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It's about TIME

Proposal of standard conventions for TIME within the meteorology community
Based on Met-Ocean DWG discussion at OGC TC Meeting (Sept 2010) & subsequent review

Third Workshop on the use of GIS/OGC Standards in Meteorology

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November 2010

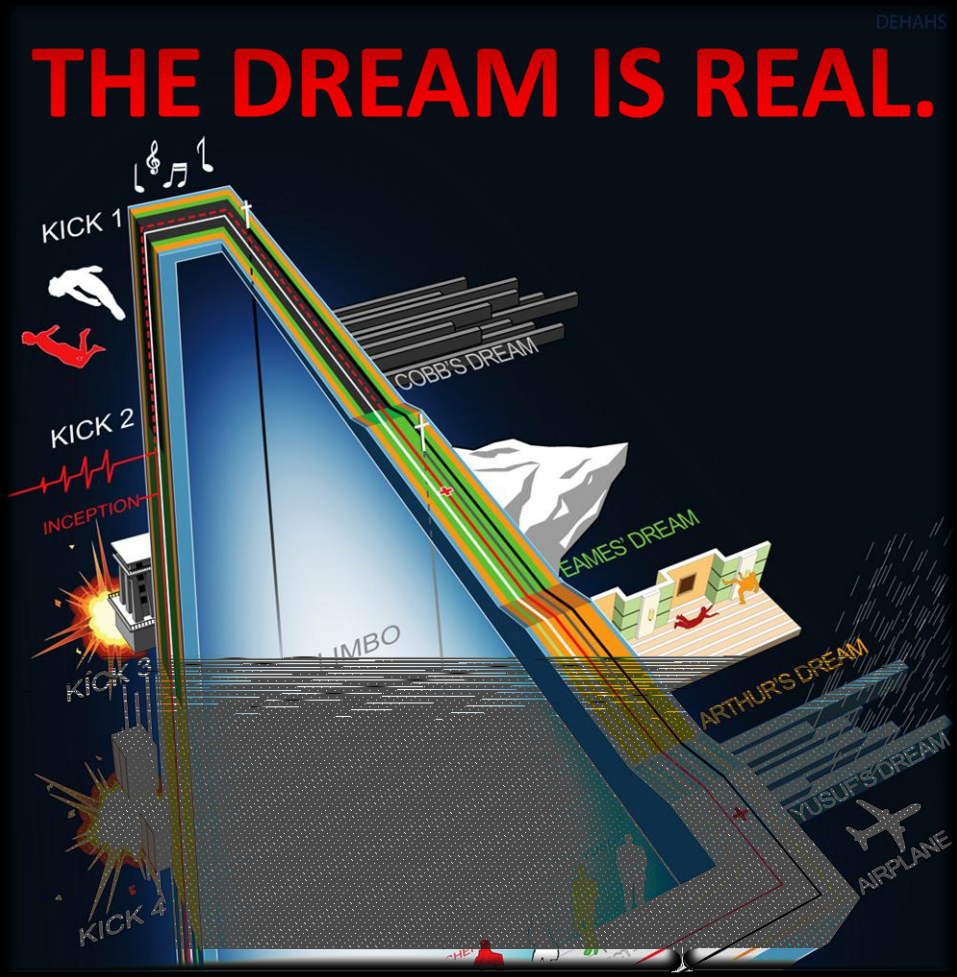
Aim

Agree a standard way to describe the different time perspectives of meteorologists in a way that can be easily understood

(in other communities)


CONNECTION
52
WEST

THE DREAM IS REAL.



I have a DREAM …

Using the metaphor of a DREAM to represent a forecast …

b de a b _ eb b eb c eb d bb

Just as in a *real* forecast, the weather I imagine will be different every time I dream – *perhaps depending on whether I ate cheese before bed time!*

