OAR Science supporting Seasonal to Sub-seasonal Prediction

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OAR is invested in Sub-seasonal to Seasonal to prediction (S2S)

- OAR laboratories and programs have provided the foundational science for better forecasts, earlier warnings, and greater understanding of the ***Earth system***

- S2S is a key science priority for OAR, and we have a history of achievements in seasonal prediction
  - OAR is helping improve western water management via better understanding of water cycle processes and advances in monitoring and prediction methodologies

- OAR can make further progress in precipitation forecasting with targeted investments.

How OAR Adds Value to S2S

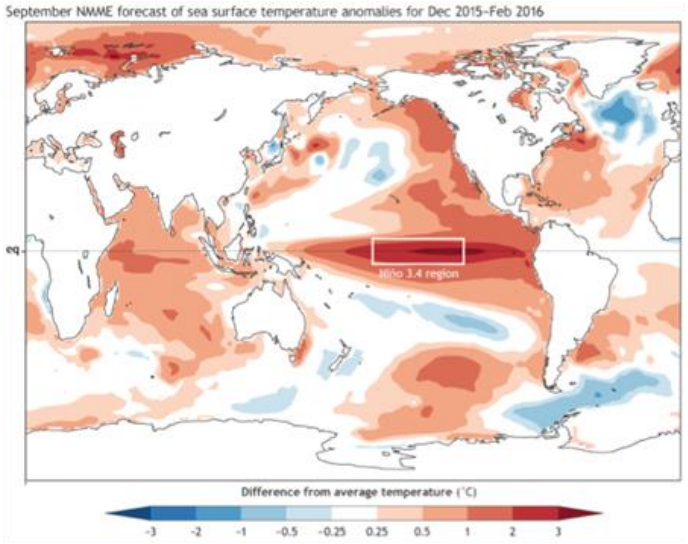
- OAR Climate Program Office (CPO), through the Modeling, Analysis, Predictions, and Projections (MAPP) program leverages the external community with grants.

- OAR water cycle research is integral to national and international efforts such as:
  - US Global Change Research Program (USGCRP)
  - CLIVAR (Climate Variability research program) and GEWEX (Global Energy and Water Cycle Exchanges)

- National Earth System Prediction Capability initiative
  - OAR labs and programs leverage the federal science community to improve predictions - supporting policy and planning efforts that span days to decades

Relevance of OAR Research

- OAR and NWS have developed a strong R2O relationship
  - OAR Labs advance NOAA operational models
    - GFDL – Finite Volume 3 dynamical core (FV3), an NGGPS finalist
  - CPO-Climate Test Bed project delivers new operational multi-model seasonal prediction system (North Am. Multi-Model Ensemble - NMME)
- NOAA Drought Task Force and NIDIS research led to improvements in our ability to understand, predict and map drought.



NGGPS Phase 1 Testing
Project Summary Assessment

	Idealized Tests	3-km, 3-day forecasts	Performance	Scalability	Nesting or Mesh Refinement	Software Maturity
FV3	🟢	🟢	🟢	🟢	🟢	🟢
MPAS	🟢	🟢	🟡	🟢	🟢	🟢
NIM	🟡	🔴	🟢	🟢	🔴	🟢
NMM-UJ	🔴	🟡	🟢	🟢	🟡	🔴
NEPTUNE	🟡	🔴	🔴	🟢	🟢	🔴

🟢 Meets or exceeds readiness for needed capability
🟡 Some capability but effort required for readiness
🔴 Capability in planning only or otherwise insufficiently ready

