

Weather Related Space Service Management

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Service Management Cycle



- Weather and the environment effects the Space Service Management Cycle
 - Facility/Site Planning/Upgrades
 - New sites, geographic diversity, site upgrade assessment
 - Climatology
 - Strategic Mission Planning
 - Future mission profile trades, cost estimations
 - Climatology
 - Operational Mission Planning and Data Recovery
 - Assess mission scenarios for data recovery and implement
 - Near-space
 - Doppler radar and nowcasting for $K\mu$ and above
 - GeoMetSat WV and nowcasting for optical
 - Deep space
 - Mesoscale short range forecasting with mesonet inputs for both RF and optical

Use of climatology



- Historically, climatology has been used to assess:
 - The viability of new facilities
 - Future mission profiles
 - Site availability
- Climatology is used to assess
 - Severe weather probabilities
 - Optical transparency
 - Aerosol and water vapor
 - RF link availability
 - Historical rain frequency, amount and rate

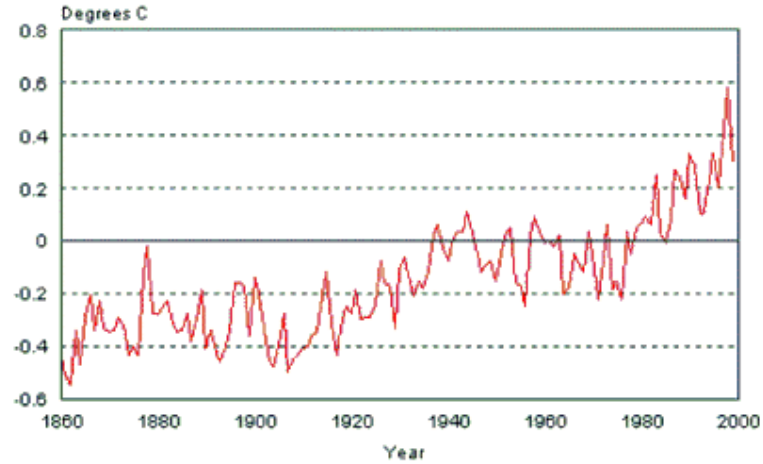
Climatology is no longer enough



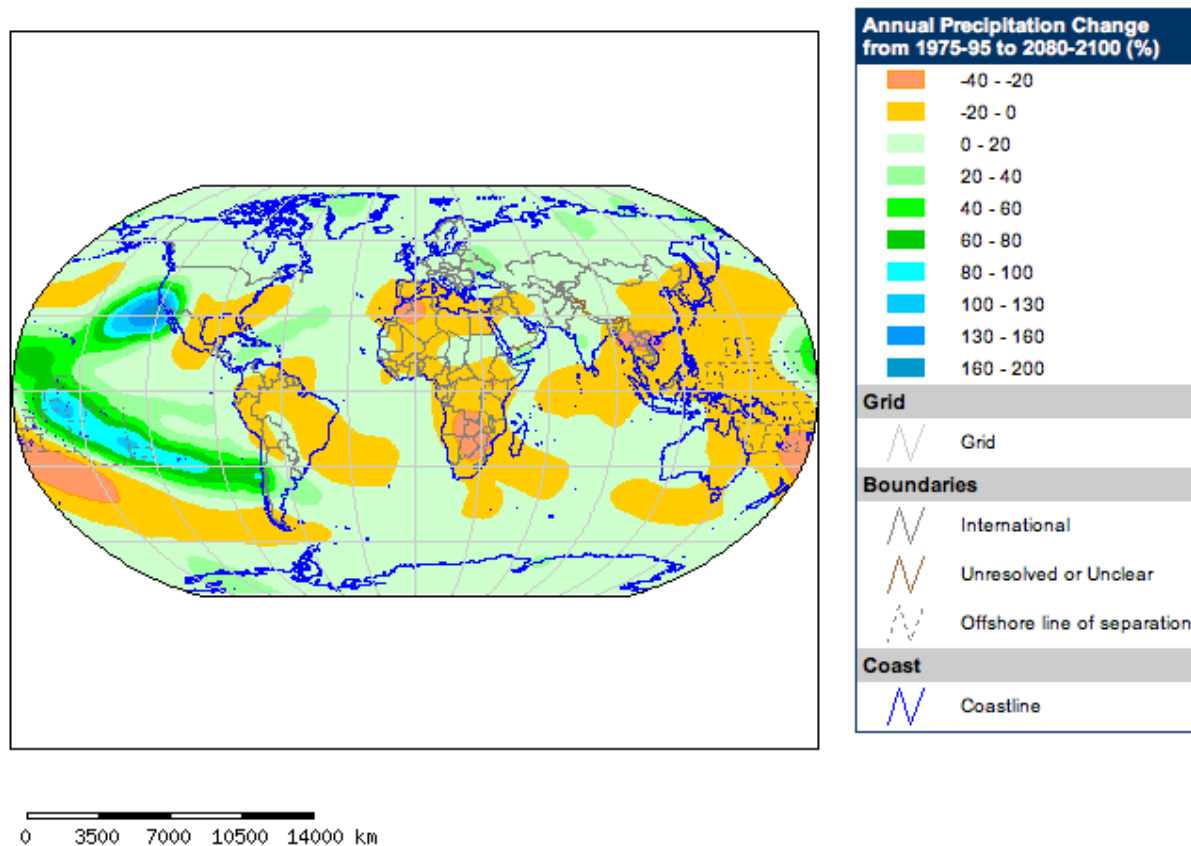
Historic Temperature



Global Temperature Change
1860-1999

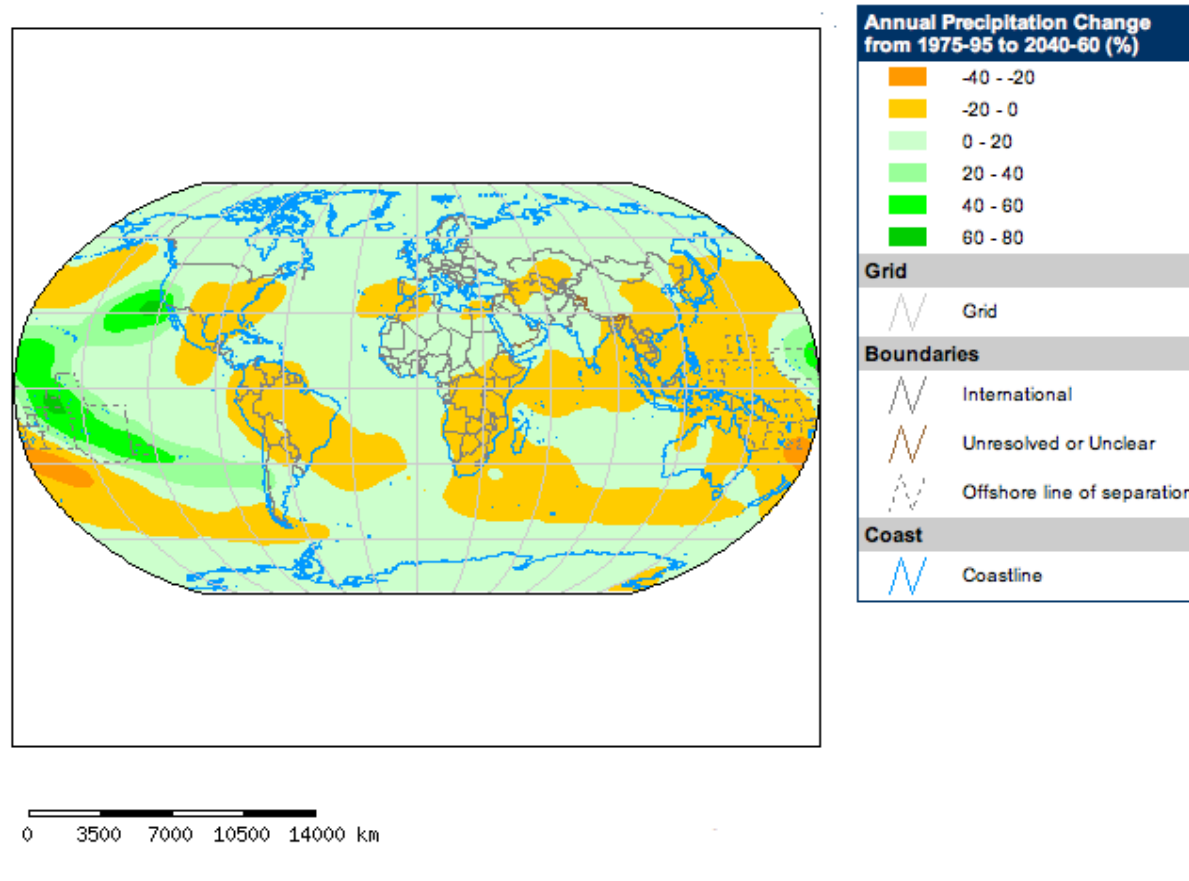


100yr Precipitation Change



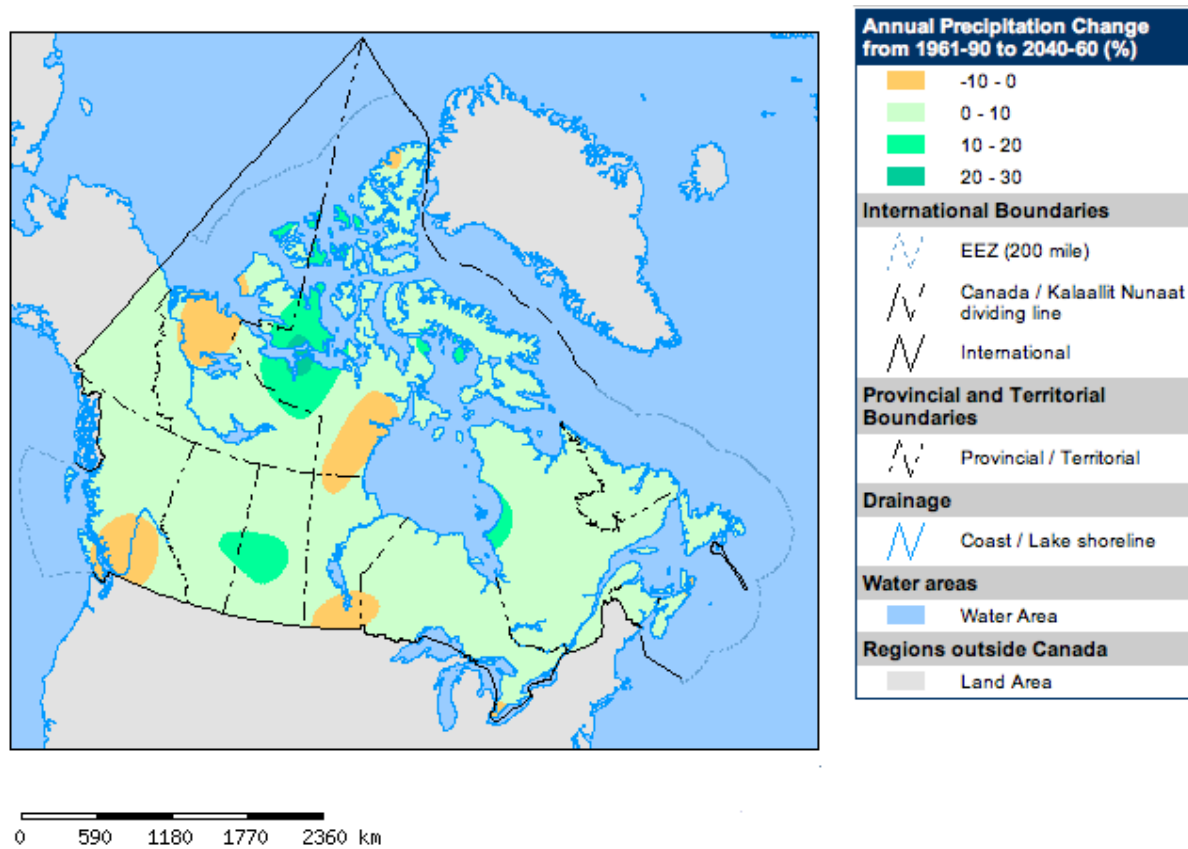
Note: This model output (low resolution) assumes a simple CO2 component increase only