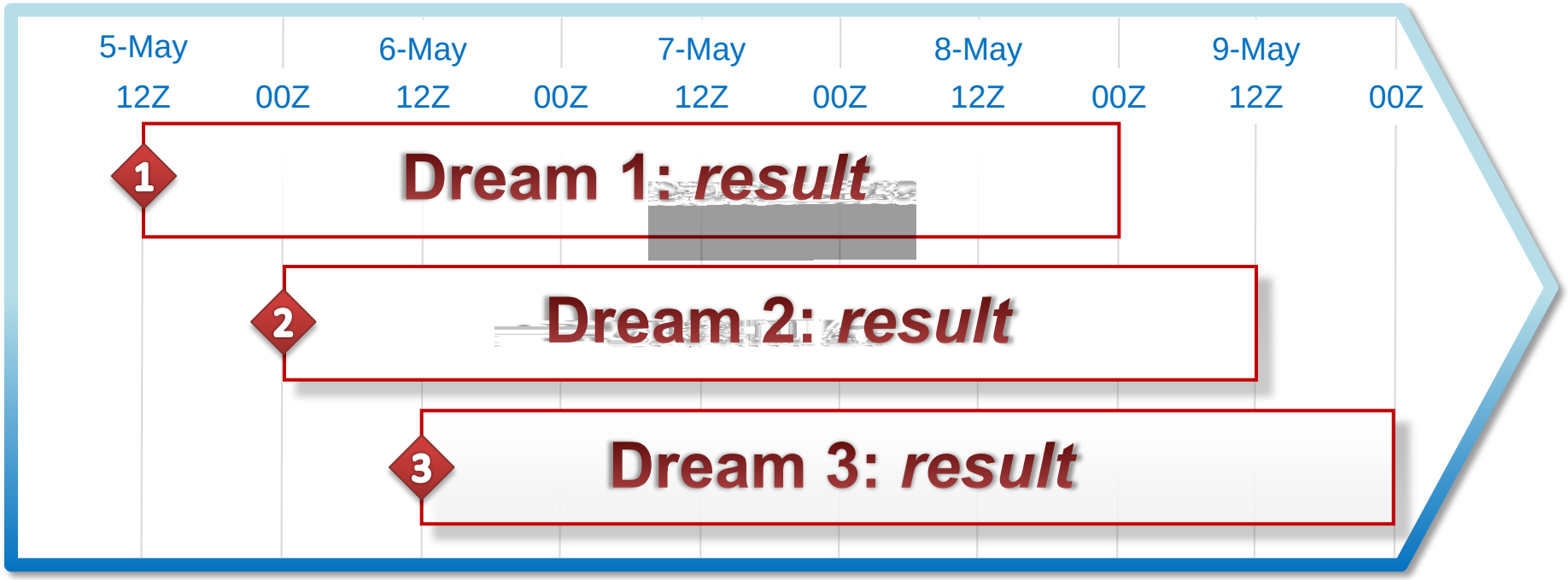
There can be only one *(conceptual space)*

There is only one conceptual space in which we operate: x, y, z & T

These are our PRIMARY DIMENSIONS

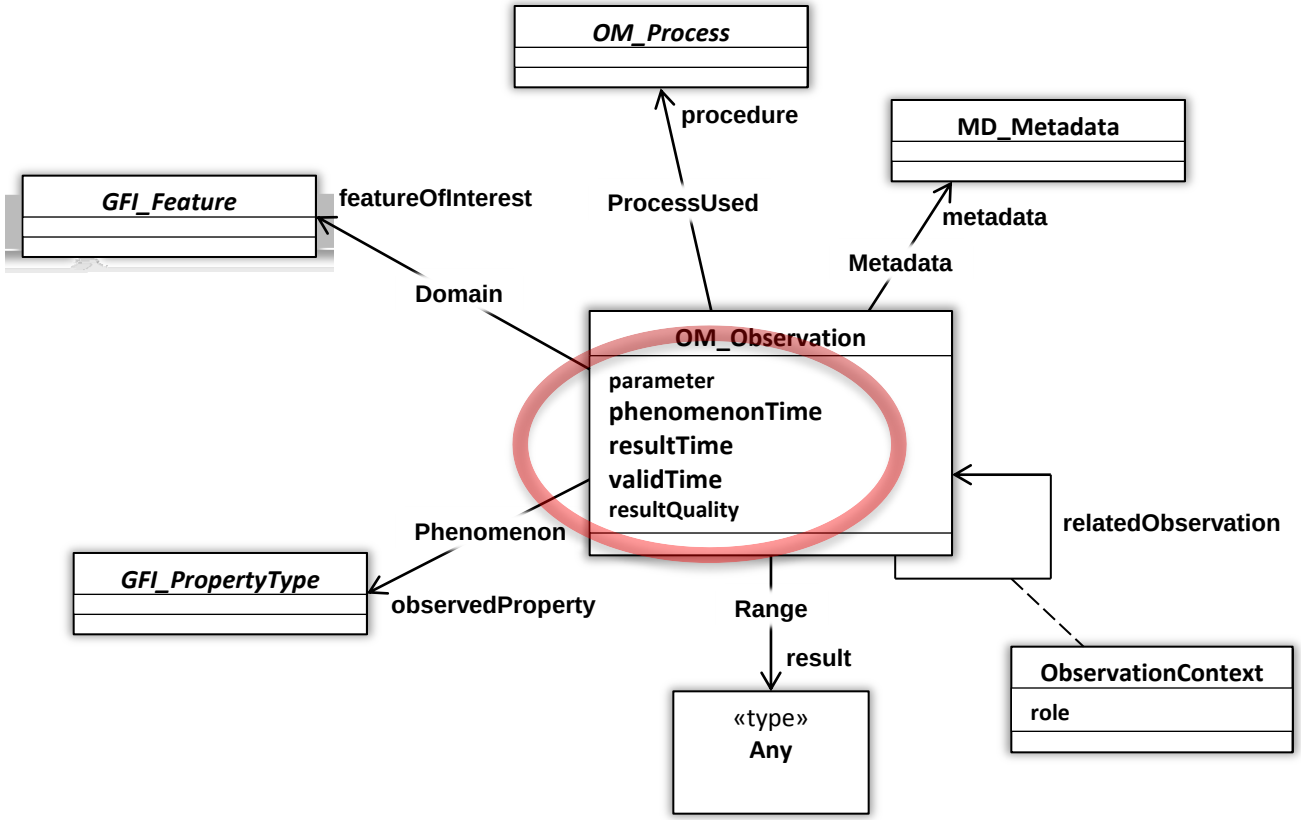
Each dream RESULT is related to a specific dreaming EVENT …

