Introducing Vertical Transformations in ArcGIS

Ivonne Seler and Melita Kennedy

Height

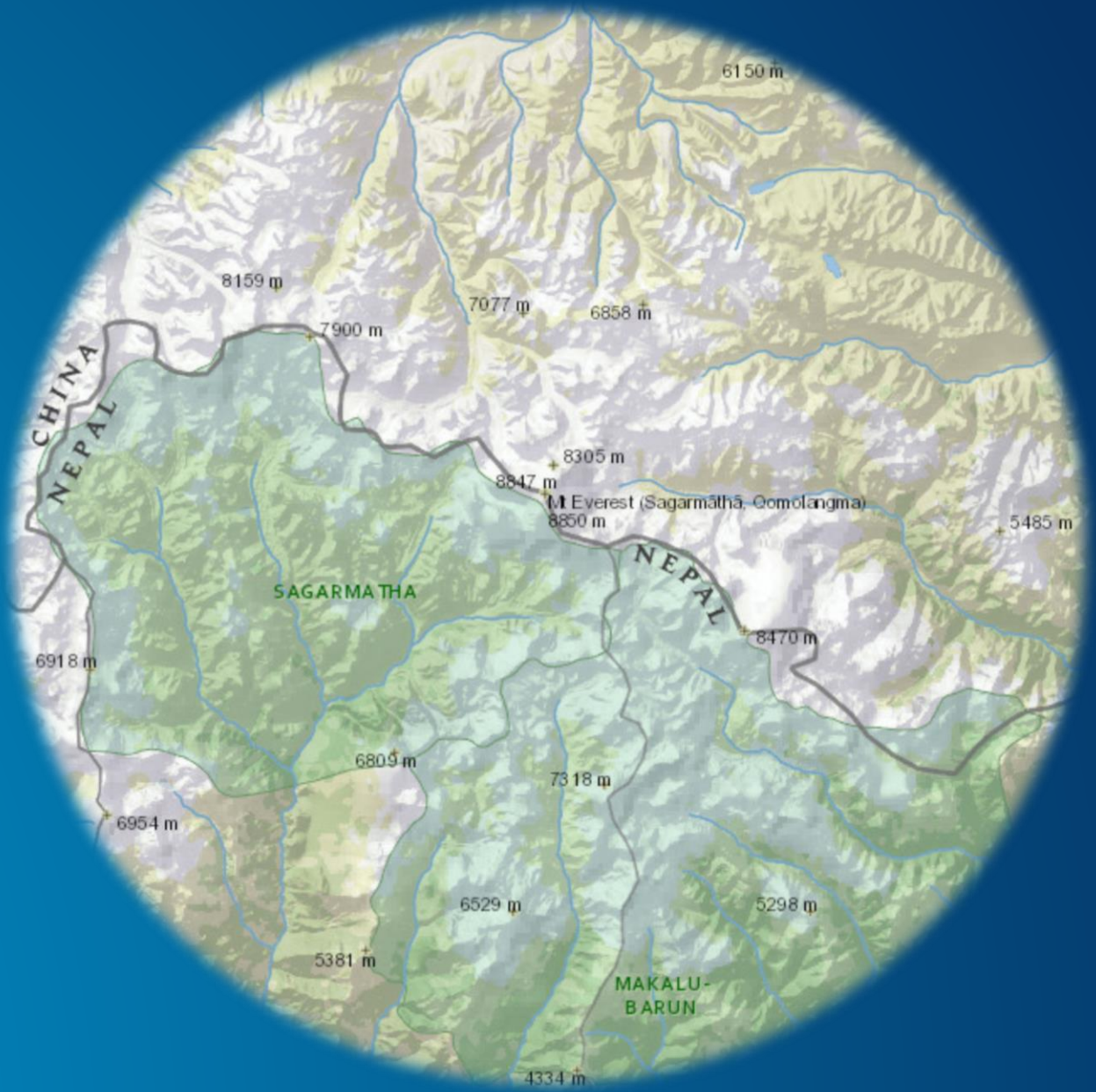
- Q: How high is Mount Everest?