50yr Precipitation Change



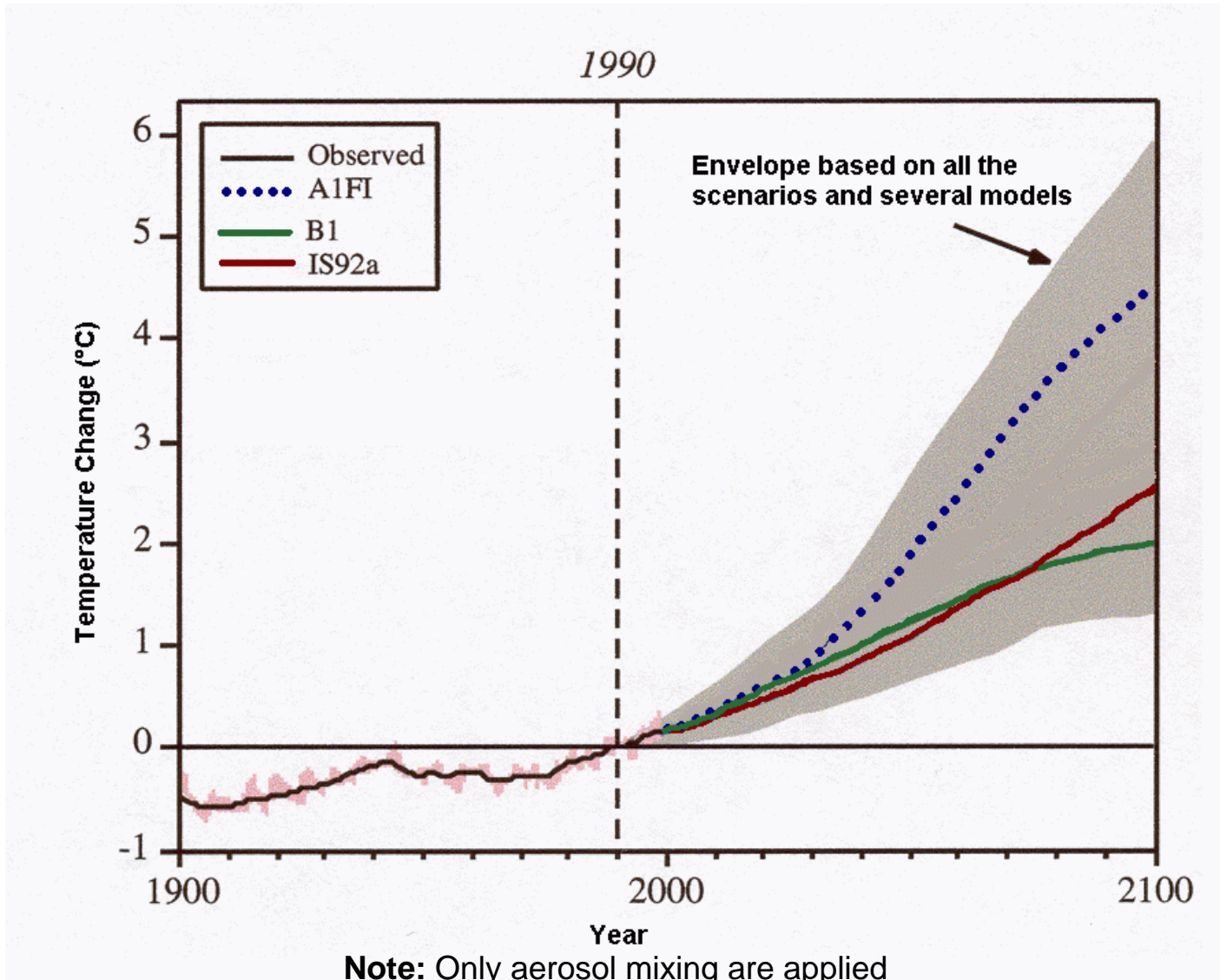
Note: This model output (low resolution) assumes a simple CO₂ component increase only