just like a weather forecast is related to a specific simulation event



ISO 19156 Observations and Measurements

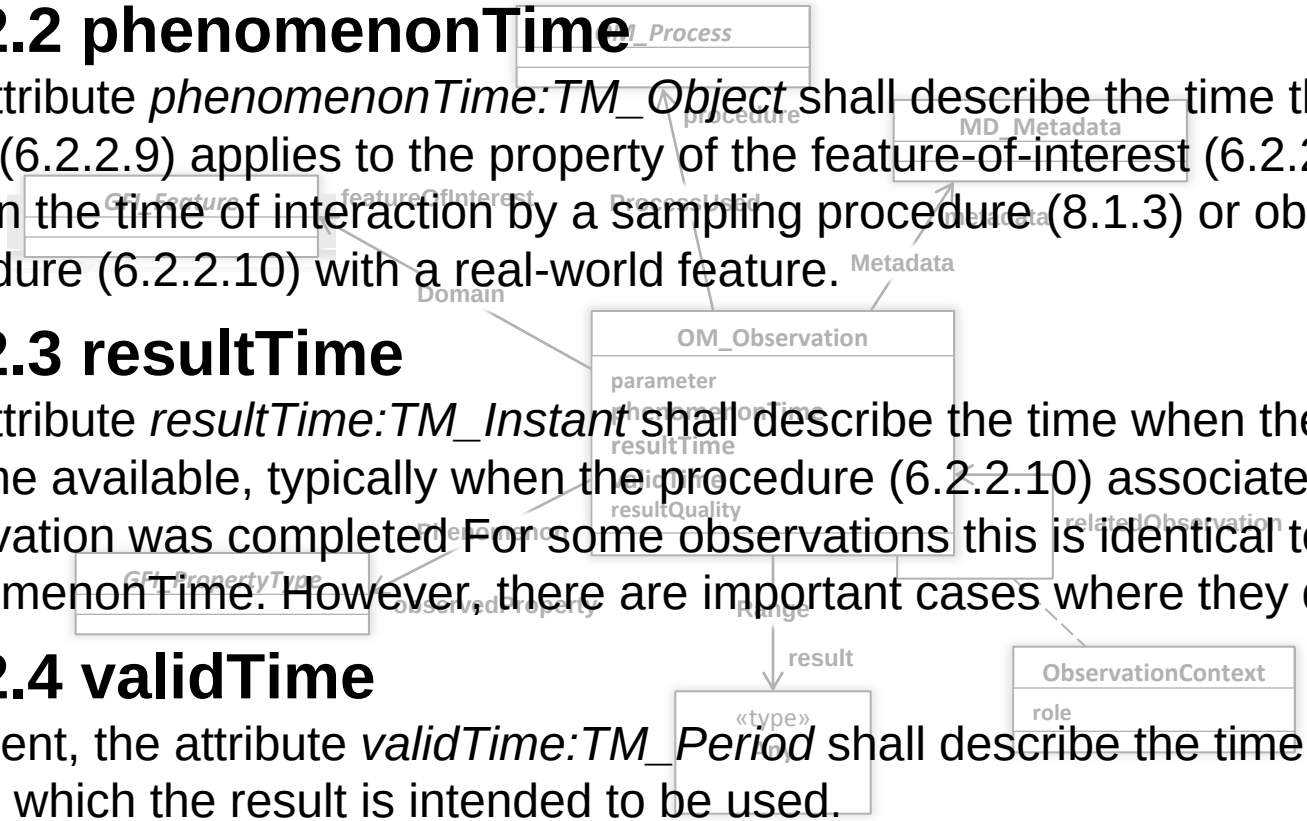
An Observation is an **EVENT** whose Result is an estimate of the value of some Property of the Feature-of-interest, obtained using a specified Procedure



… and it works for forecasts too !