8844.43 meters

29029 feet

8.850 kilometers

29017.16 feet



Height

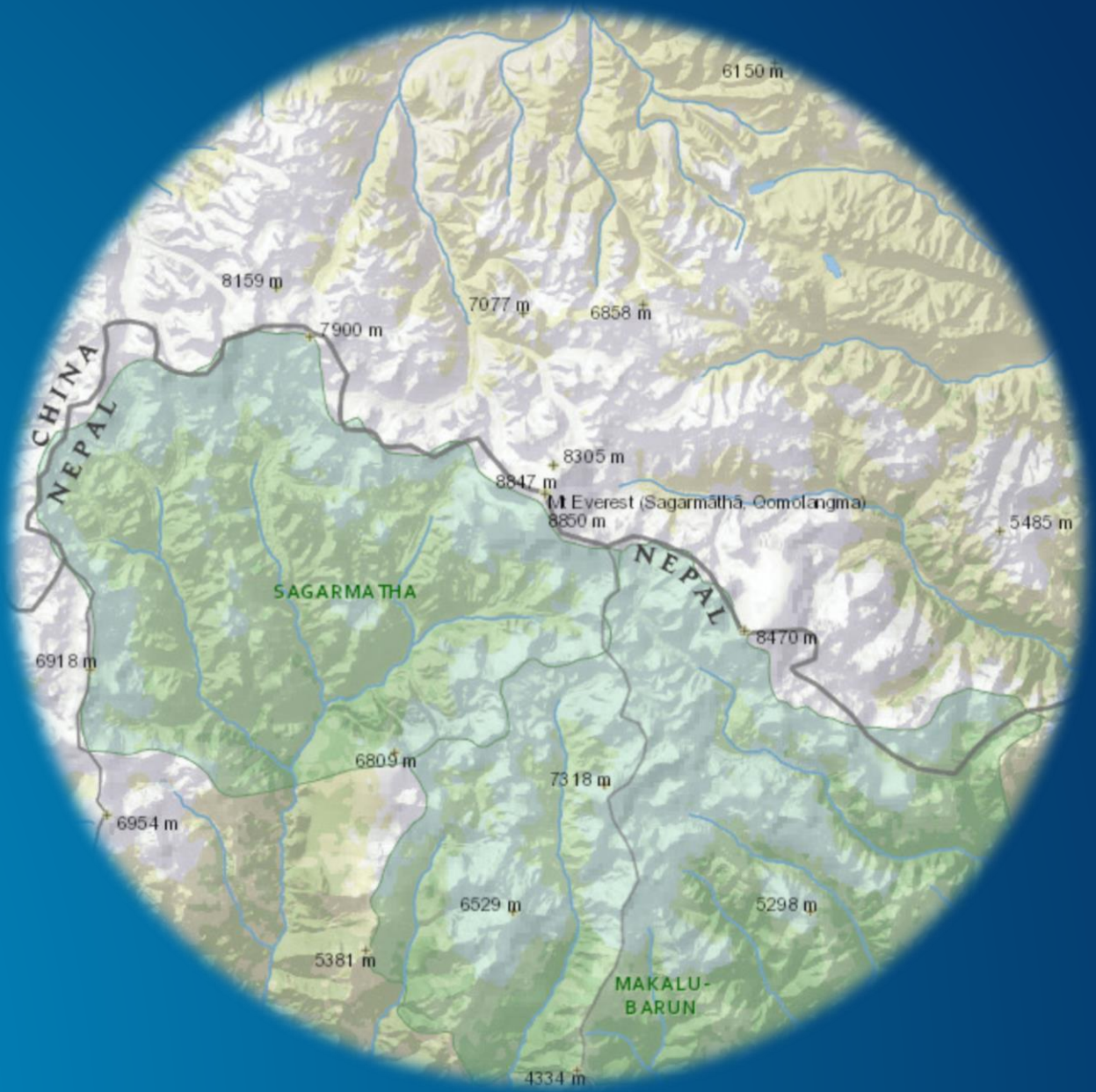
- Q: How high is Mount Everest?
- A: It depends on the vertical coordinate system.

