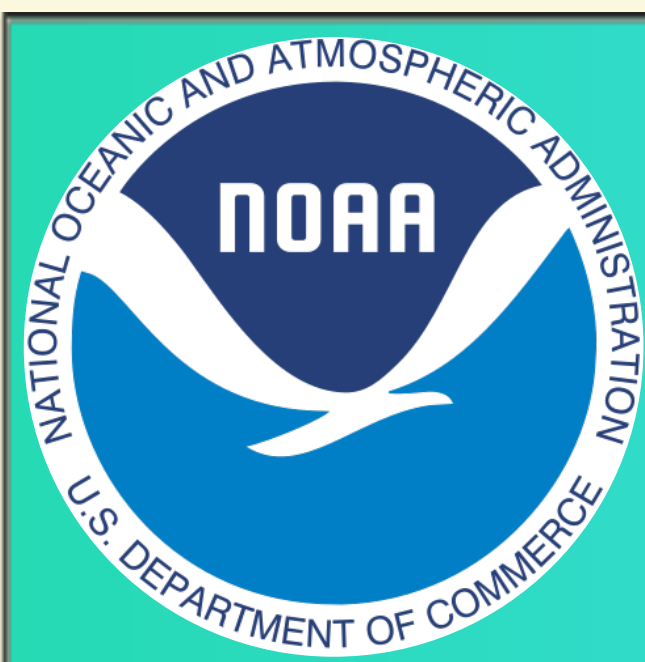




# The US NWS Strategic Modeling Plans

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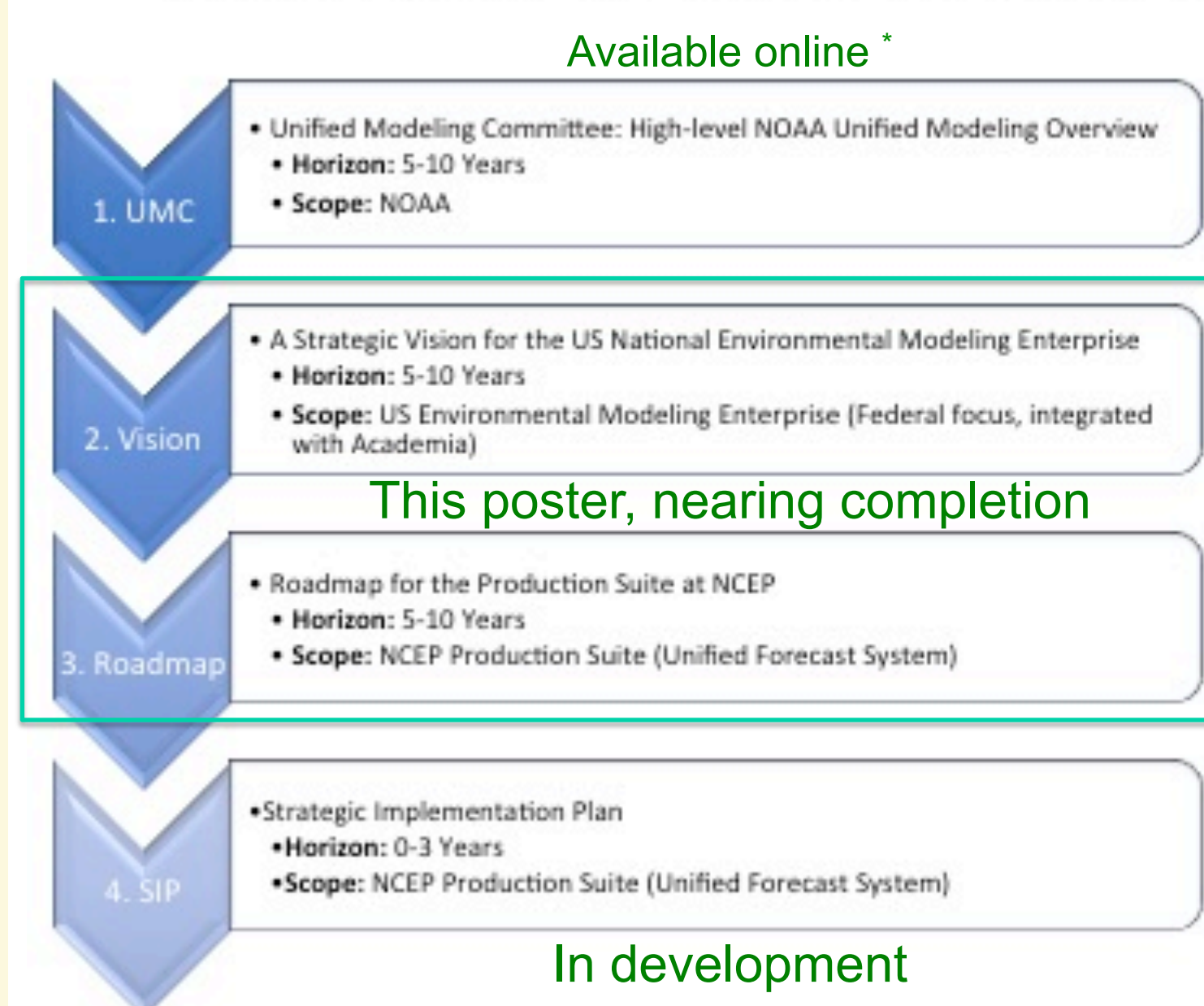
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## 1. Background