6.2.2.2 phenomenonTime

The attribute *phenomenonTime:TM_Object* shall describe the time that the result (6.2.2.9) applies to the property of the feature-of-interest (6.2.2.7). This is often the time of interaction by a sampling procedure (8.1.3) or observation procedure (6.2.2.10) with a real-world feature.



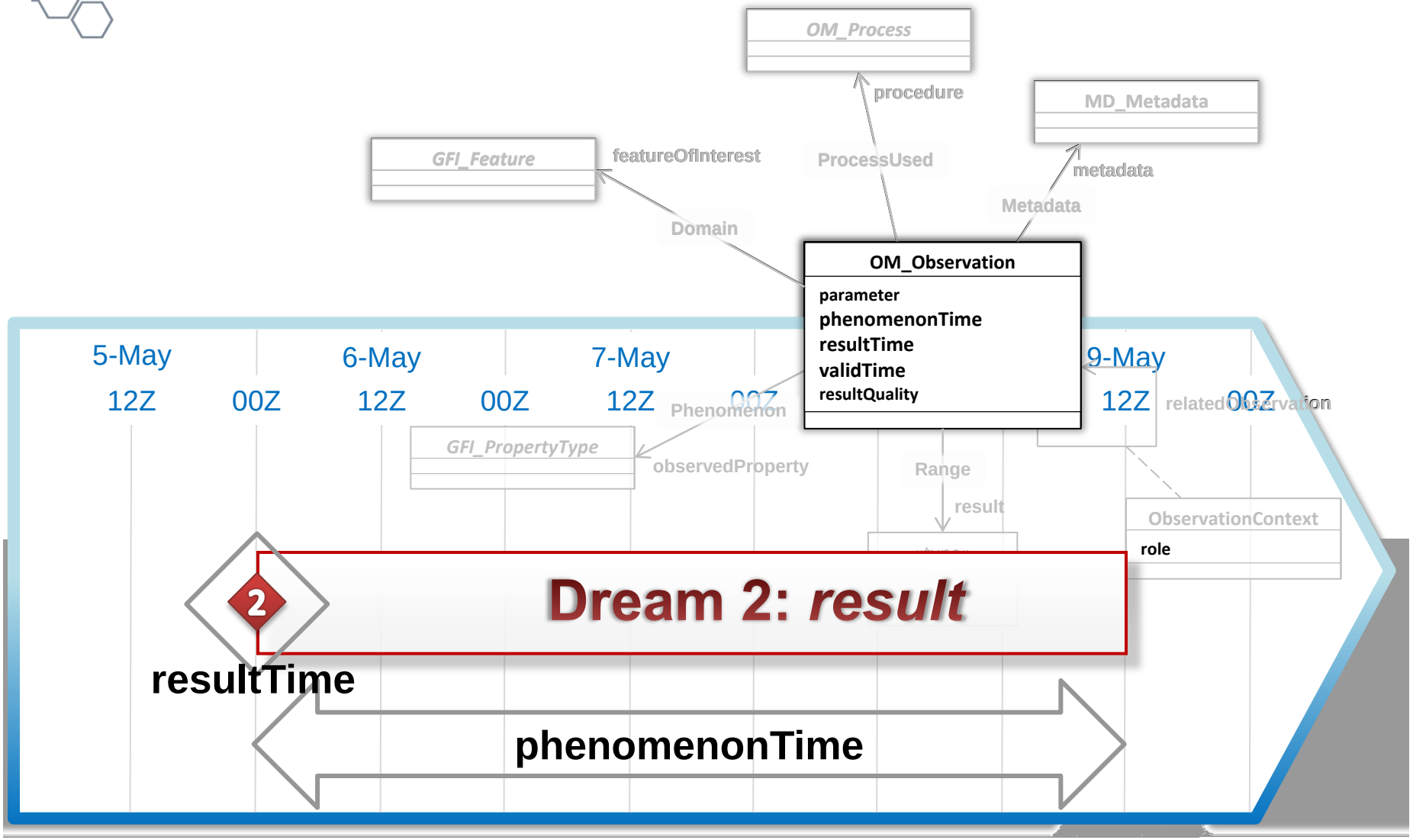
6.2.2.3 resultTime

The attribute *resultTime:TM_Instant* shall describe the time when the result became available, typically when the procedure (6.2.2.10) associated with the observation was completed For some observations this is identical to the phenomenonTime. However, there are important cases where they differ.