50yr Regional Precipitation

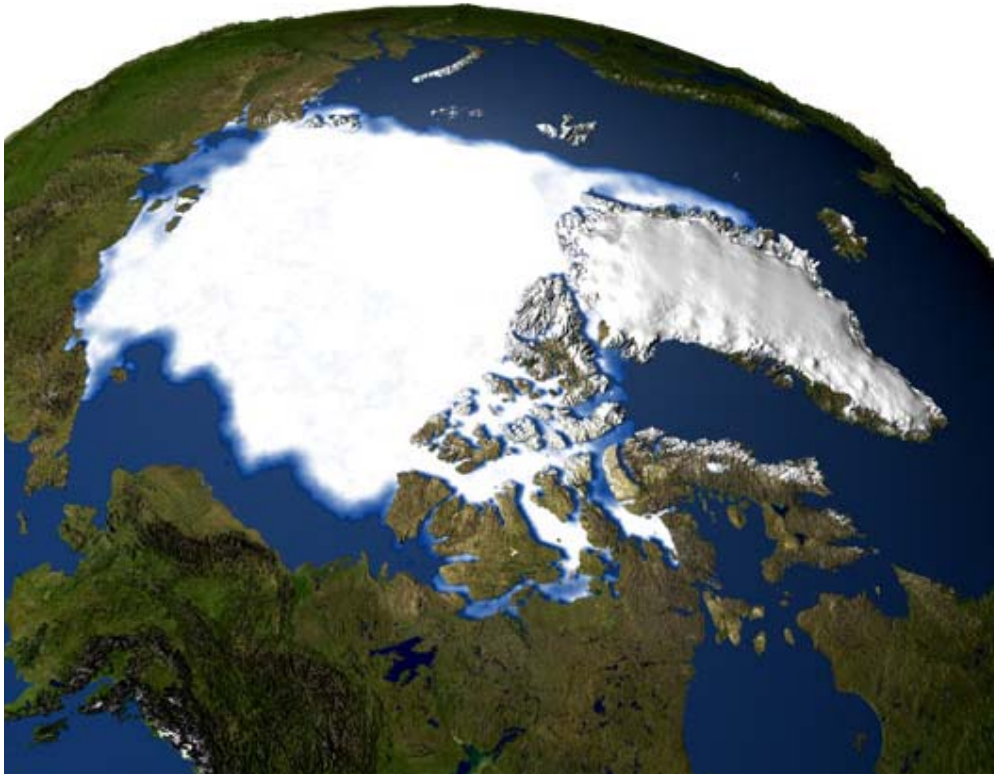


Note: This model output (regional low resolution) assumes a simple CO₂ component increase