8844.43 meters

29029 feet

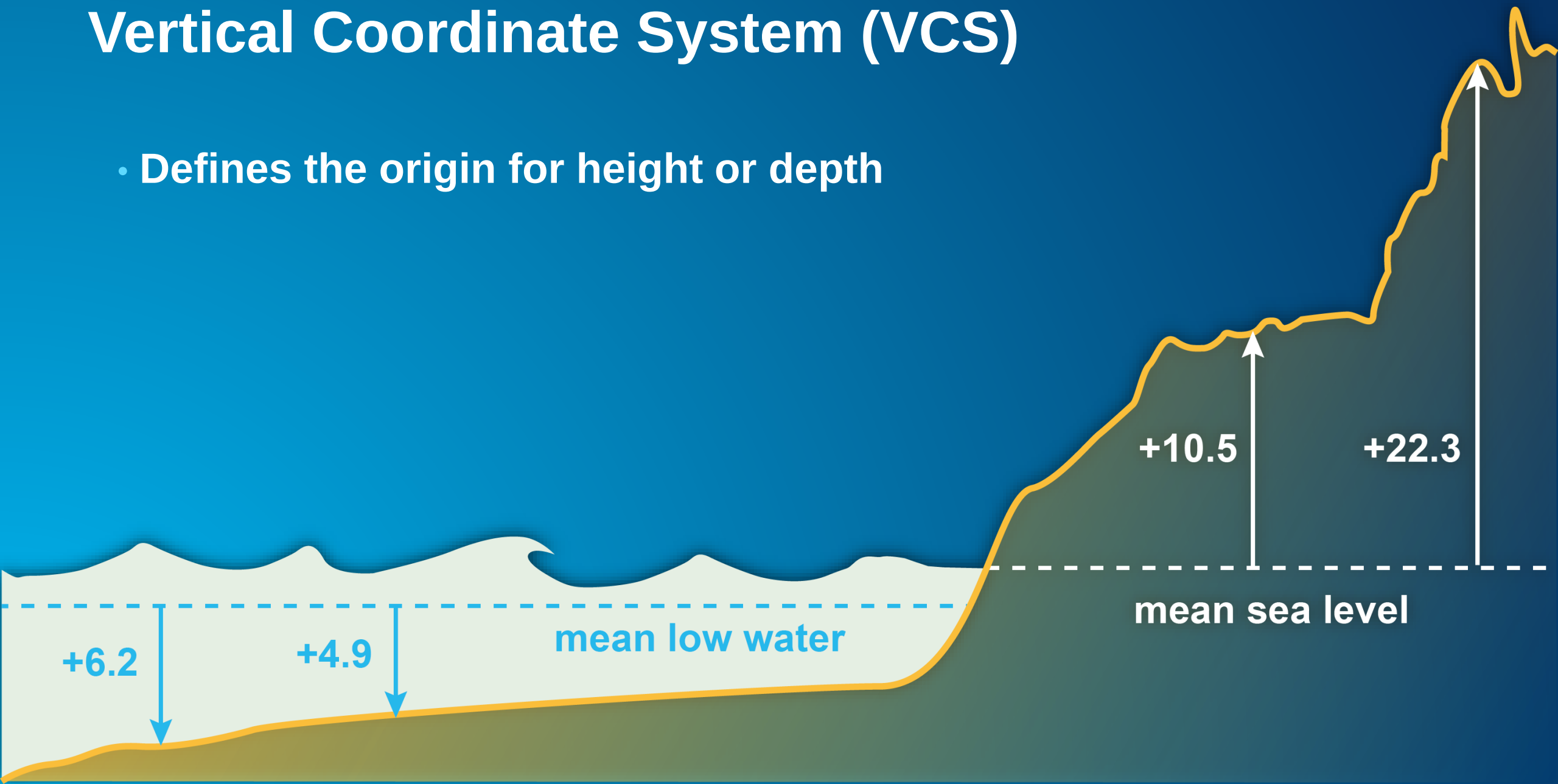
8.850 kilometers

29017.16 feet



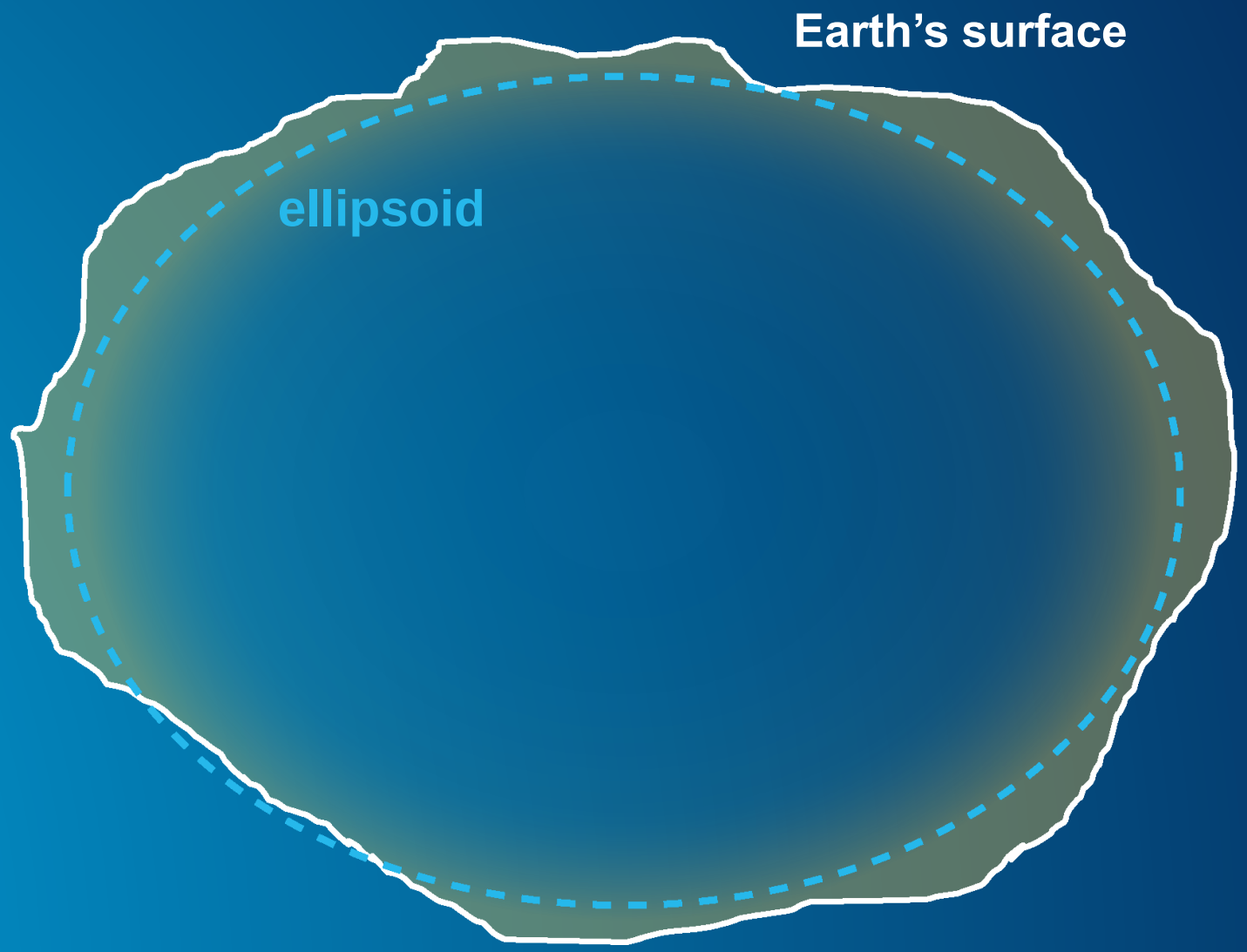
Vertical Coordinate System (VCS)