### A Hierarchy of Plans Related to the Unified Forecast System

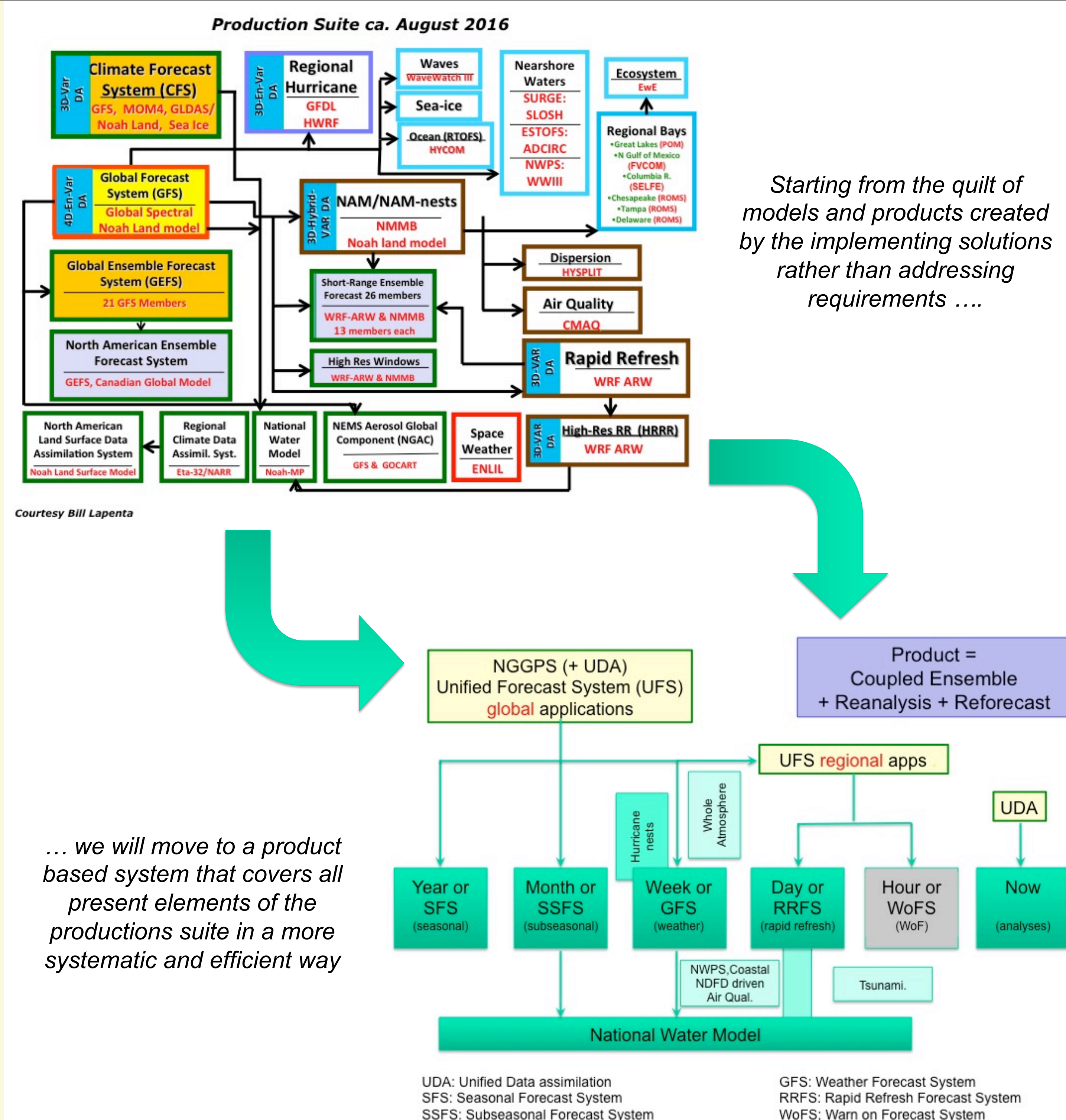


**Caption:** There is a cascade of four interrelated and coordinated planning efforts and documents:

- (1) A broad "strategy document" from the NOAA Unified Modeling Committee (UMC); under the auspices of the NOAA Research Council; spans the entirety of the NOAA modeling enterprise, inclusive of bio-geo-chemical, social and physical.
- (2) The NWS and OAR are developing a Strategic Vision Document looking out 10 years and bridging US Environmental Modeling Enterprise with the higher level NOAA UMC effort.
- (3) Also emanating from an NWS-OAR partnership, is a Roadmap document that lays out how we can move the NCEP Production Suite towards the vision described in the Vision Document.
- (4) At a practical level, the Strategic Implementation Plan (SIP), describes NOAA's concrete steps over the next 3 years to build the Next Generation Global Prediction System based on the Unified Forecast System, beginning with numerical weather prediction across scales and in partnership with the community (all stakeholders).

\* [ftp://ftp.library.noaa.gov/noaa\\_documents.lib/NOAA\\_UMTF/UMTF\\_overview\\_2017.pdf](ftp://ftp.library.noaa.gov/noaa_documents.lib/NOAA_UMTF/UMTF_overview_2017.pdf)

## 3. Roadmap: consolidation



... we will move to a product based system that covers all present elements of the productions suite in a more systematic and efficient way

## 5. Total Coastal Water

Riverine water is addressed at NOAA in a unified National Water Model (NWM), which is identified in Section 3. As this is by design a model for the US only, it will not (yet) be two-way coupled to our global forecast systems. "Offshore" water including coast, estuaries and the Great Lakes are presently address based on various themes, programs and authorizations. This is outlined in the Table below