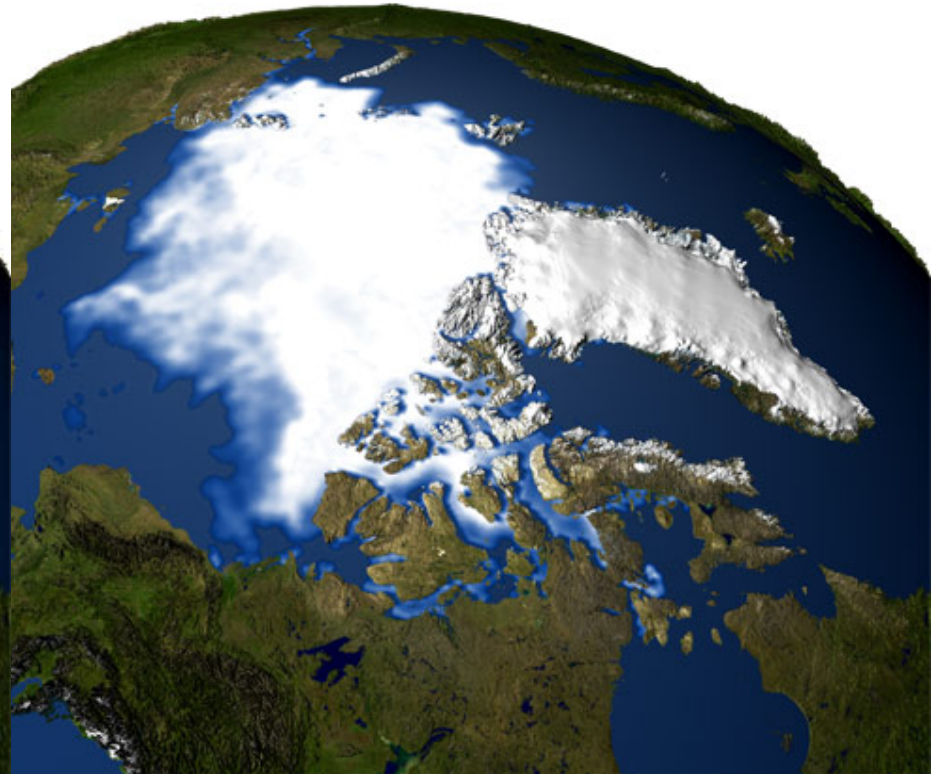
Temperature Forecast



Arctic Ice Sheet



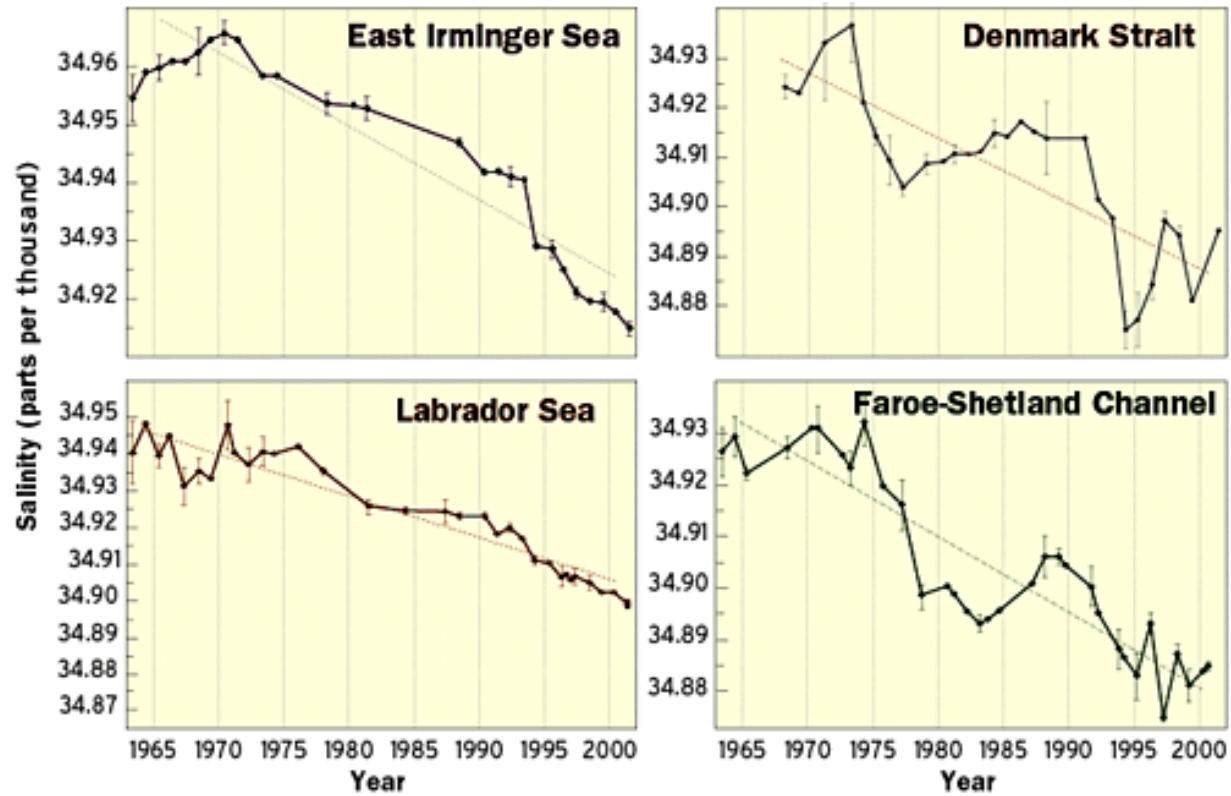
1979



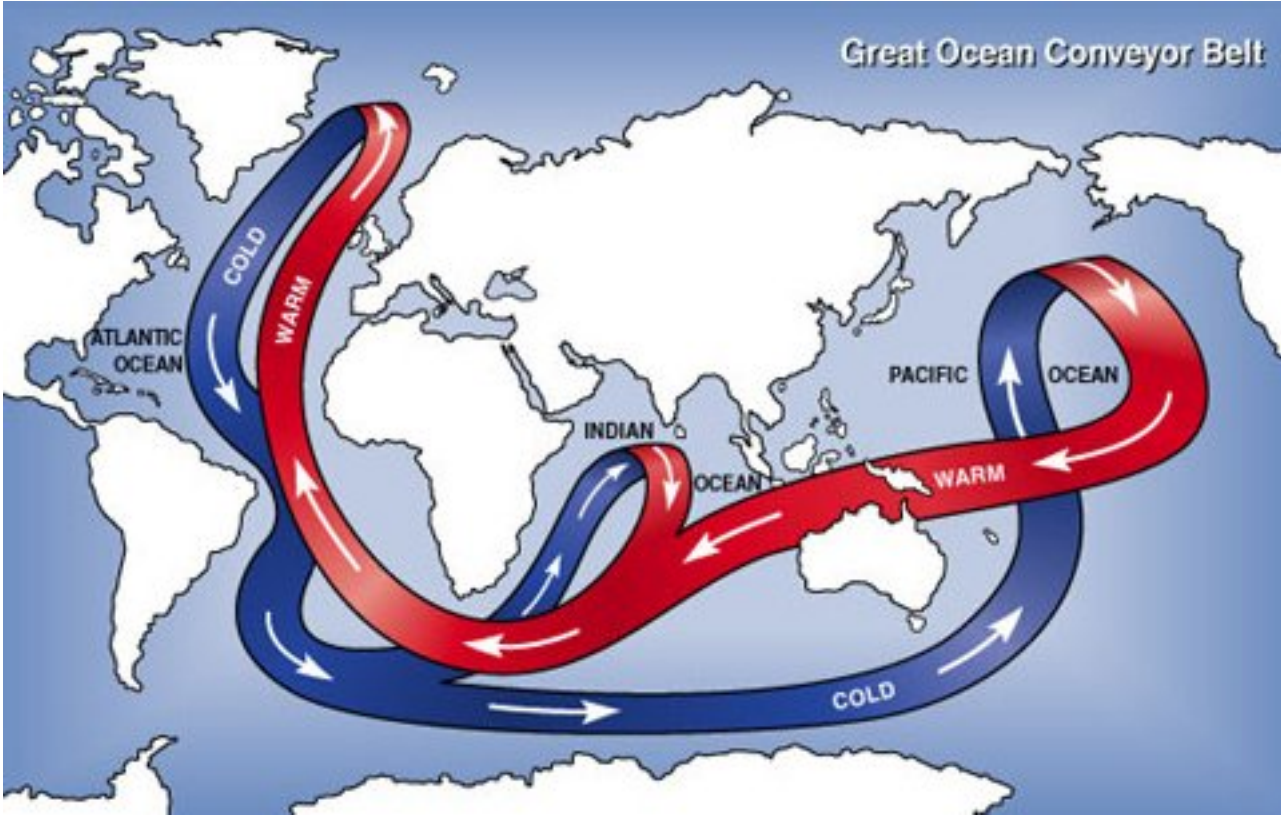
2003

Arctic perennial sea ice has been decreasing at a rate of 9% per