STANAG 4370, AECTP-230)

- Operations:
  - Optical Reconnaissance
  - Weapons Systems
  - Communications Systems

- The systems may have sufficient tolerance thresholds to manage, but may not be optimised for peak performance under extreme climatic conditions
  (i.a. air transport and aircraft limitations due to turbulence)

- Logistical Challenges:
  - Station times
  - Icing/de-icing requirements
  - Supply routes to Airfields (e.g. fuel)

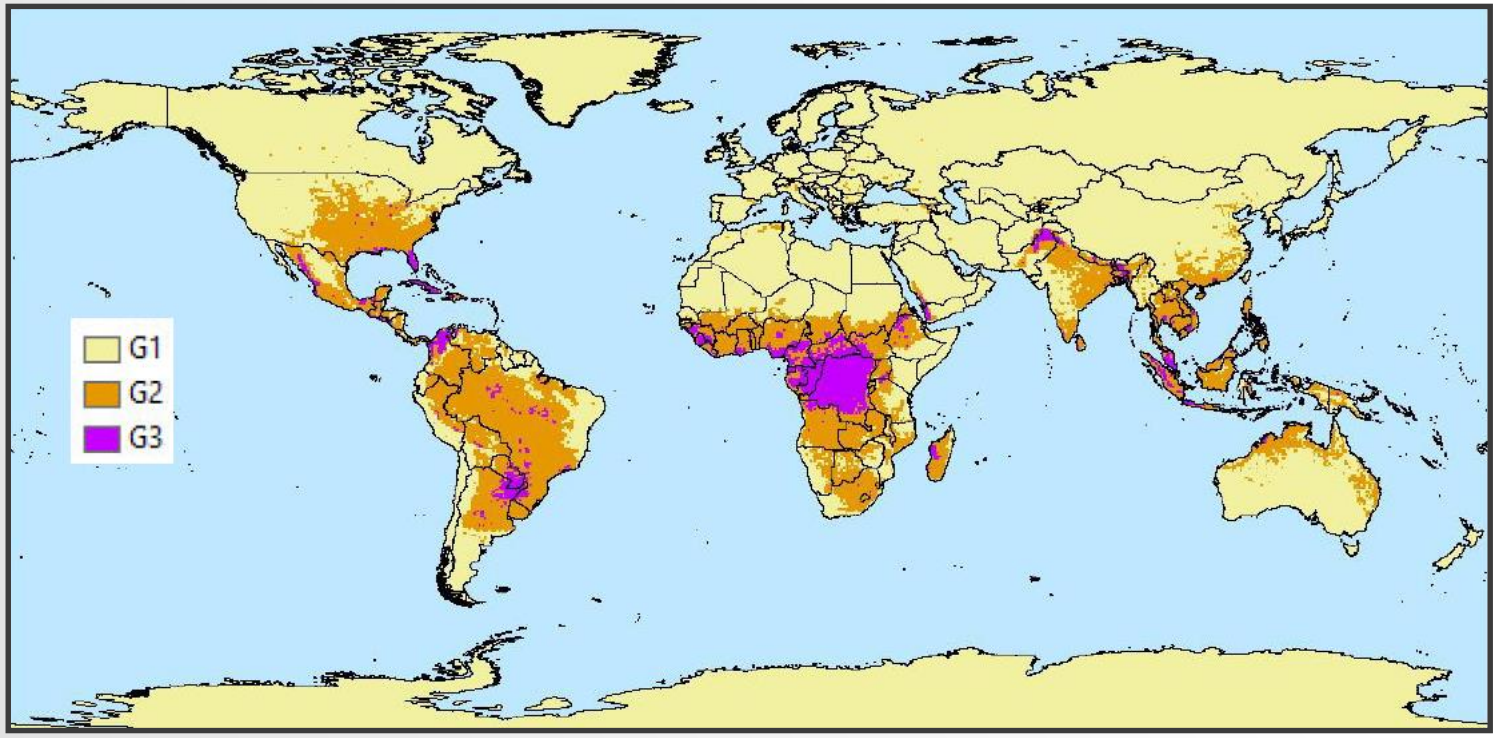
AIR OPERATIONS



Max. of gusts*
WG1: < 10kn
WG2: 10 - 20kn
WG3: 21 - 40kn
WG4: 41 - 63kn
WG5: > 63kn

* Maximum of gusts/wind speed (average per month)

AIR OPERATIONS



Hazard- thunderstorm/ligthning strikes

Lightning strikes per km² per year in the long-term average

G1: <= 10; light risk
G2: 10 - 20; mod risk
G3: 21 – 40; sev risk

LAND OPERATIONS

Personnel:

- Generally only equipped to certain latitudes and temperature extremes,
- These limits can be stretched, but not for too long or too often,
- Increasingly extreme conditions will present challenges to personnel when extended to new, key areas of operation (e.g. desertification in MENA).