### Present coastal non-riverine water efforts in NOAA

| Requirement Theme                                            | Auth. / Org/ Program            | Present Geogr. Focus Area                                                 | Technical Aspects (req. / foci) |                                                   |                                                 |
|--------------------------------------------------------------|---------------------------------|---------------------------------------------------------------------------|---------------------------------|---------------------------------------------------|-------------------------------------------------|
|                                                              |                                 |                                                                           | 2D / 3D                         | Major Error Sources                               | Foci (other than coupling)                      |
| Tropical Storm Surge                                         | HFIP / OWP / NHC / RFCs         | Atlantic Coast, Gulf of Mexico                                            | 2D                              | Atm. forcing uncertainty                          | Ensemble Forcing / DEM                          |
| Extratropical Storm Surge                                    | OWP / OPC / NOS / RFCs          | Continental US, AK, Puerto Rico, all US Pacific Areas of Interest         | 2D                              | Forcing (atm + waves) / bathymetry                | Bathymetry (+DEM), high fidelity 2D surge model |
| Coastal Ocean and Lake Models (Operational Forecast Systems) | NOS                             | CONUS - AK - HI estuarine/coastal (head of tide to shelf) and Great Lakes | 3D                              | Forcing (global ocean, atm + rivers) / bathymetry | 3D circulation modeling, ecosystem forecasting  |
| Water Quality                                                | Ecological forecasting, HABHRCA | Atlantic coast, Gulf of Mexico coast, Pacific coasts, Great Lakes         | 3D                              | 3D flow details / contamination sources / biology | Coupling to 3D circulation modeling             |

The lack of linkage between riverine and coastal water modeling has been identified as a major gap in capabilities of NOAA.

NOAA is presently developing a plan to couple riverine and "offshore" coastal water modeling into an integrated total coastal water model. This plan will be complementary to and aligned with the Roadmap presented here.

This effort will also be used to address unification of the various traditional coastal water approaches as identified in the Table.

## 2. Strategic Vision

Focus on products supporting mission requirements

- "Weather Ready Nation" end-to-end for NOAA enterprise, focus on models

Unified modeling and data assimilation

- Coupled, ensemble based, reforecast and reanalysis
- Including pre- and postprocessing, calibration, verification validation, dissemination, + (end-to-end WRN)

Focus on community modeling

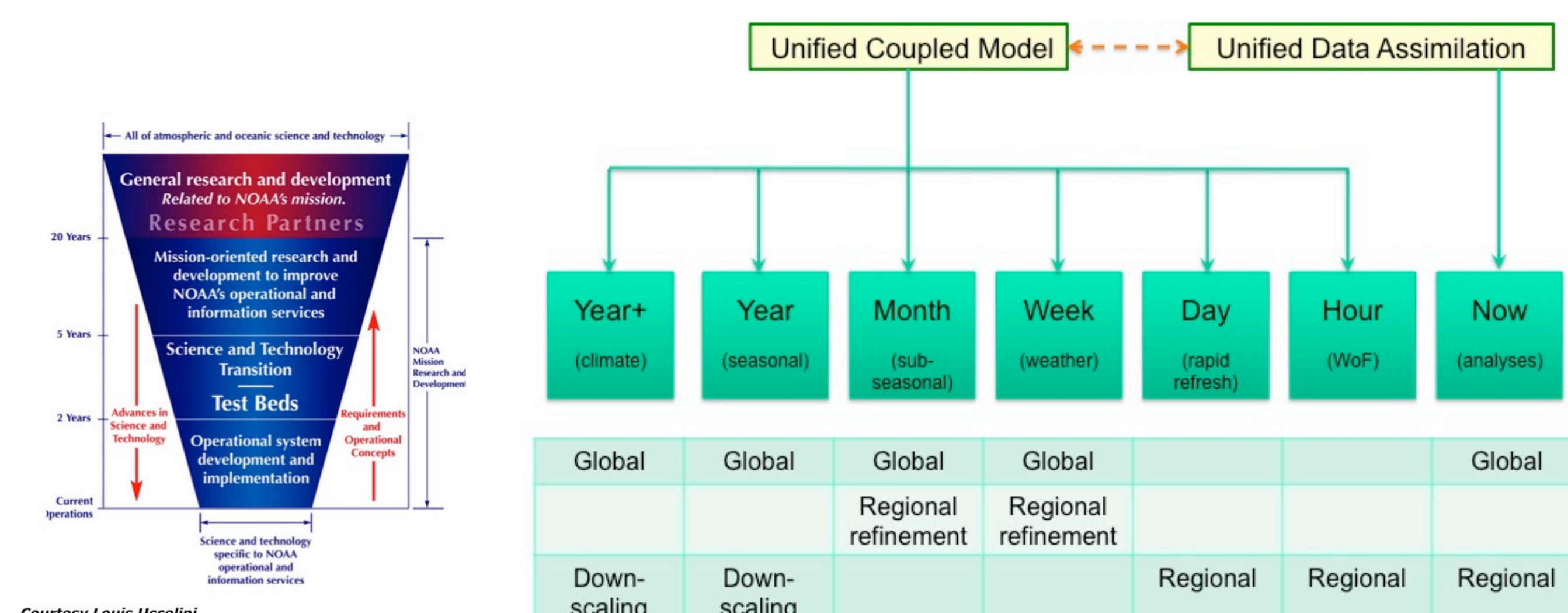
- NOAA mission requirements served faster using community
- NOAA community focus on O2R enabling R2O