decade. Source: Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave Imager (SSM/I).

Salinity



Ocean Currents



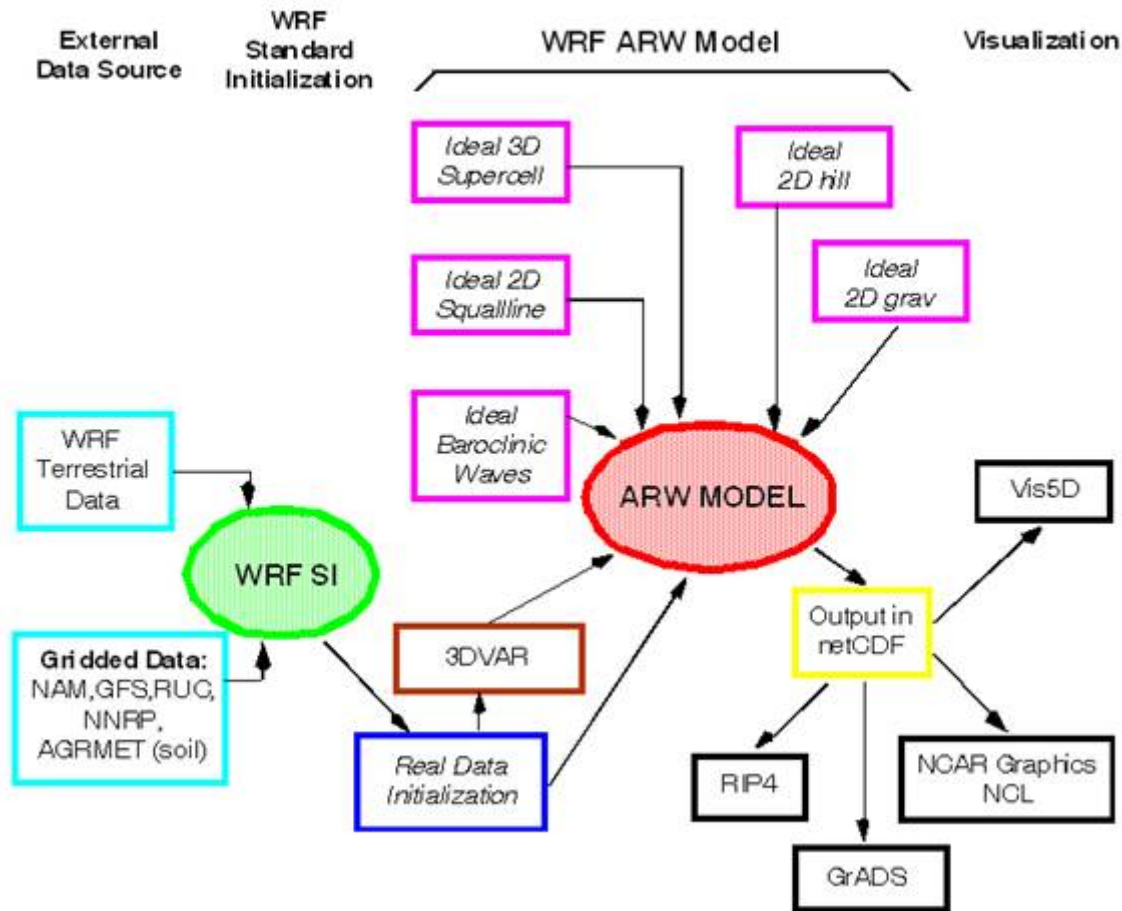
- Climatology is no long enough data for an informed assessment on long term endeavors
- A single set of climate assumptions is also no appropriate for informed assessments
- Recommendation:
 - Run an ensemble of climate models
 - High resolution over areas of interest
 - Assess model consensus
 - Accept consensus for planning purposes