Equipment:

- Extreme conditions cause faster 'wear and tear' of equipment (weapons, vehicles etc.) – e.g. increased weapon 'jamming' in Afghanistan's arid environment,
- Operating bases (FOBs/Command Posts) do not operate as efficiently in climate extremes (computing temp. requirements, air conditioning/ heating systems etc.),
- Engineering efforts can be compromised by climate extremes.

LAND OPERATIONS

Logistical Capability:

- Logistical supply chains require predictable climate/environment patterns

- Operational supply routes may become inhibited by flooding, snow/ice, and storms. In addition, humanitarian emergencies and instability due to climate change can impact logistical capability.

MARITIME OPERATIONS

- Ice retreat in the Arctic presents a significant challenge to NATO's maritime operations:
  - Increased navigability due to reduced ice cover will open up new trade routes and competition for resources
  - Arctic border countries comprise NATO nations (Canada, Norway, Denmark/Greenland)… and Russia
  - Vast geographic expanse and sparse shorelines will likely put added pressure on maritime resources, where land & air capabilities are diminished due to the nature of the environment
  - The combination of extreme cold, ice obstacles, high seas, remoteness (e.g. GPS precision) and the potential presence of adversaries, challenge NATO's maritime capabilities in the region

- Gulf of Aden:
  - Increased salinity in the Gulf of Aden has caused turbines on several UK Frigates to fail
  - Increased instability (drought, desertification, famine) correlates with increased piracy

- Flooding:
  - Maritime forces commonly responsible for humanitarian emergencies and flood relief in flood-prone areas such as Bangladesh and small island nations

SPACE OPERATIONS

- Launch facilities are typically close to shorelines and marginally above sea-level, thus at risk from sea-level rise associated with climate change,
- Unpredictable and/or erratic winds in the upper and lower levels of the atmosphere - associated with alterations to wind patterns – could influence launch trajectories for satellites and missiles,
- If unpredictable atmospheric wind patterns are observed in a given area over the long-term, the viability of space operations in the region could be challenged.

CLIMATE CHANGE IN THE OPERATIONAL THEATRE

- Military Facilities and deployed Forward Operating Bases and HQs in theatre are increasingly confronted with the hazards presented by climate change

- Climate change impacts are already dramatic and visible

- Examples…

- Arctic training has been challenged by thawing permafrost in areas used to train troops in air drops and parachute drills,
- A lakebed used as an emergency runway at Edwards Air Force Base was inundated with floods that did not dry out for 8 months,
- A recent Pentagon report has found that >50% of US Military Bases, including operational bases abroad, are at grave risk from flooding, extreme temperatures, wind, drought and wildfire. All of these are directly attributable to climate change.

- It is increasingly necessary for climate projections to be incorporated into the REP and GIS products - Map overlays for 10, 20 and 30 year projection periods for support of allied operations in areas of interest

GEOGRAPHIC HOTSPOTS

- There has been a recent trend among climate change & security stakeholders to produce spatial vulnerability assessments and geographic "hotspot" maps.

- The aim has been to draw attention to areas at specific and significant risk from climate change, with the objective to mitigate the risks of:
  - Humanitarian Crises
  - Armed Conflict
  - Food & Water Scarcity
  - Reduced Crop Yield + Agricultural Degradation
  - + More.

- Hotspot mapping aims to incorporate various factors in assessing risk:
  - High exposure to climate change
  - High sensitivity to climate change due to a range of factors
  - Low adaptive capacity to climate change and climate-related risks

EXISTENTIAL RISK MANAGEMENT

- to monitor actual observations (EO, climate) combined with scenarios (esp. IPCC),
- To study the option of upcoming " tipping points *" and the worst case scenarios,
- To develop a concept for adaption of military capability packages concerning upcoming extreme conditions and hazards,
- Integration of climate change scenarios in combination with the military planning process of operations

* A **tipping point** in the climate system is a threshold that, when exceeded, can lead to large changes in the state of the system, the *IPCC AR5* defines a tipping point as an irreversible change in the climate system.

QUESTIONS

References

- NATO STANAG 4370-Environmental Testing, Edition 6, 2016,
- AECTP-230 (Edition 1) - CLIMATIC CONDITIONS
- Guideline Geofactors for the Ability Management in the Bundeswehr, BGIO, 2017

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