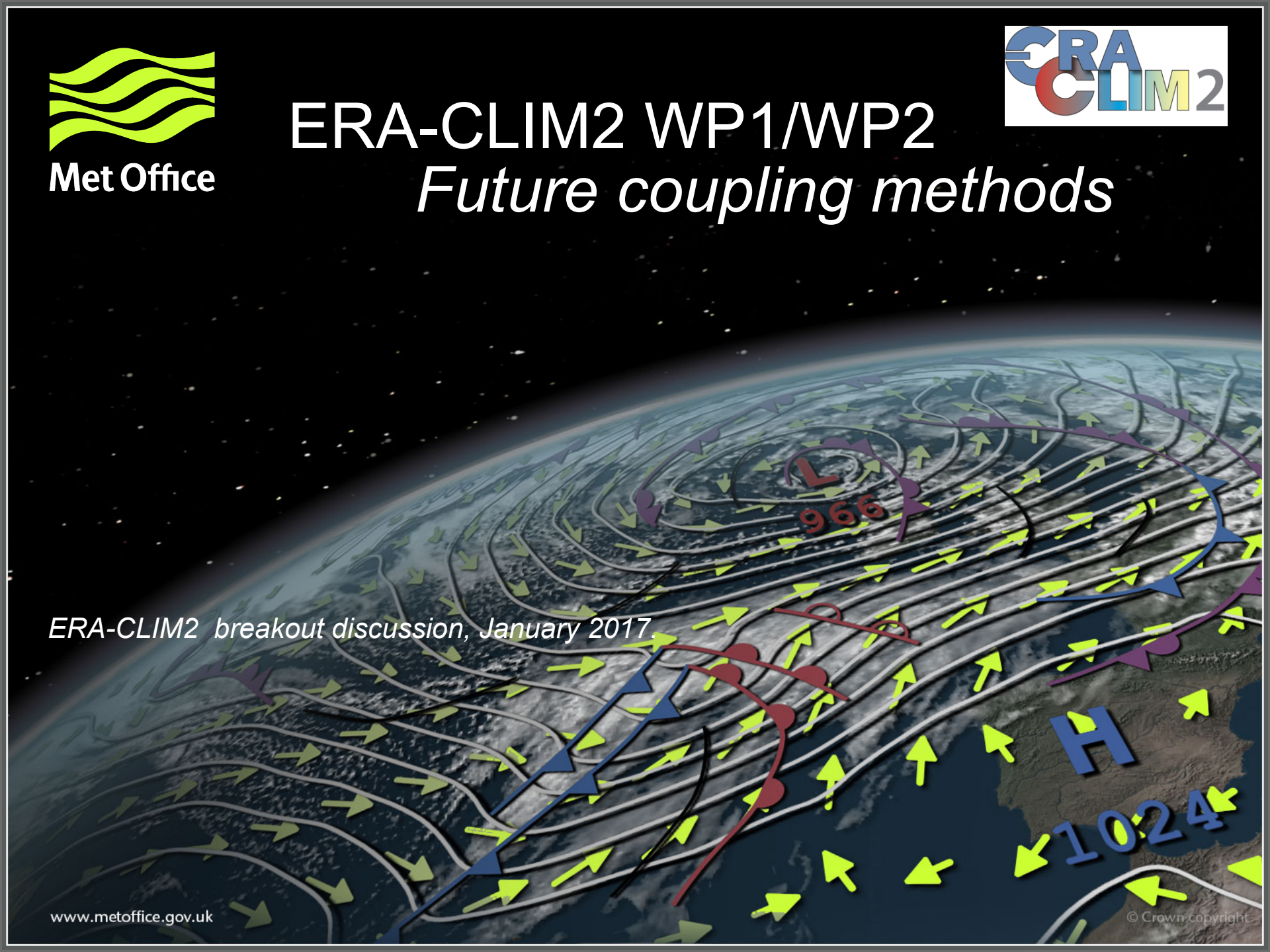
ERA-CLIM2 WP1/WP2
Future coupling methods

ERA-CLIM2 breakout discussion, January 2017.



Contents

- Discuss outstanding deliverables – particularly any issues.
- Integrating code developments in CERA: e.g. METO and SST assimilation; MERCO sea-ice assimilation code delivery.
- Outcomes from the WMO CDAW breakout session in Toulouse.