- Defines the origin for height or depth



The Origin for Height or Depth

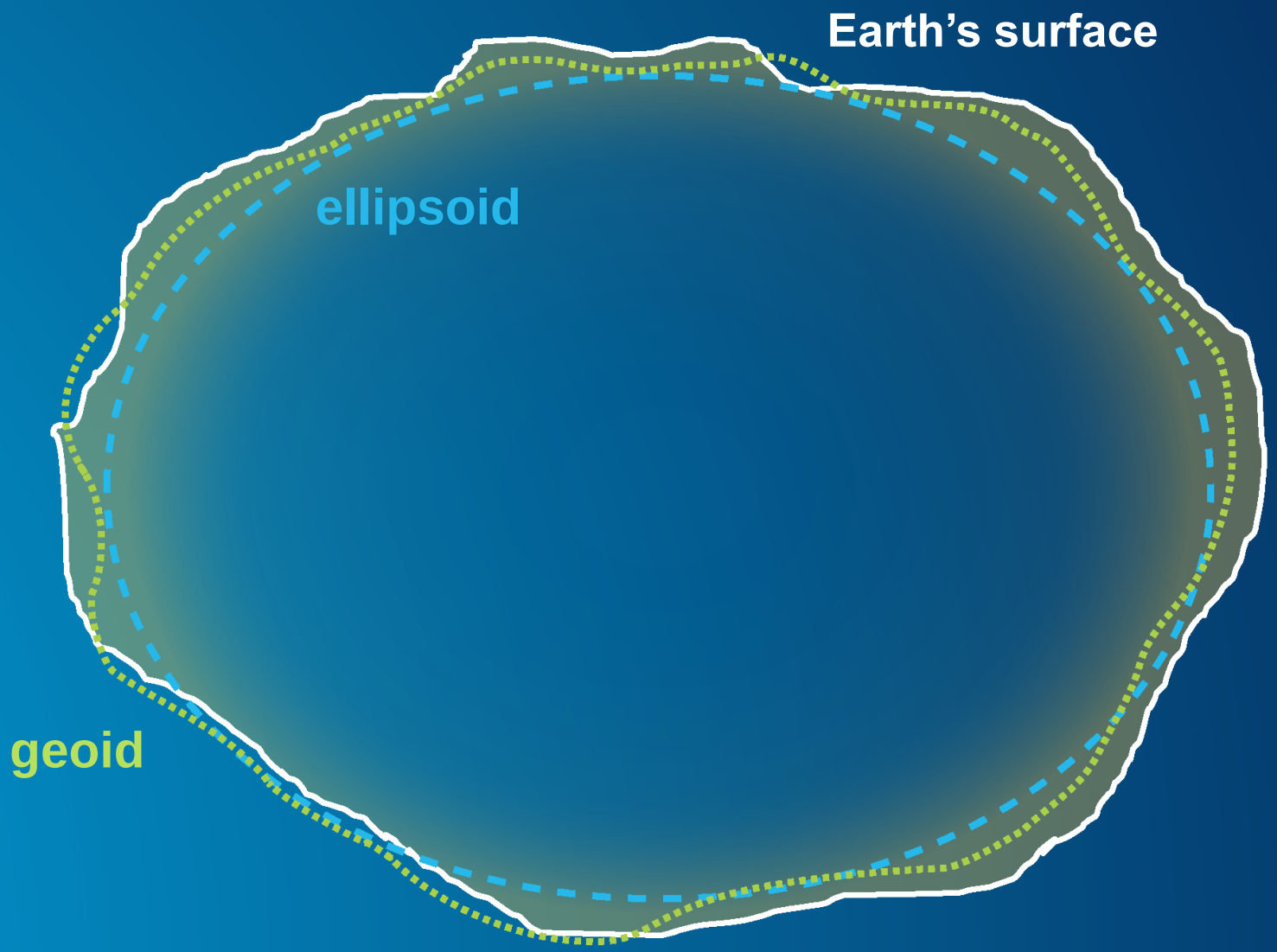
Geometric model



The Origin for Height or Depth

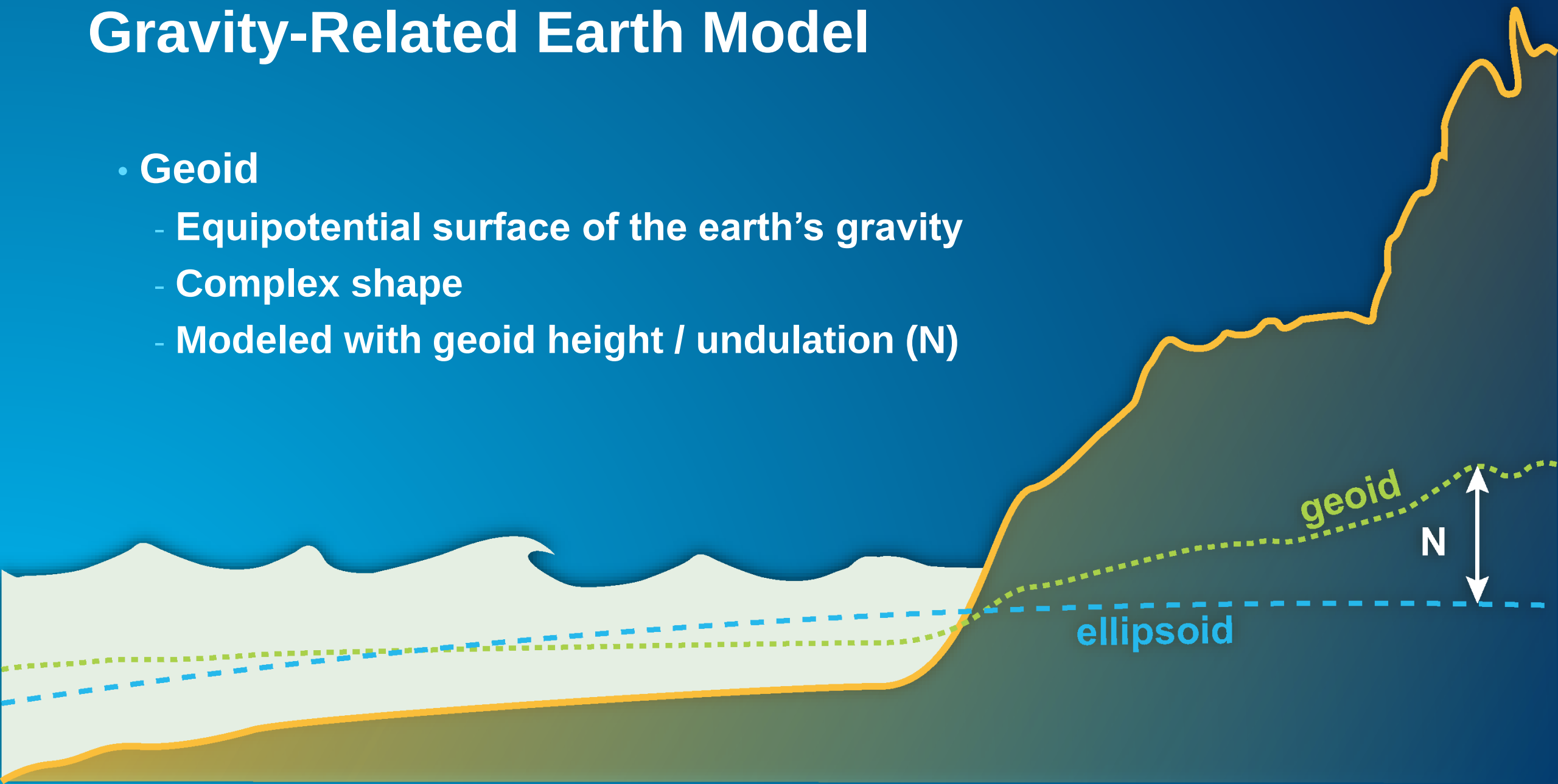
Geometric model