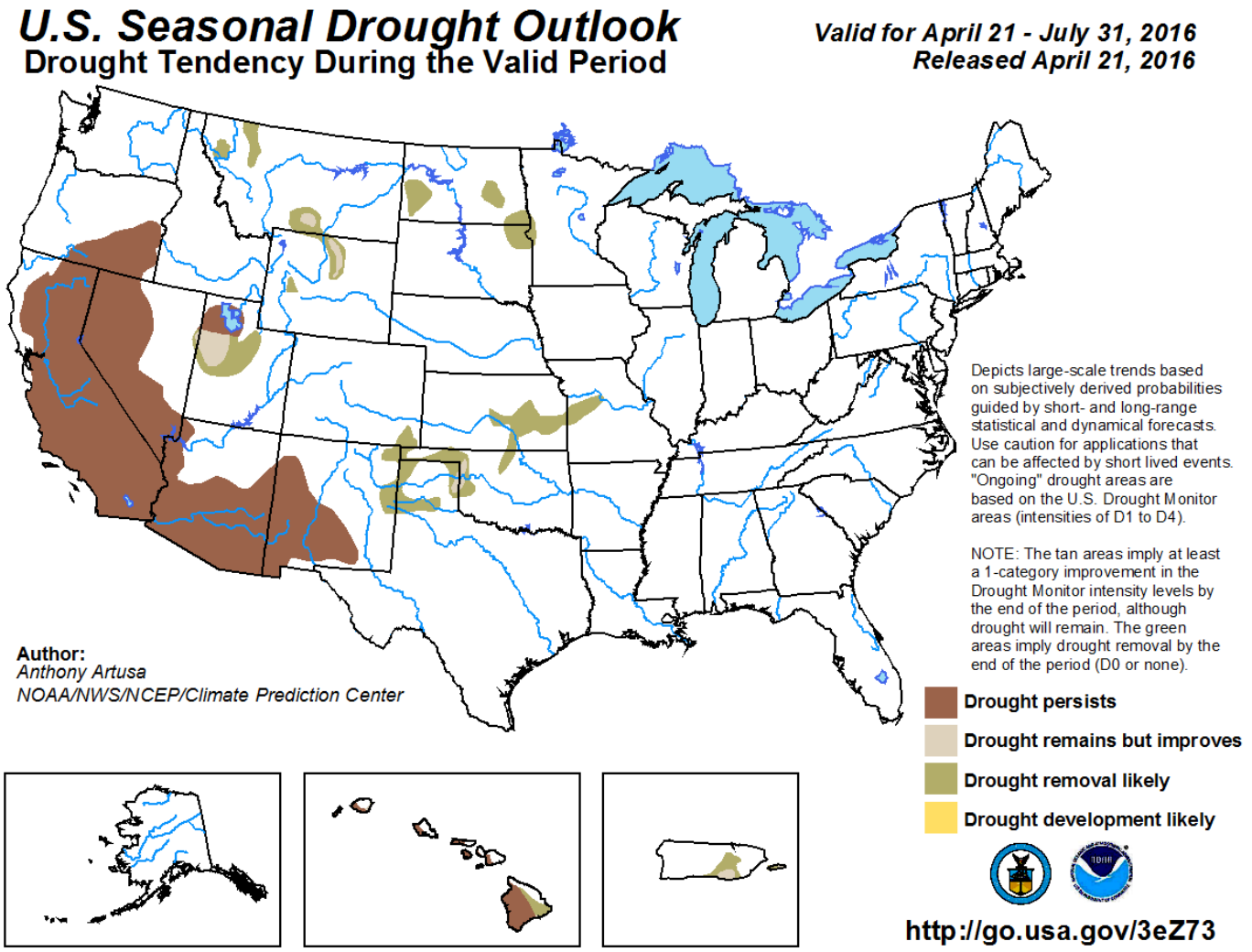
Recommendation (strongly endorsed by NWS) is to perform phase 2 testing with only MPAS and FV3

National Integrated Drought Information System (NIDIS)

Seasonal

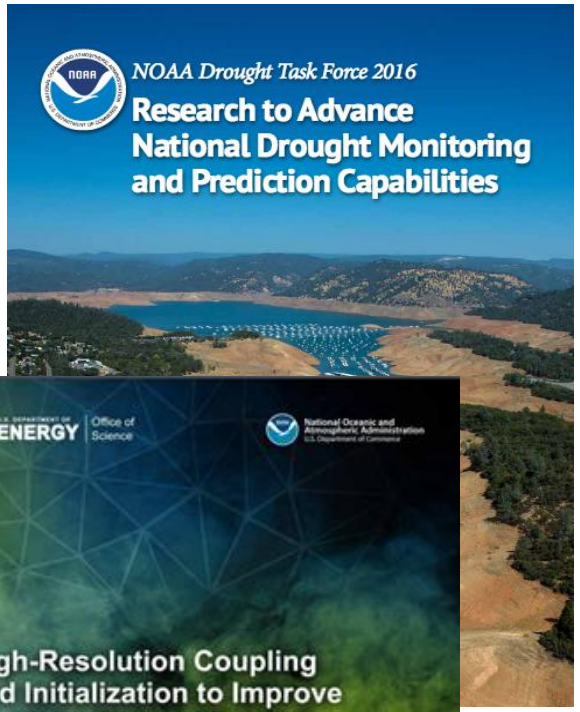
(3 month) drought forecasts published every 3rd Thursday

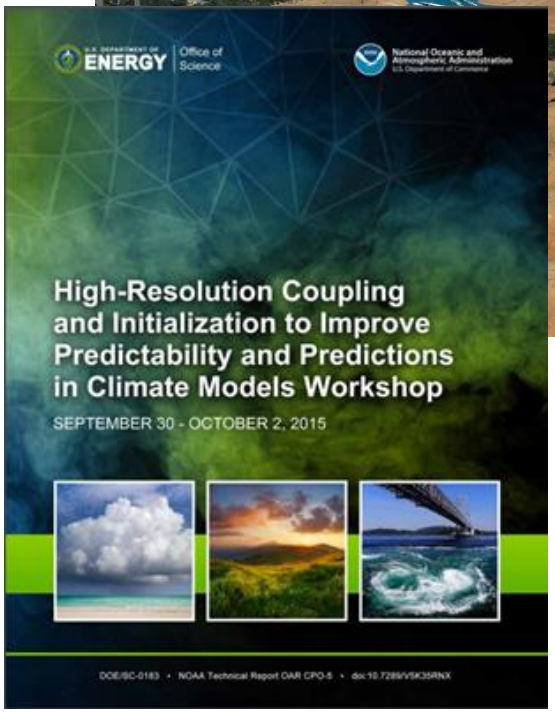
OAR/NIDIS research is providing new predictive tools to improve the skill of the official outlook