6.2.2.4 validTime

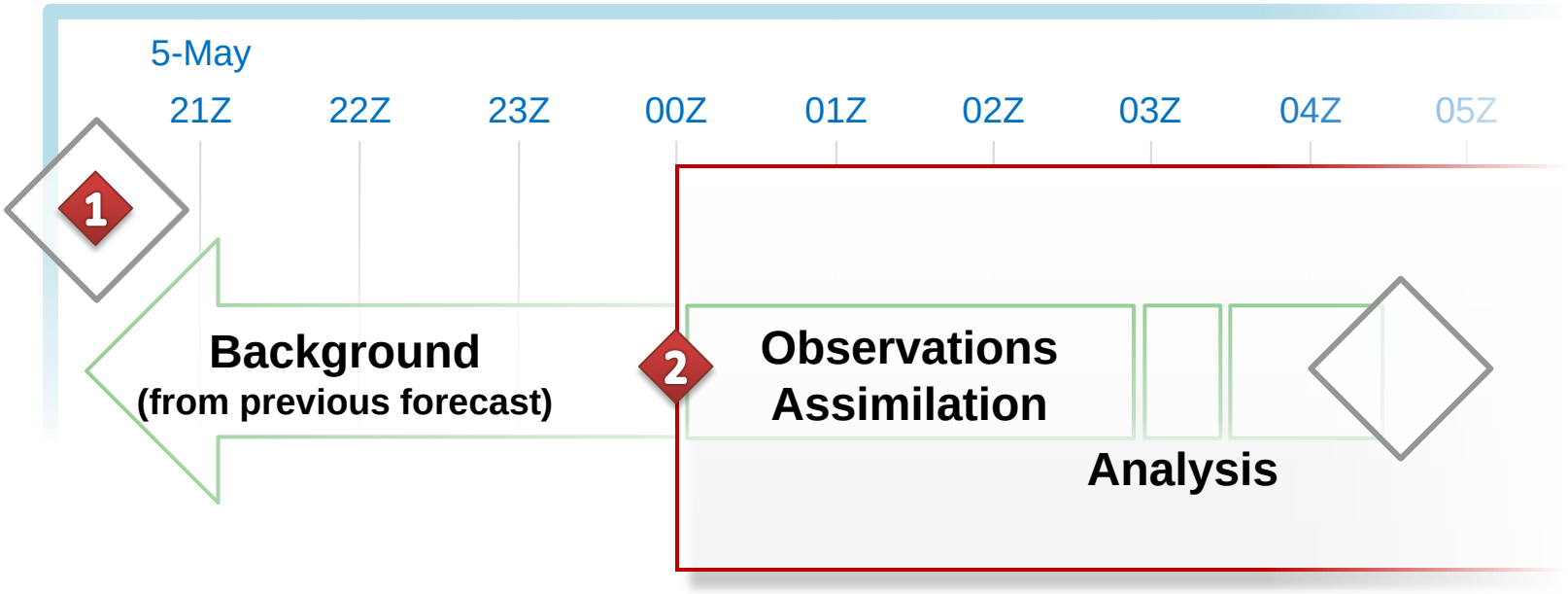
If present, the attribute *validTime:TM_Period* shall describe the time period during which the result is intended to be used.

Mapping terms from O&M to meteorology



When does a forecast start?

Just like dreams, forecasts are not created instantaneously –
The dreaming (simulation!) event has DURATION.