- Forecasting is required to maximize data recovery, minimize data loss and optimize ground station and relay assets
- Forecasting (and nowcasting) on these timescales
 - Is no longer “research”
 - Requires a certain amount of “productization”
- Biggest stumbling block of deployment is lack of interfaces to the real-time mission planning and operational systems

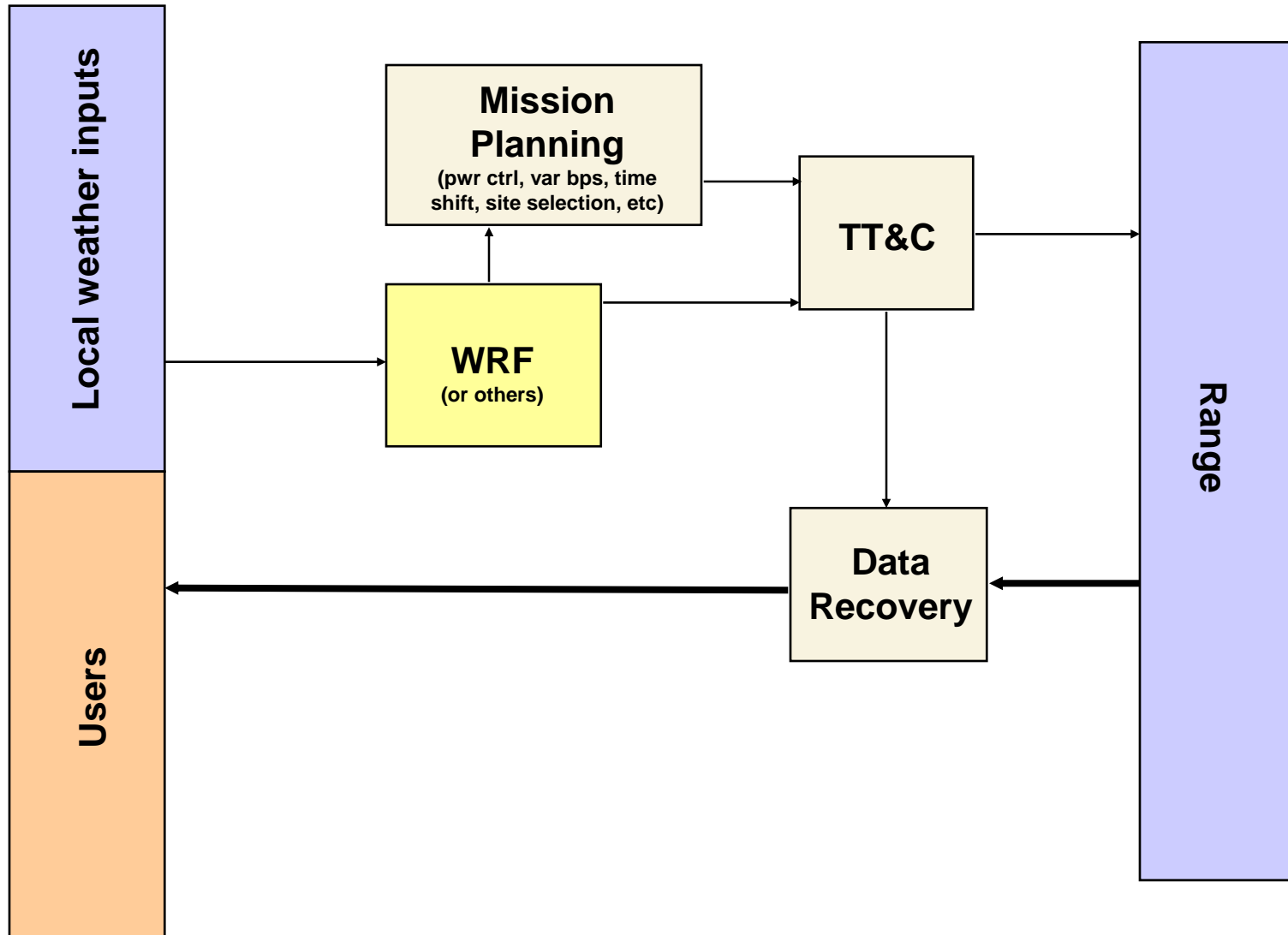
WRF Mesoscale Model



WRF ARW Modeling System Flow Chart (for WRFV2)



Integrated Approach



Summary



- Climatology needs to be augmented with climate forecasting for assessments in future years (40-60 yr)
- Near term weighted climatological trends should be used for assessments in near term years (~10 yr)
- Future upgrades in mission planning and mission operations systems should contain interfaces to allow the addition of weather data inputs operationally