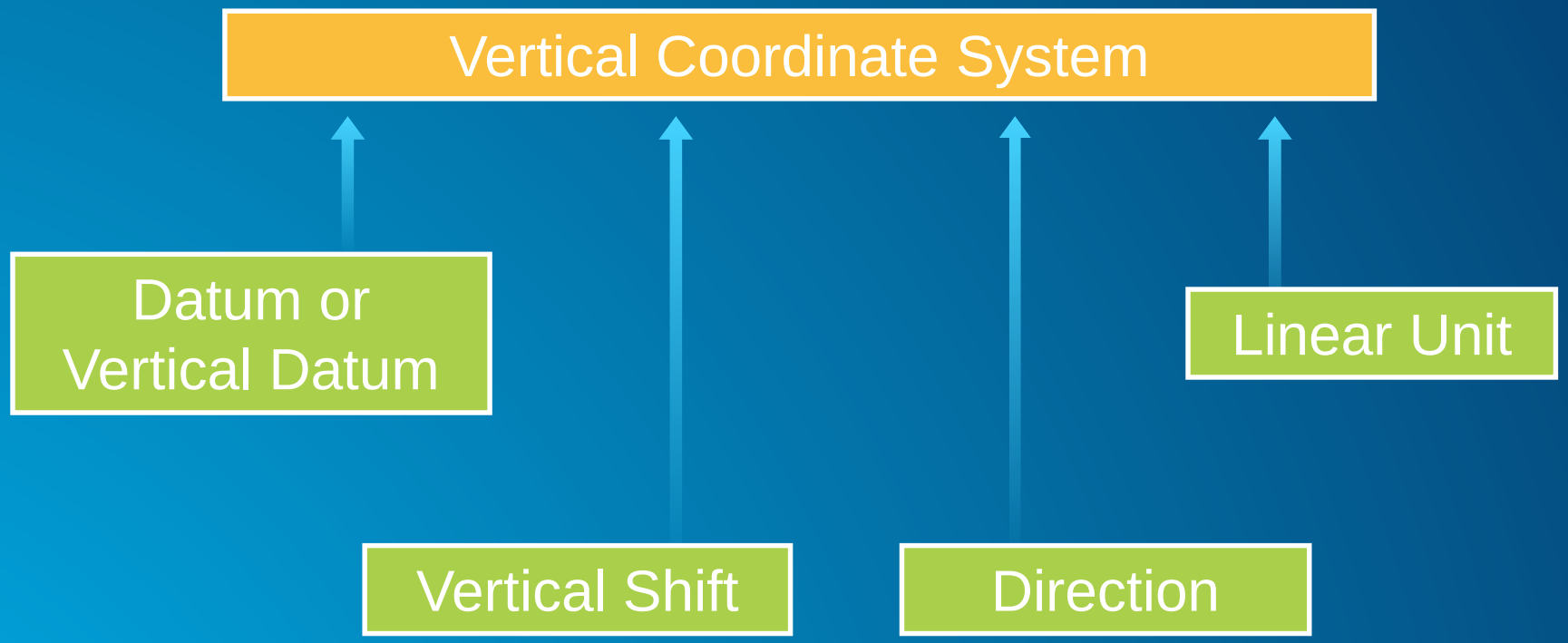
Gravity related model



Gravity-Related Earth Model

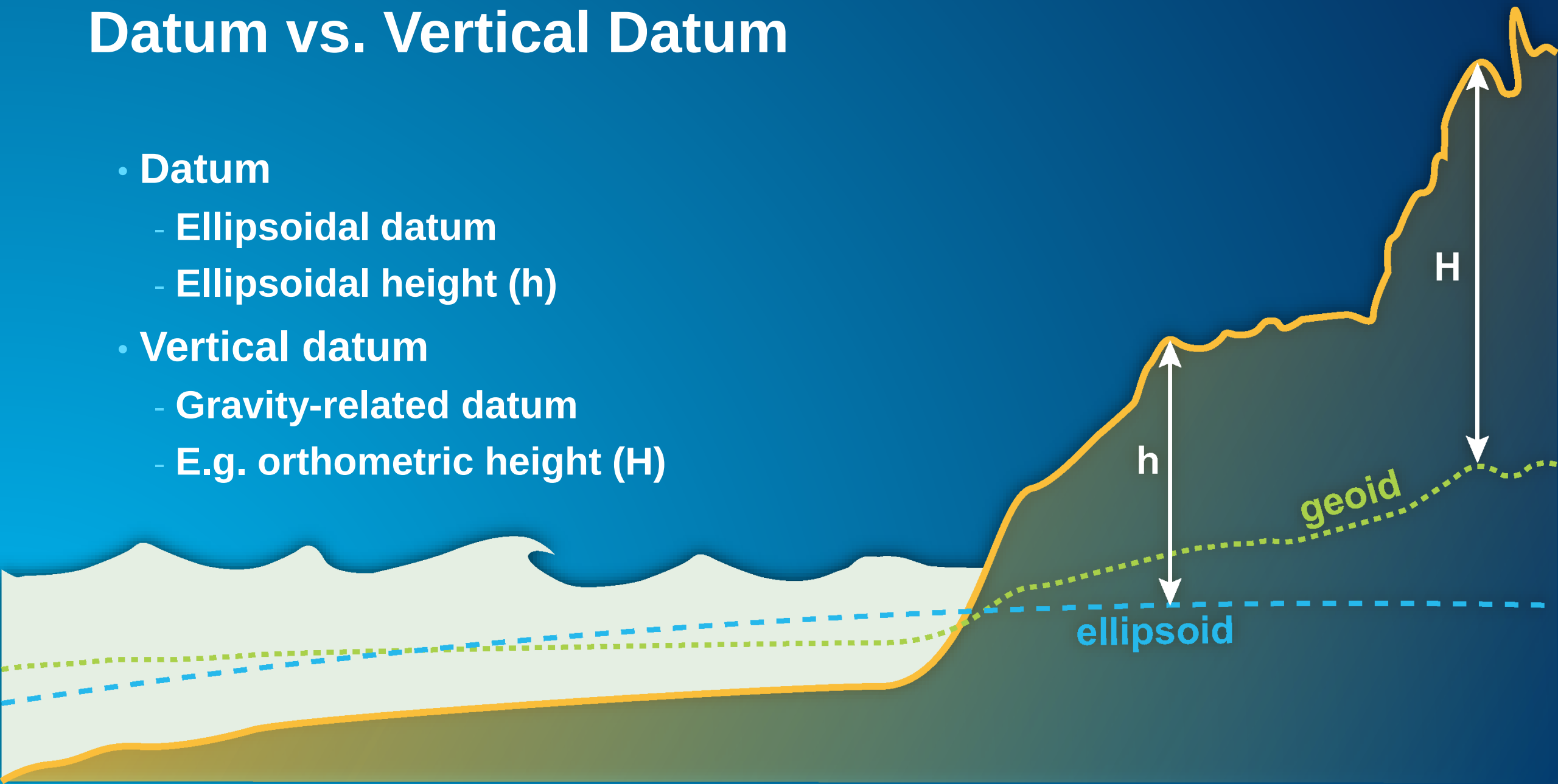
- Geoid
  - Equipotential surface of the earth's gravity
  - Complex shape
  - Modeled with geoid height / undulation (N)