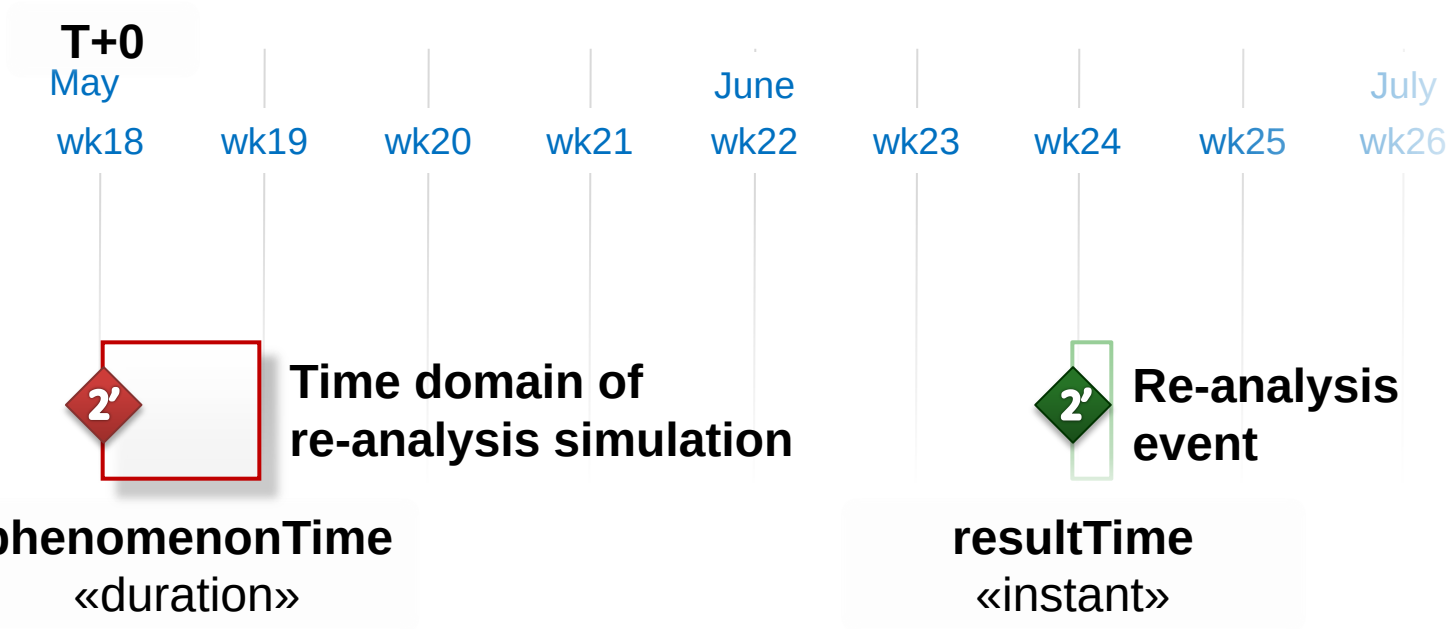


Analysis

… except for Re-analyses …

For re-analyses, there is no correlation between the nominal Analysis-Time and the time that the simulation is executed (i.e. the observation *event*).

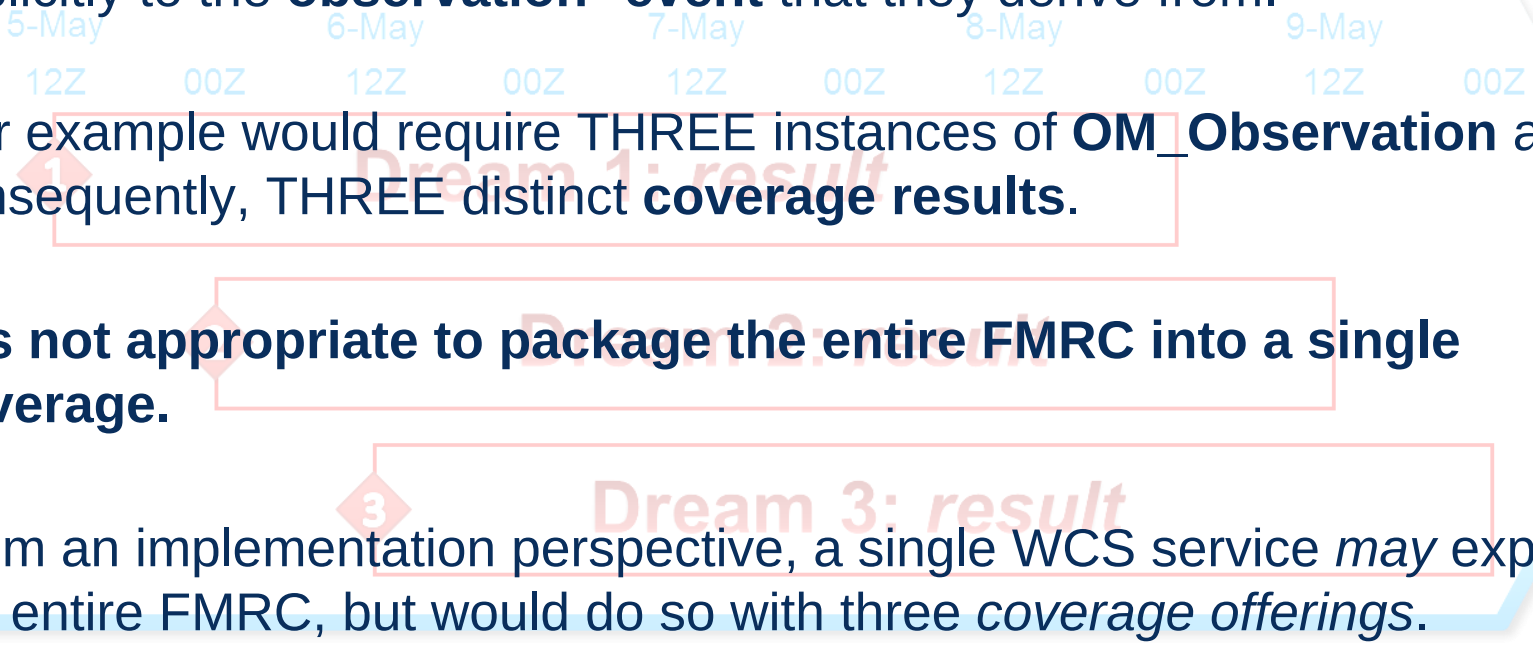
In this case, the **resultTime** clearly must relate to the time at which the re-analysis event occurs – *noting that this may still be an approximation*