Evidence-driven decisions

- Same standards for all who contribute

Transparent and robust governance

- Service requirements
- Technical requirements / solutions
- Prioritization



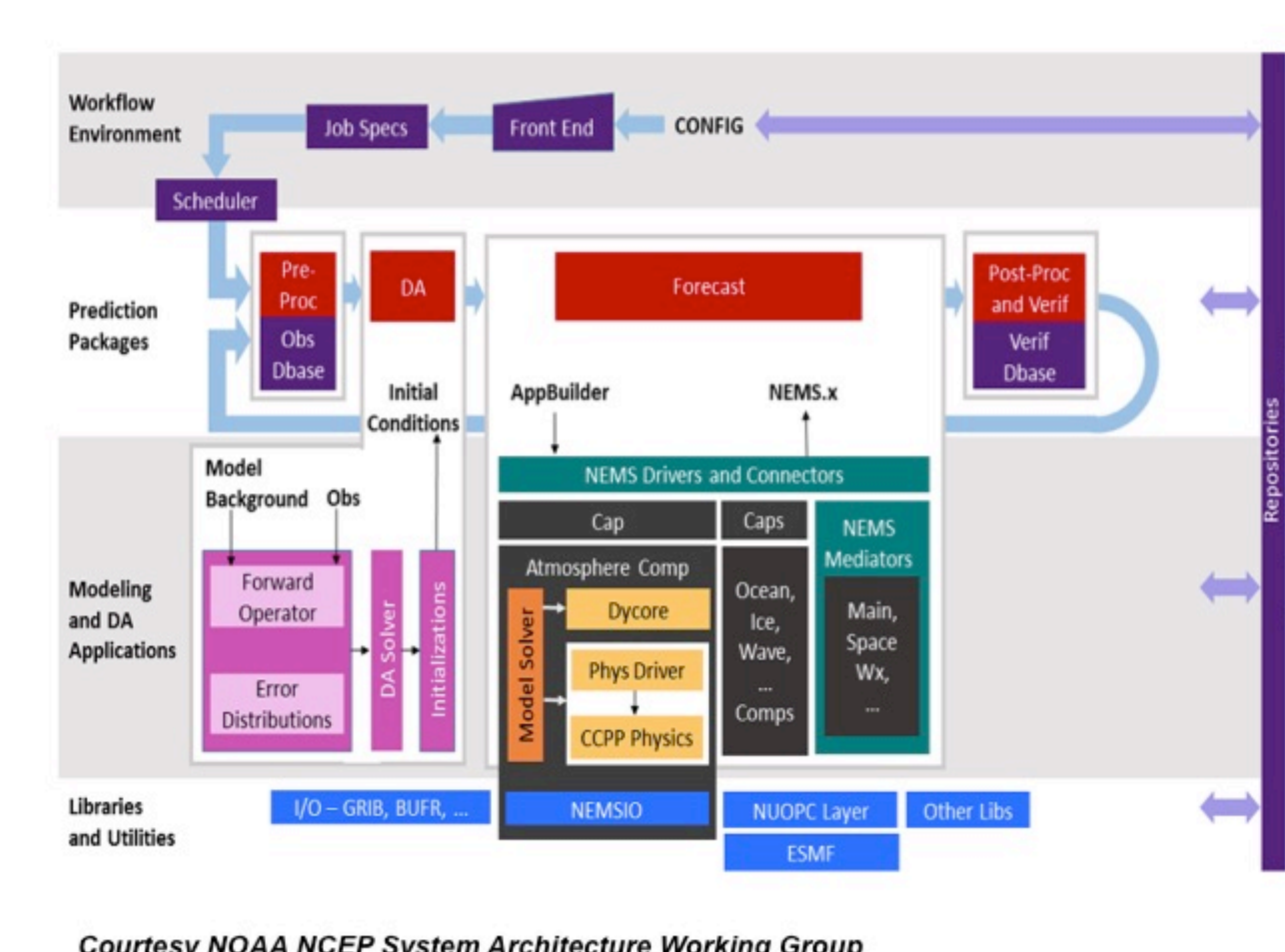
### Product ranges needed for the NWS mission