Vertical Coordinate System
Datum or
Vertical Datum
Vertical Shift
Direction
Linear Unit

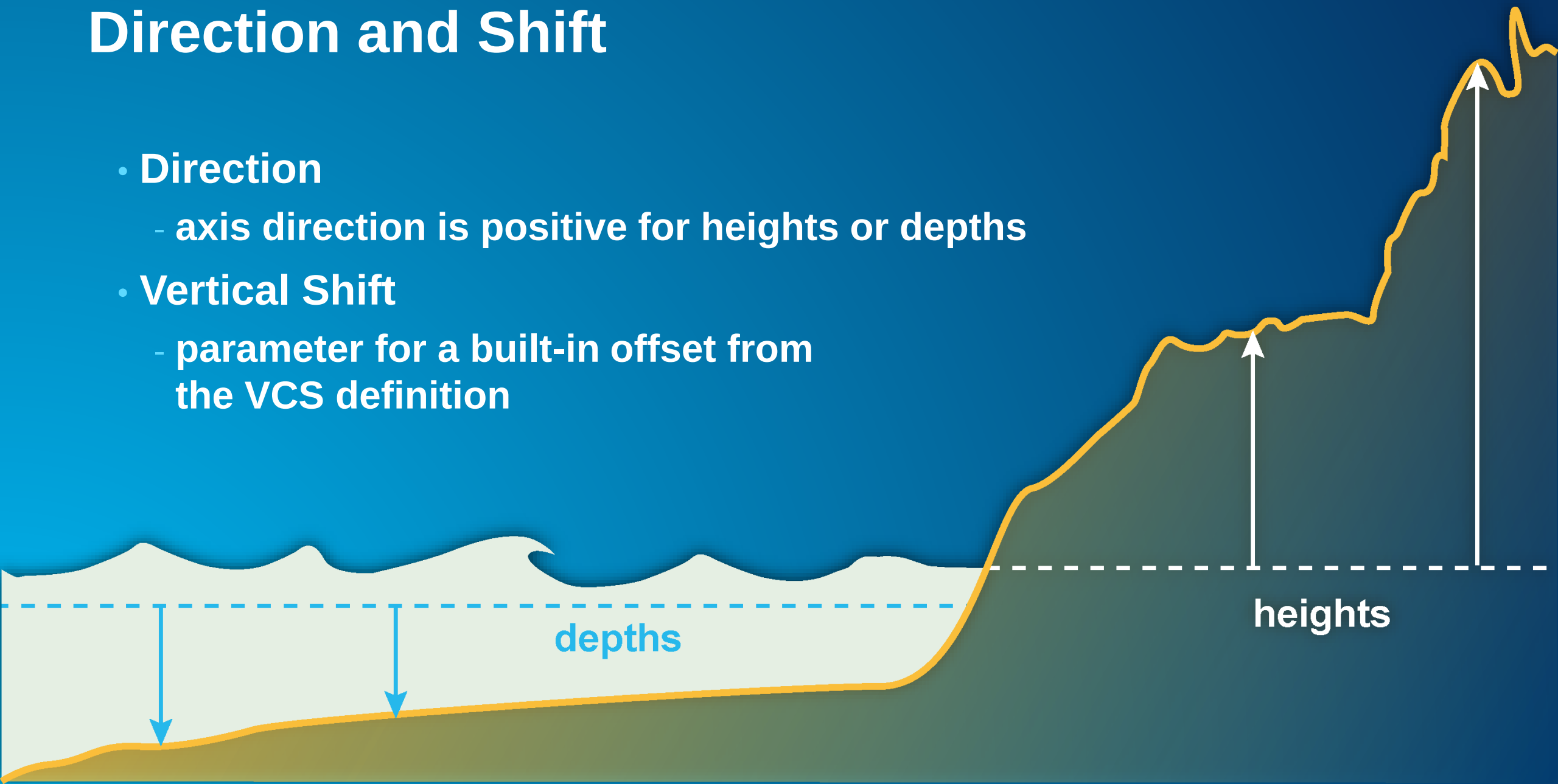
Datum vs. Vertical Datum

- Datum
  - Ellipsoidal datum
  - Ellipsoidal height (h)
- Vertical datum
  - Gravity-related datum
  - E.g. orthometric height (H)