WP2 status of deliverables

Deliverable number	Deliverable title	Delivery date	Type
D2.1	Assimilation of sea-surface temperature observations [METO]	27 => 39	Code + documented results
D2.2	Assimilation of sea-ice observations [MERCO]	27 => 39	Code + documented results
D2.3	Ensemble-based covariance estimates [CERFACS]	34 => 46	Code + documented results
D2.4	Ensemble-based covariances in coupled data assimilation [CMCC]	24 => 36	Report
D2.5	4D-Var in NEMOVAR [INRIA]	27 => 39	Report
D2.6	Optimised model parameters for the carbon cycle [UVSQ]	34 => 46	Report
D2.7	Alternatives for coupling ocean biogeochemistry [MERCO]	34 => 46	Report
D2.8	Weakly coupled assimilation methods [UREAD]	18	Report
D2.9	Covariances from weakly coupled data assimilation [METO]	18	Report
D2.10	Coupled-model drift [UREAD]	34 => 46	Report
D2.11	Fully coupled data assimilation [INRIA]	34 => 46	Report
D2.12	Status report WP2 [METO]	8	Report

- 4 deliverables complete. The latest is the D2.4 report.
- 3 deliverables are due soon (month 39). They are expected to be delivered on time.
- 5 deliverables are due at month 46.

WP2 deliverables

- Two types of deliverables:
  - Reports – standard report of the developments and results. Can provide template if needed.
  - Code developments, documentation and test results. Suggested template:

Summary

Brief summary of what was delivered, its impact in the testing carried out, and how it can be integrated into CERA.

1 Introduction

- Aim of the work.
- Background on how it is building on previous scientific work.
- Background on the code/system used for the developments and how similar/different the framework is to CERA.

2 Scientific description of the developments

- Brief description of the theory behind the developments.
- Describe any idealised experiments if appropriate.

3 Technical description of the code and its review

- Describe the code changes which were made.
- Describe how the code was reviewed and how it has been delivered to ECMWF (e.g. in what revision of the NEMOVAR code has it been included).
- Describe how the new functionality can be used at ECMWF in CERA.

4 Test results

- Describe experimental set-up.
- Demonstrate impact of new development.

5 Discussion and conclusions

- Discuss likely impact of new developments in CERA system.
- What else needs to be done before implementation in CERA.
- Discuss ideas for future work.

WMO Coupled Data Assimilation Workshop

- Breakout session on challenges and priorities for coupled data assimilation for reanalysis.
- Summary presented by P. Laloyaux.
- Could we come up with a list of priorities for further research based on that and other ideas?

CDAW breakout
Challenges/priorities for coupled DA

- **Coupled model biases**
  - Fewer data to constrain the system in the early period.
  - Drift and "jumps" in stratosphere, deep ocean, sea ice.
  - Challenge for strongly coupled DA (transfer of biases or positive impact?).
  - More research needed on coupled model improvement and bias correction.
  - Less flexibility in coupled system to compensate for biases in individual components.
  - Encourage inter-comparison of biases and drifts in different coupled reanalyses.

CDAW breakout
Challenges/priorities for coupled DA

- **Coupled DA methodology**
  - Smoothness between cycles.
  - Longer assimilation windows (?)
  - Flexibility in the representation of (multiple) spatial scales in the background error covariances.
  - Better assimilation at the air-sea interface (bias reduction vs. coupled interactions).
  - Use of coupled reanalysis ensembles for flow-dependent covariance estimation as well as uncertainty estimation.
  - Consistent DA methodology between components.