| Range | Target                                             | Cadence  | Forecast |
|-------|----------------------------------------------------|----------|----------|
| Year  | Seasonal (months)                                  | 7 days   | 9-15 mo. |
| Month | Subseasonal (weeks)                                | 24 h     | 35-45 d  |
| Week  | Days 1-7, Actionable Weather                       | 6 h      | 5-8 d    |
| Day   | Days 1-3, Mesoscale / Stormscale                   | 1 h      | 18 h     |
| Hour  | Hours 1-4, Stormscale Hazardous Weather Prediction | 5-15 min | 2-4 h    |
| Now   | Analysis                                           | 5-15 min | ---      |

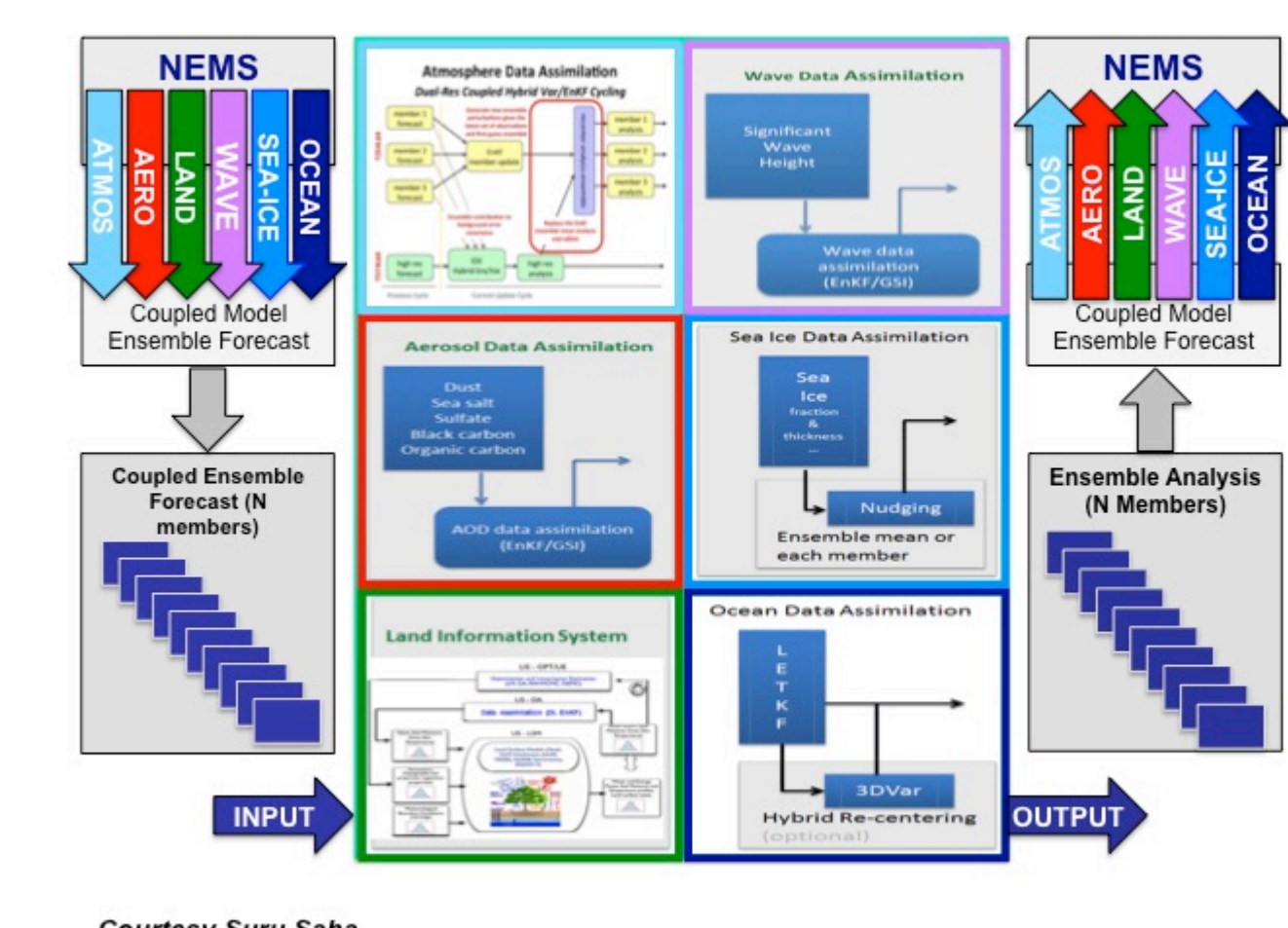
Product = Coupled Ensemble + Reanalysis + Reforecast