Forecast Model Run Collections (FMRC)

The situation of overlapping (coverage) domains is analogous to having different coverage datasets derived from multiple observing instruments – such as a radar mosaic.

The critical point is that **both** cases should relate each coverage dataset explicitly to the **observation*** **event** that they derive from.



Our example would require THREE instances of **OM_Observation** and, consequently, THREE distinct **coverage results**.

It is not appropriate to package the entire FMRC into a single coverage.

From an implementation perspective, a single WCS service *may* expose the entire FMRC, but would do so with three *coverage offerings*.

The need for model inter-comparison

Even if one accepts that each Forecast Model Run creates a distinct coverage result, there is still the requirement to compare the values across model-run collections. For example, the ‘verification process’ will compare datasets to identify systematic errors in earlier forecasts.

Even in this case, there is no requirement for interpolation between model-runs*. Each model-run is treated as a discrete entity. This further supports the proposal to prohibit packaging an entire FMRC in to a single coverage.

Furthermore, an individual coverage has only a **single domain** extent … (x, y, z, T). A FMRC packaged in a single coverage would imply a **sparse** data-set.

Our requirement is to be able to present the structure of the FMRC in such a way that enables the consumer to select the entities of interest.

The Sensor Observation Service (SOS) API may help resolve this concern as it exposes ‘observation offerings’ as its primary entities.

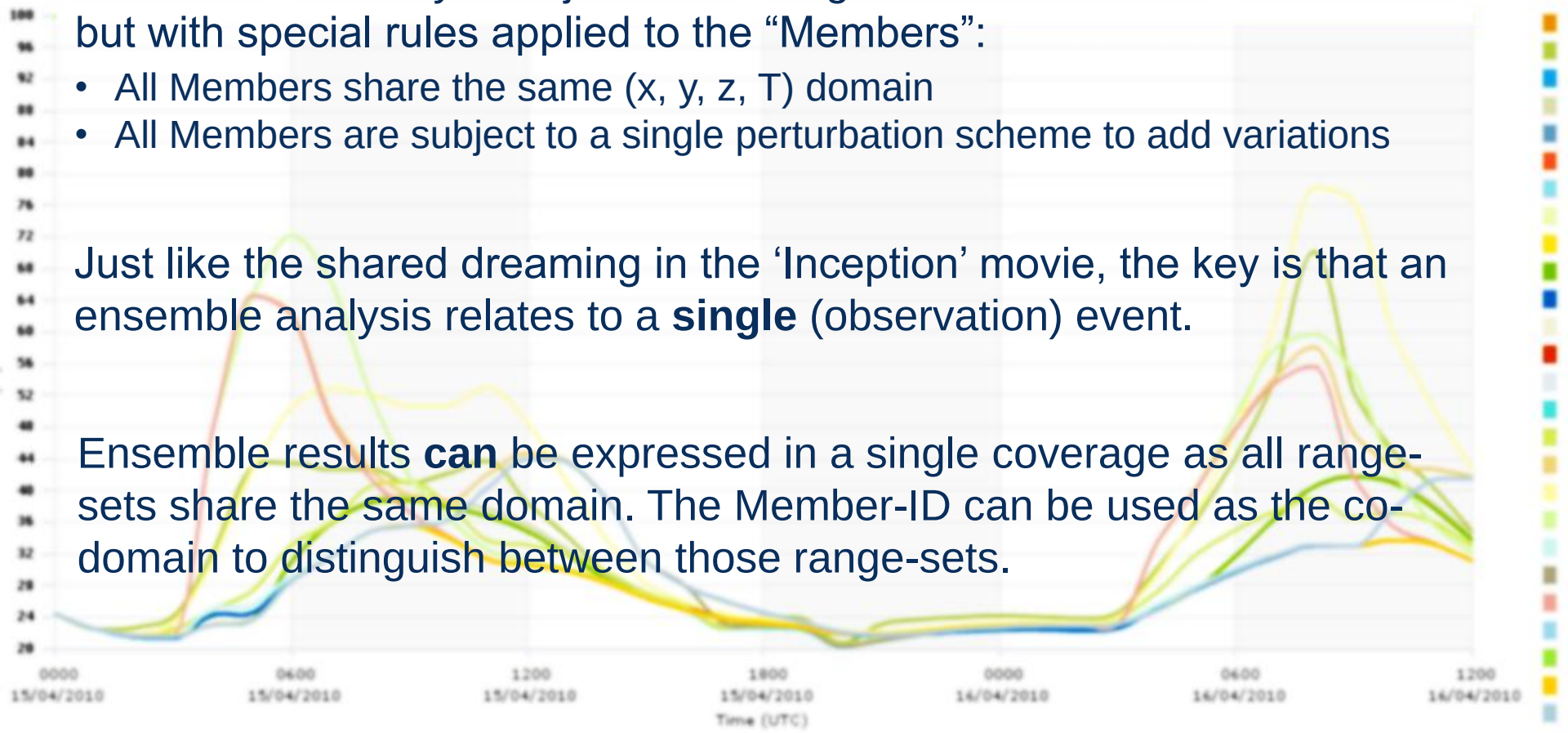
What about Ensembles?