Direction and Shift

- **Direction**
  - axis direction is positive for heights or depths
- **Vertical Shift**
  - parameter for a built-in offset from the VCS definition

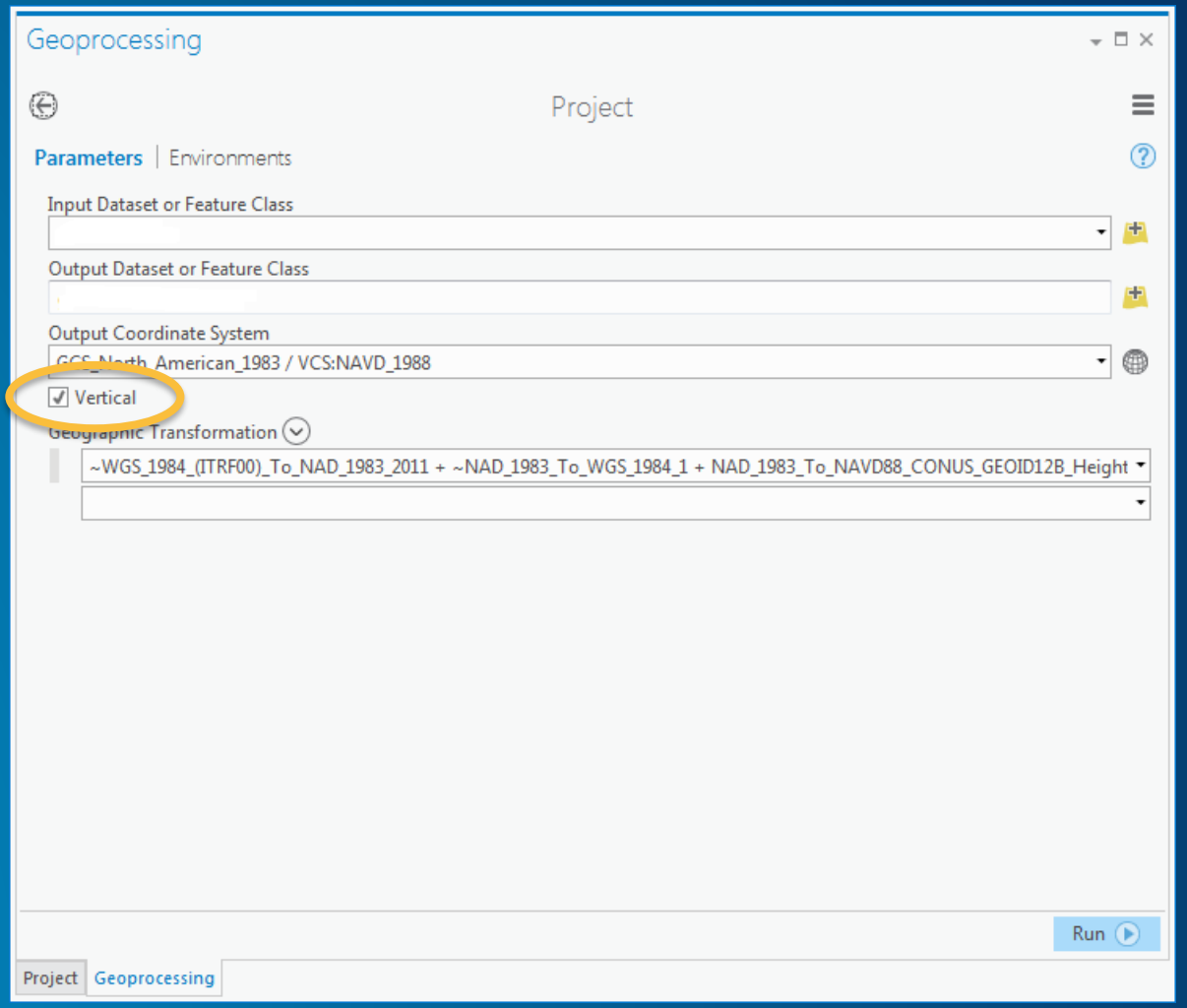


Vertical Transformation

Ellipsoidal Heights (NAD83)

NAD_1983_To_NAVD88_
CONUS_GEOID12B_Height

Orthometric Heights (NAVD 88)