Further Progress Can Be Made

- OAR/CPO investing ~$3M/year in sub-seasonal to seasonal research initiatives
  - SubX – a Sub-seasonal Prediction Experiment
  - NOAA S2S Task Force research
- New initiatives will require additional resources; examples include:
  - Experimentation with high-resolution seasonal prediction systems
  - Data assimilation for improved initial conditions
  - Hybrid statistical-dynamical multi-model techniques
  - Enhanced understanding of processes and predictability



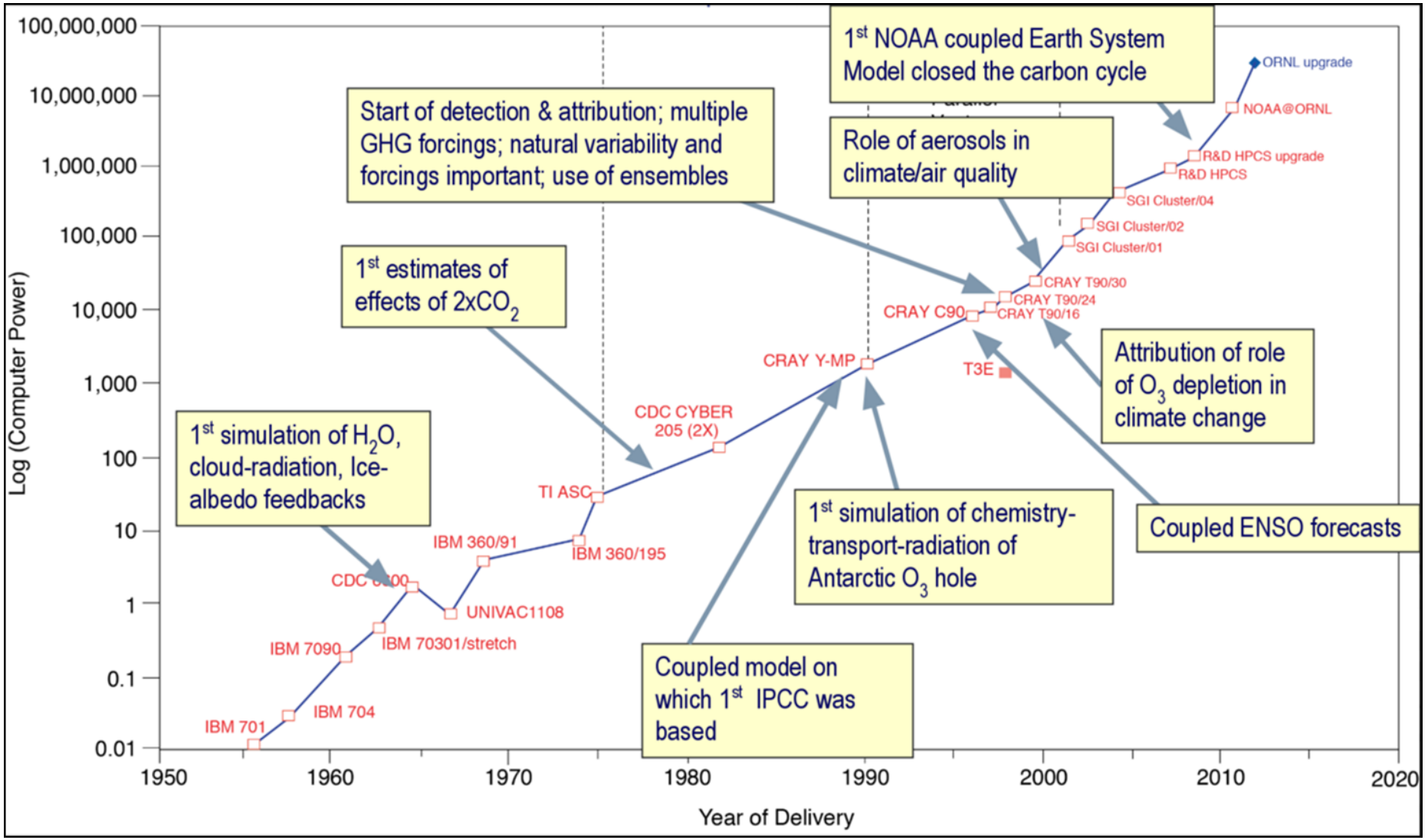


Challenge: High Performance Computing (HPC)

- **Significant HPC capacity** is needed to advance predictions from weeks to seasons
  - High spatial resolution, large ensemble, and higher level of Earth system model complexity needed for prediction experiments to be relevant
- In the past, major advances in HPC depended on major disasters (financial and physical) spurring major investment.
  - Gaea (Stimulus – the Great Recession)
  - Theia (DRA – Superstorm Sandy)
- NOAA is working corporately for stable HPC increase plan
  - OAR's scientific capabilities have far outpaced the available HPC

History of GFDL Computing

Growth of Computational Power with Time

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Questions?