## 4. Roadmap: Tools

Architecture: Modular ESMF / NUOPC / NEMS



Coupling: Model and DA JEDI: Joint Effort for DA Integration



## 6. Roadmap: End State

Transition to Unification, 5 year goal needs estimated 37 PFlop without WoFS

| Element   | Cadence  | Range   | Resol.    | Ens. | Update | RR           |
|-----------|----------|---------|-----------|------|--------|--------------|
| SFS       | 7 d      | 9-15 mo | 50 km (g) | 28   | 4 y    | 1979-present |
| SSFS      | 24 h     | 35-45 d | 35 km (g) | 31   | 2 y    | 20-25 y      |
| GFS       | 6 h      | 7-10 d  | 13 km (g) | 26   | 1 y    | 3 y          |
| RRFS      | 1 h      | 18 h    | 3 km (r)  | 26   | 1 y    | TBD          |
| WoFS      | 5-15 min | 2-4h    | 1 km (r)  | 26   | 1 y    | TBD          |
| Analyses  | 6-24 h   | ---     | Var. (g)  | ---  | 6 mo   | N/A          |
| Trad. RUA | 15 min   | ---     | TBD (r)   | ---  | ---    | ---          |

(g) global  
(r) regional  
Red: uncharted territory

"Moonshot", best in the world, 10 year goal needs estimated 730 PFlop with WoFS covering 10% of RRFS

| Element   | Cadence  | Range  | Resol.     | Ens. | Update | RR           |
|-----------|----------|--------|------------|------|--------|--------------|
| S3FS      | 7 d      | 12 mo  | 15 km (g)  | 200  | TBD    | 1979-present |
| GFS       | 24 h     | 45 d   | 100        | ---  | ---    | ---          |
| RRFS      | 1? - 6 h | 7-10 d | 5 km (g)   | 50   | 1 y    | 3 y          |
| RRFS      | 1 h      | 24 h   | 1.5 km (r) | 50   | 1 y    | TBD          |
| WoFS      | 5 min    | 2h     | 0.5 km (r) | 50   | 1 y    | TBD          |
| Analyses  | 6-24 h   | ---    | Var. (g)   | ---  | 1 y    | N/A          |
| Trad. RUA | 5 min    | ---    | TBD (r)    | ---  | ---    | ---          |