Vertical Transformation Methods

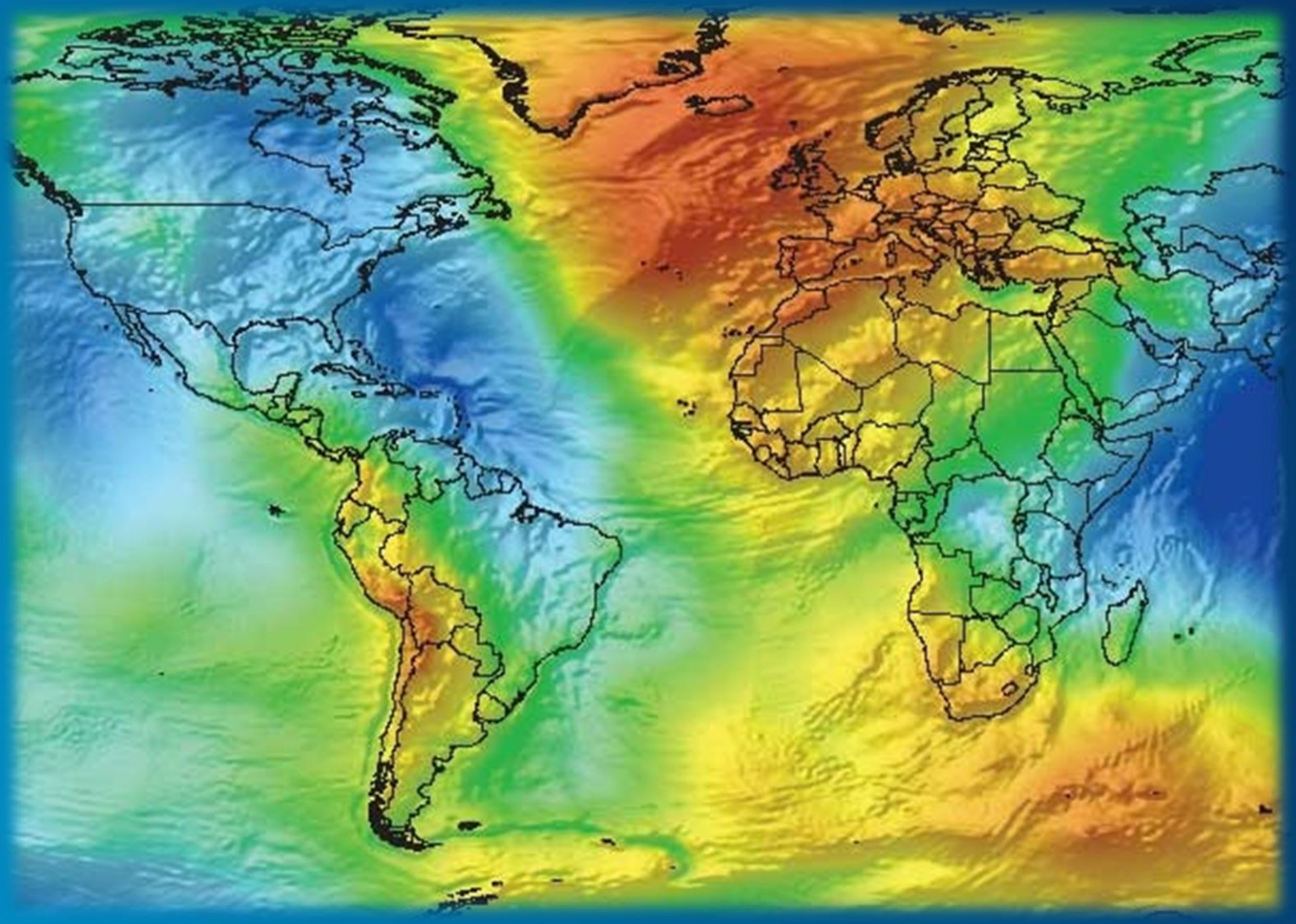
Geoid models

- EGM2008
- EGM84 and EGM96
- GEOID12B

VERTCON

Vertical offset

Vertical offset and slope



ArcGIS Coordinate Systems Data

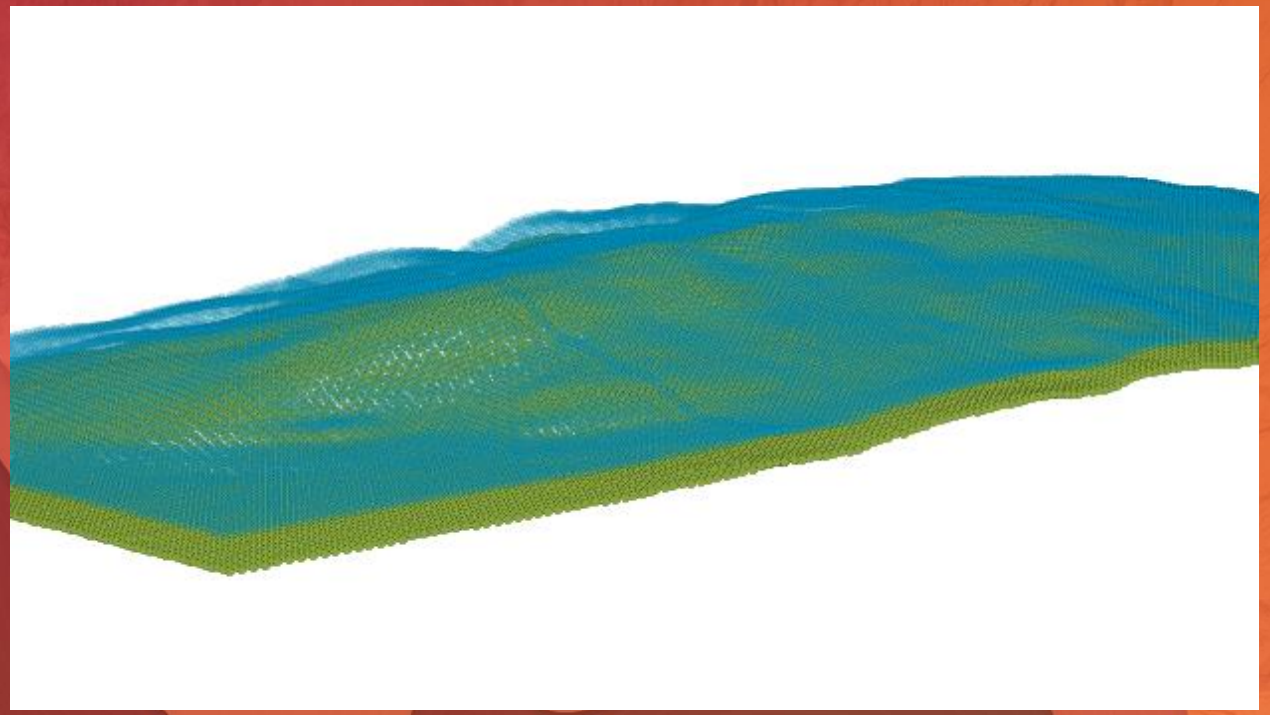
- 1.5 GB additional data install

- GEOCON v1.0
  - NAD 1983 HARN, NSRS2007, 2011
- NTv2

Geographic Transformations

- VERTCON
- GEOID12B
- EGM2008
  - 1′ x 1′ and 2.5′ x 2.5′

Vertical Transformations



Vertical transformations

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