CDAW breakout
Challenges/priorities for coupled DA

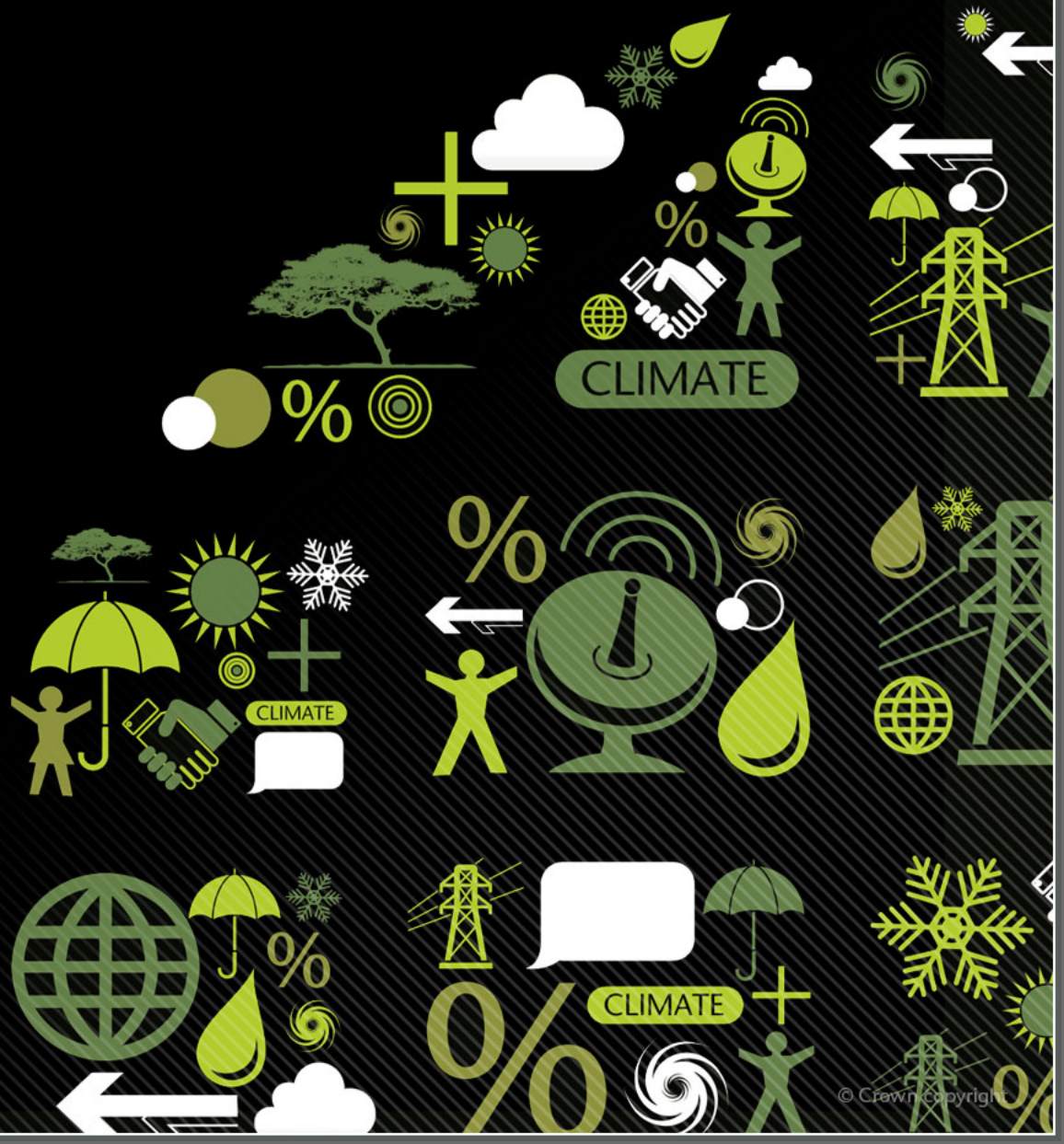
- **Spin up and initialization of multiple streams**
  - Computational cost.
  - Ocean and sea-ice initialization at start of century.
  - Determining uncertainty in initial conditions.

- **Changes in the observing system over time**
  - Spurious climate signals/trends exacerbated by model and observation bias.
  - Model and observation bias correction is needed.
  - Assimilate only surface pressure and SST (current approach for climate reanalysis).
  - Quality control (esp. newly observed area).

CDAW breakout
Challenges/priorities for coupled DA

- **Assessment**
  - Difficult because of multiple components.
  - Visualization and diagnostics.
  - Provide feedback on coupled model biases (analysis increments).
- **Novel observation types**
  - Tracer observations
  - Bottom pressure
  - Tide gauges
  - Tree rings, coral isotopes

Met Office



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