An Ensemble Analysis is just like having 50 simultaneous dream-events – but with special rules applied to the “Members”:

- All Members share the same (x, y, z, T) domain
- All Members are subject to a single perturbation scheme to add variations

Just like the shared dreaming in the ‘Inception’ movie, the key is that an ensemble analysis relates to a **single** (observation) event.

Ensemble results **can** be expressed in a single coverage as all range-sets share the same domain. The Member-ID can be used as the co-domain to distinguish between those range-sets.



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THUS CONCLUDES THE PROPOSAL –

BUT CAN WE BE SURE WE ARE BACK IN THE REAL WORLD?

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Thank you

Comments from the crowd: general agreement but…

- (Baudouin Raoult) This is different to agreement at Toulouse 2009 (2nd workshop on the use of OGC/GIS standards in meteorology)
  - Need to confirm with Jon Blower et al.
- (Chris Little / Bruce Wright) What about 'lagged ensembles' (i.e. when you compare results from successive model runs to build probabilities)or 'multi-model ensembles'?
  - They are all related to discrete simulation events - thus they should be EXPLICITLY associated with different Observation Events … implying that the results from each model run will be packaged into separate coverages …
  - You may choose to combine the range-sets from different coverages for some analysis in the same way you may combine range-sets from overlapping radar mosaics … but there is NO requirement to pack all the range-sets from a multi-model or lagged ensemble into a single coverage!
- (Marie Francoise Voidrot) the ISSUE time of a forecast is required in addition to the nominal analysis time.
  - The nominal analysis time is USUSALLY correlated with the beginning of the forecast period (phenomenonTime:TM_Object … i.e. a duration) … so we can imply the nominal analysis time from the **phenomenonTime** object
  - This means we CAN use the **resultTime** for describing the issue time of the forecast. For our example, depending on the *precision* we choose, this MAY be 04.30Z (if we want to accurately describe the issue time) or 00Z (if we are using the precision typically used by meteorologists … i.e. the 'midnight run' or 'midday run')
  - If the RESULT is only describing , say, forecast days 3-to-5 then the nominal analysis time is NOT correlated with the start point of the phenomenonTime period! In this case we have two options:
    - For a 'normal' operation forecast, the **resultTime** is (reasonably) correlated with the nominal analysis time (i.e. the model initialisation time); the presentation example shows the nominal analysis time @ 00Z 6-May with the *actual* **resultTime** @ 04.30Z 6-May … but we agree to *approximate* the **resultTime** to correspond with the normal terminology used by meteorologists
    - If we don't want to approximate, we could create a separate observation instance that describes the simulation event that creates the Analysis … in which case we can be explicit for the **phenomenonTime** and **resultTime** for each observation (i.e. the simulation that created the analysis [observation^{A}] is declared as a separate 'event' to the simulation that created the forecast [observation^{B}]; each event has its own metadata)
  - Option (ii) explicitly sets the nominal analysis time to be the **phenomenon Time** of observation^{A}.
  - For simplicity, observation^{A} could have a **nil value** for the **result**; *i.e. observation^{A} only holds metadata*
  - These same two options can be applied to a re-analysis